

Cultural Adaptation in Music-Based Oral Health Education: A Comprehensive Review

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ABSTRACT

Music-based oral health education is widely used to promote preventive behaviors among children, as rhythm and melody are thought to enhance memory and knowledge retention. As these interventions have expanded across culturally distinct populations, adaptation efforts have frequently emphasized linguistic translation while leaving visual imagery, musical structure, and embedded cultural values largely unchanged. This review examines the extent to which music-based oral health interventions for children reflect genuine cultural adaptation rather than translation alone. Using a comparative qualitative approach, the review synthesizes evidence from pediatric oral health, music cognition, behavioral theory, and cross-cultural adaptation science, examining how linguistic content, visual imagery, musical structure, and embedded social values shape cultural responsiveness. Findings indicate that interventions developed collaboratively within target communities show greater cultural responsiveness than standardized programs applied with minimal adaptation, which often retain unfamiliar elements that may plausibly reduce engagement and limit music-based education's mnemonic benefits. Existing interventions rarely draw on established cultural adaptation frameworks; adjacent literatures on cultural adaptation suggest that adaptation depth may be relevant to intervention outcomes, though this relationship has not been directly tested for music-based programs specifically. These findings suggest that translation alone is insufficient for culturally responsive music-based oral health education. This review proposes the Four-Dimension Music-Based Cultural Adaptation (MBCA) framework to guide future design and evaluation of such interventions.

Keywords: Linguistic Translation, Music Cognition, Behavioral Theory, Cross-Cultural Adaptation Science, Music-Based Cultural Adaptation

1. INTRODUCTION

Oral health has constituted a foundational component for overall pediatric well-being. Delivery methodology for preventive dental education across culturally distinct populations remains inconsistently studied. Music-based pedagogy—an educational approach that uses musical concepts, rhythms, and sounds to teach—has proliferated as a strategy for transmitting preventive health behaviors to children, a

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trend attributable to the mnemonic advantages rhythm and repetition confer during memory encoding processes. Controlled research on verbal memory in children has found that musical mnemonic training outperforms spoken-word rehearsal, with the pitch and rhythm structure of a song thought to scaffold sequence recall more effectively than speech alone (Knott & Thaut, 2018). This cognitive mechanism underlies the broader premise of music-based health education: content set to melody and rhythm is intended to be retained more reliably than the same content delivered as plain instruction. This literature review operationalizes cultural adaptation as modification extending beyond linguistic content to encompass visual imagery, musical structure, and embedded value systems. Specifically, this review synthesizes four recurring dimensions of cultural adaptation identified across the reviewed literature: (1) linguistic content, the language in which material is delivered; (2) visual and symbolic imagery, the characters, settings, and iconography used to convey the message; (3) musical or rhythmic structure, whether the melodic and rhythmic conventions of the material align with local auditory transitions rather than imported ones; and (4) embedded values and social structures, including family roles, authority figures, and community norms reflected in the intervention's content. Together, these dimensions form the proposed Four-Dimension Music-Based Cultural Adaptation (MBCA) framework. The MBCA framework was developed through a thematic synthesis of recurring concepts identified across the reviewed literature rather than adopted from a pre-existing framework and should therefore be understood as a conceptual model requiring future empirical validation. These four dimensions organize the case discussion that follows: Section 3.3 examines evidence for the cognitive and linguistic dimensions, Section 3.4 situates this framework within established cultural adaptation science, and Section 3.5 evaluates specific interventions against all four dimensions directly.

Music-based oral health interventions demonstrate measurable efficacy across diverse regional contexts. Ibiyemi et al. (2022) developed an oral hygiene education song in Nigeria through direct collaboration with parents, educators, and community stakeholders. Previous interventions employing didactic lectures or printed materials failed to incorporate culturally familiar elements, a limitation attributed to their development in the absence of local stakeholder input. As the study was a randomized controlled trial protocol, efficacy outcomes had not yet been reported at the time of publication; the authors nonetheless posited that folk songs may hold considerable promise for oral health education given their cultural relevance and high likelihood of sustainability (Ibiyemi et al., 2022). Not all music-based interventions achieve comparable depth of cultural embedding. The Brush Day and Night program, a 21-day school-based oral health education initiative incorporating bodily movement and song components, exemplifies a comparatively superficial model of adaptation. This program was implemented across ten countries and evaluated among 7,991 children aged 2 to 12, including cohorts in Indonesia and Nigeria (Melo et al., 2018). The program's core educational content and song format remained standardized across national contexts rather than undergoing independent construction within each target population. The two interventions diverge fundamentally in their developmental origin: the Nigerian folk song was constructed endogenously within a single community, co-developed and validated in conjunction with local stakeholders and parents, whereas the Brush Day and Night program applied a uniform intervention model across culturally heterogeneous populations, with no evidence of population-specific content redevelopment. This distinction differentiates adaptation originating endogenously within a cultural

context from a standardized model applied homogeneously across multiple contexts. The Nigerian and Brush Day and Night interventions thus occupy opposing poles of a single variable (depth of cultural embedding within intervention design), which, rather than delivery medium, constitutes the central axis of investigation for this literature review.

This literature review identifies and aims to address a disparity in existing research concerning the depth of cultural adaptation present in music-based oral health interventions for children. Specifically, this review analyzes cases such as the Nigerian folk song and the Brush Day and Night program to distinguish interventions developed collaboratively within a target community from those that apply a standardized model, translated linguistically but structurally unchanged, across culturally distinct populations. This distinction underscores, for researchers, public health practitioners, and educators alike, the urgency of moving beyond linguistic translation toward structural cultural adaptation. The MBCA framework proposed here is intended to guide future intervention design toward measurable, replicable standards of cultural responsiveness, rather than relying on ad hoc or intuition-driven localization efforts.

1.1 Research Question: To what extent are music-based oral health interventions for children culturally adapted, and how can existing evidence inform a more effective framework for population-responsive intervention design?

2. METHODS

A structured search was conducted using the databases PubMed, Google Scholar, and CINAHL. Search terms included combinations of ‘music-based intervention,’ ‘oral health education,’ ‘cultural adaptation,’ ‘pediatric dental caries,’ ‘song-based public health,’ and ‘Ecological Validity Model.’ The initial search identified 536 records across the three databases. Following the removal of 234 duplicates, 302 records were screened by title and abstract. Article inclusion was limited to peer-reviewed studies published within the past three decades (1996-2026) that described a music-based intervention and addressed its development or cultural context; studies were excluded if they focused solely on adult populations, did not report on intervention design or origin, or addressed oral health outcomes without any educational or behavioral component. Applying these criteria, 292 records were excluded at the title and abstract stage, leaving ten full-text articles assessed for eligibility. Of these, five were excluded, most commonly for lacking any description of intervention development or cultural context. A total of five primary studies (excluding secondary studies such as systemic reviews and meta-analysis) met all inclusion criteria and were retained for full synthesis. Other primary studies cited throughout this review (e.g., studies examining the Social Cognitive Theory, Health Belief Model interventions, music cognition, or oral health epidemiology) served only as supported background literature and were not included in the formal evidence synthesis because they did not evaluate the development or cultural adaptation of music-based oral health interventions. Non-musical interventions were incorporated only for direct comparative cases showing surface-level versus deep-structure cultural adaptation (e.g., the Brush Day and Night program and the Great Beginnings for Healthy Native Smiles project). Recurring patterns across stakeholder

involvement, musical structure, and embedded cultural values formed the basis of this paper's thematic organization.

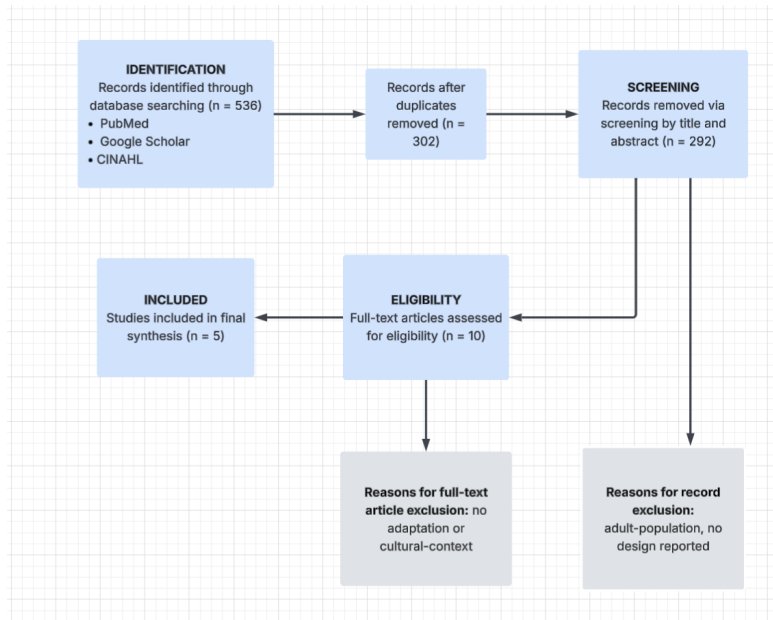


Figure 1: Flow Diagram of the Literature Search and Study Selection Process

3. LITERATURE REVIEW

3.1 Pediatric Oral Health and Access Disparities: The World Health Organization (2020) reported that the 2017 Global Burden of Disease Study found more than 530 million children worldwide had primary tooth decay. This burden persists across different economic and healthcare contexts. A cross-sectional study conducted at a hospital in Meerut, India, reported a 60.3% prevalence of early childhood caries, identifying it as the most common reason for clinical presentation among the children examined (Kaur et al., 2024). A separate study conducted in a rural community in Uganda highlighted a 48.6% prevalence of early childhood caries among children aged three to five (Musinguzi et al., 2019). These metrics show that pediatric oral disease exemplifies a near-universal childhood health burden rather than a localized or context-specific problem. This burden extends well beyond prevalence alone, carrying continuous downstream consequences that include impaired nutrition and growth, along with broader quality-of-life effects for children and their families (Uribe et al., 2021). Because this pattern recurs across such varied healthcare systems and cultural contexts, early preventive education emerges as a critical intervention point with broad, cross-contextual relevance, rather than a recommendation specific to any singular setting.

3.2 Theoretical Foundations: Two main behavioral change models are central within pediatric oral health education. The Health Belief Model (HBM) operates by enhancing a child's perceived susceptibility to oral disease, perceived severity of consequences, and perceived benefits of preventive behavior relative to perceived barriers (Sanaeinasab et al., 2022). As illustrated in Figure 2, these constructs also anticipate the dimensions developed later in this review: the model's modifying factors, including demographic and psychological variation among children, correspond to the population-specific differences the MBCA framework is designed to accommodate, while perceived susceptibility and severity depend partly on whether health messaging is delivered in linguistically and symbolically familiar terms. Self-efficacy and cues to action, also shown in Figure 2 and discussed further below, likewise demonstrate the role that culturally embedded delivery plays in translating perceived threat into actual behavior change. The Social Cognitive Theory (SCT) instead emphasizes self-efficacy and observational learning, wherein children model hygiene behaviors demonstrated by parents, teachers, or community stakeholders. As shown in Figure 3, self-efficacy and sociostructural factors (facilitators and impediments) parallel the MBCA framework's emphasis on culturally embedded delivery, as children are more likely to model preventive behaviors when they are demonstrated by trusted, familiar community figures rather than external instructors. In elementary schoolchildren, SCT constructs alone have been shown to account for roughly half the variance in toothbrushing and flossing behavior (Bashirian et al., 2021). Sanaeinasab et al. (2022) applied the HBM to elementary school students using a randomized controlled trial; 112 children ages six to twelve received either five weekly HBM-based educational sessions or routine dental clinic education as a control. Outcomes were measured using Decayed, Missing, and Filled Teeth scores alongside a papillary bleeding index at baseline and three-month follow-up, with significant improvement observed across nearly all measured domains (Sanaeinasab et al., 2022). A comparable trial structure has also been applied to the SCT: Xiang et al. (2022) conducted a cluster-randomized controlled trial of a peer-led oral health program grounded in both the SCT and HBM among Hong Kong adolescents, demonstrating that theory-driven peer delivery can also improve oral health outcomes independent of adult-led instruction. A subsequent systematic review and meta-analysis incorporating nineteen randomized controlled trials across ages five to eighteen found that HBM theory-based interventions improved oral health behavior, knowledge, and clinical indicators including plaque and periodontal status (Nazari et al., 2025). Despite this foundational evidence, standard interventions used in most schools and clinics—brochures, single-session videos, and generic classroom presentations—are often implemented without grounding in any established theoretical model. This inconsistency raises the question of whether alternative formats, such as music-based programs, are built on comparable theoretical structure or rely mainly on engagement value without a clear behavior change mechanism. Notably, none of the theory-grounded interventions reviewed here—the HBM-based program of the SCT/HBM peer-led program—are music-based; both use conventional educational sessions. This absence suggests that music-based oral health programs have developed largely outside the behavior-change theory literature that has otherwise shaped the field, raising the question of whether their design and evaluation might benefit from more deliberate integration with the established frameworks.

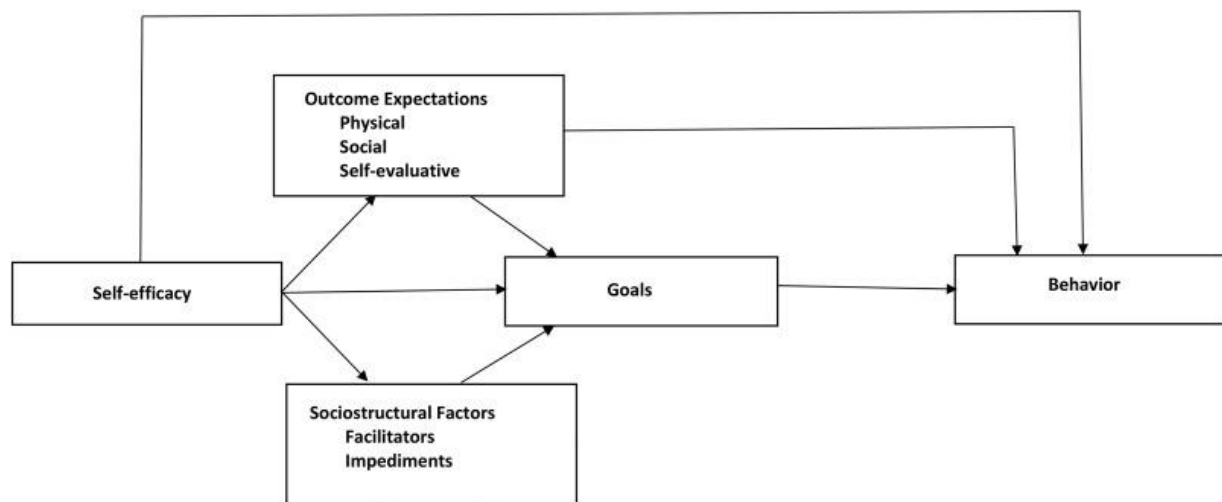


Figure 2: Health Belief Model (HBM) Applied to Health Behaviors. Adapted from [Etheridge et al., 2023]

The Health Belief Model illustrates how perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action collectively influence preventive oral health behaviors in children.

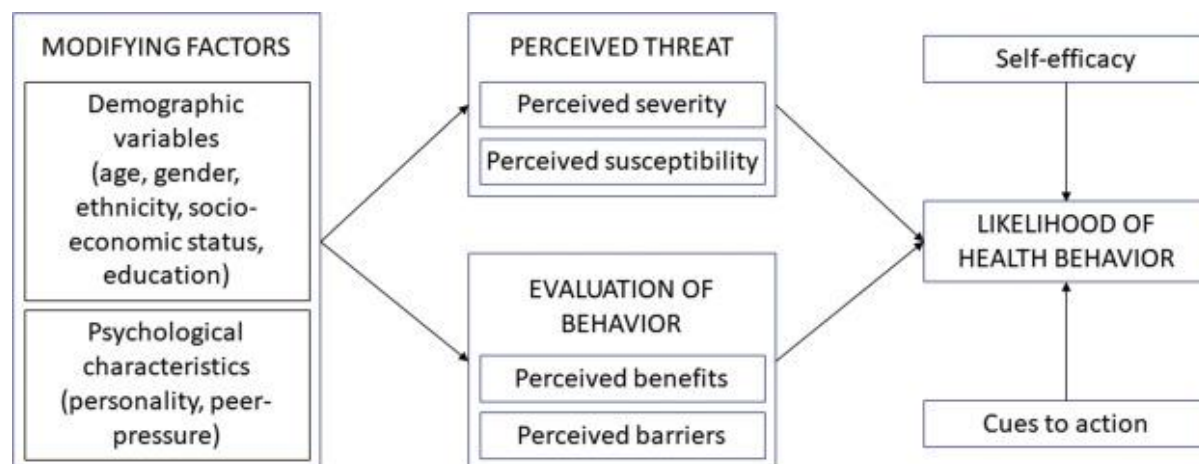


Figure 3: Social Cognitive Theory (SCT) Model Illustrating Determinants of Behavior. Adapted from [Beauchamp et al., 2018]

The Social Cognitive Theory framework illustrates how self-efficacy, outcome expectations, goals, environmental influences, and behavioral feedback interact to shape preventive oral health behaviors.

3.3 Music-Based Interventions in Pediatric Health: Music-based education has been validated as an effective strategy across several domains of child health beyond oral hygiene alone. A handwashing

education program implemented in a Japanese kindergarten incorporated picture books, songs, and videos across both school and home settings; materials were reviewed with kindergarten teachers beforehand to confirm the content was appropriate for target children before implementation. This program significantly improved kindergarteners' handwashing steps, time, and previously unwashed areas following both short-term and long-term implementation (Ueno et al., 2024).

A systematic review of song-based public health programs identified ten studies showing that songs are an accessible medium for delivering health messages across age groups, and that effective programs often involved local communities in creating the song rather than distributing a pre-made product (Sheffield & Irons, 2021). A global example is Vietnam's handwashing song "Ghen Cô Vy," produced domestically with local musicians, which reached over 40 million YouTube views during the COVID-19 pandemic (UNESCO, 2020). As shown in Figure 3, rhythmic training produces measurable gains in short-term memory even in a domain-general recall task. This suggests that the mnemonic mechanism underlying music-based education is not specific to any one cultural context but is instead activated by rhythm generally, which raises the question of whether that mechanism performs optimally only when the rhythmic structure itself is culturally familiar to the listener. This distinction anticipates the MBCA framework's musical structure dimension.

The evidence also forms a strong foundation that strengthens the premise underlying music-based oral health programs, while raising the stakes of ensuring such interventions are implemented with sufficient cultural specificity, given that the underlying mechanisms have initially been shown to function effectively when designed appropriately. Particularly, the interventions demonstrating the strongest reach and reception share a common feature: local origin or local validation, as opposed to imported content applied uniformly. The Vietnamese song was written, performed, and produced within the country by local health authorities and musicians, not adapted from an existing foreign campaign, while the Japanese kindergarten program's materials were vetted by local teachers before use. Both instances reinforce the same pattern identified in Section 3.2: the interventions with the clearest documented success were developed or validated from within the target community, rather than applied as a standardized model translated from elsewhere.

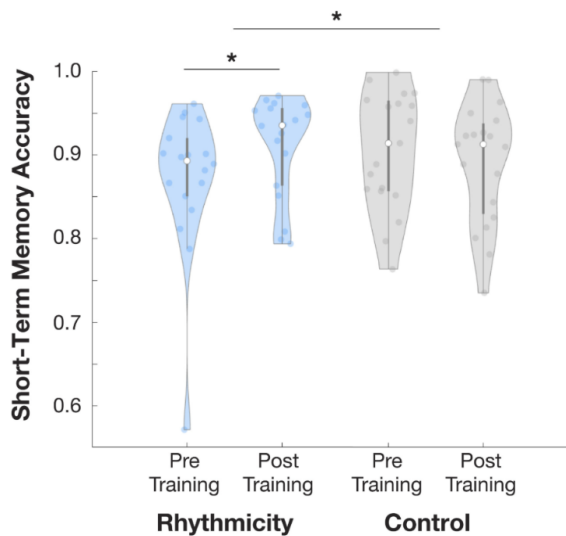


Figure 3: Improved Short-Term Memory Following Rhythmic Training Compared with a Control Group. Adapted from [Zanto et al., 2022]

As shown in Figure 3, rhythmic training improves short-term memory performance in domain-general recall tasks (facial memory) rather than in an oral-health-specific context. This effect is presented here as the proposed cognitive mechanism underlying music-based oral health education's mnemonic advantage, not as direct evidence drawn from oral health interventions themselves.

3.4 Translation and Deep Cultural Adaptation: Cross-cultural adaptation science formally distinguishes between two levels of intervention modification. Bernal et al. (1995) established the Ecological Validity Model, which identifies eight dimensions required for genuine cultural adaptation: language, persons, metaphors, content, concepts, goals, methods, and context. This framework distinguishes surface structure adaptation from deep structure adaptation. A systematic review of multiple cultural adaptation frameworks confirmed that surface-versus-deep distinction appears consistently across competing models (Day et al., 2023). The Cultural Sensitivity approach, for instance, separates surface-level changes to language and imagery from deep structure changes addressing a population's underlying values and social context. Similarly, ADAPT-ITT—an eight-phase model originally developed to adapt evidence-based HIV interventions—guides adaptation through sequential stages of assessment, decision-making, and population-specific content redevelopment. Empirical evidence supports the practical significance of this distinction beyond theoretical classification models alone. A systematic review and meta-analysis of parenting interventions for South Asian families reported that interventions demonstrating deeper cultural adaptation were associated with stronger and more consistent effects on pediatric cognitive development, compared with interventions adapted only at a surface level (Syed et al., 2026). This finding is specific to the parenting-intervention literature; whether a comparable pattern holds for music-based oral health interventions has not been established. This established framework has yet to be applied to music-based oral health interventions specifically, and it remains an open question whether

such programs would validate a similar relationship between adaptation depth and outcomes if directly evaluated.

The literature reviewed does not explicitly define a four-dimension model for music-based oral health education. Instead, the MBCA framework was developed by organizing evidence from multiple studies into a unified conceptual model. Established cultural adaptation frameworks consistently emphasize language, visual or symbolic content, and embedded cultural values as central components of adaptation, while studies of music cognition and music-based health promotion identify culturally familiar musical structure as an additional factor likely to influence engagement and memory. These recurring themes were synthesized into four dimensions that provide an organizing framework for evaluating music-based oral health interventions. Accordingly, the sections that follow distinguish between evidence directly supported by the reviewed studies and the conceptual integration proposed by this review.

3.5.1 Linguistic Content and Community-Originated Design: All interventions that demonstrated the deepest levels of cultural adaptation share a common design feature: development originates from within the target community rather than being introduced to it afterwards. Ibiyemi et al. (2022) developed their Nigerian oral hygiene song from the ground up with parents, educators, and community stakeholders, treating them as co-developers of the content rather than end-users of a finished product. A similar emphasis on community-originated design appears in interventions developed for American Indian and Alaska Native populations. Kirby et al. (2025) tested a culturally tailored oral health curriculum, built from formative interview data gathered through tribal Community Advisory Boards, against communities where no such tailoring had previously existed; following the culturally adapted sessions, and perceived benefits of recommended oral health behaviors. This directly demonstrates the variable central to this review: identical health content delivered through a culturally embedded format produces measurable gains among a population previously reliant on generic, externally developed materials.

3.5.2 Visual and Symbolic Imagery: This dimension is notably underdocumented in both cases: neither Ibiyemi et al. (2022) nor Kirby et al. (2025) report in detail on the specific characters, settings, or iconography used in their materials. This absence suggests that even interventions achieving deep adaptation on other dimensions may under-prioritize or under-report visual design relative to content and delivery—a gap this review returns to in Section 4.

3.5.3 Musical and Rhythmic Structure: The Nigerian song was composed as an original folk song rather than set to an imported melody, aligning its rhythmic and melodic conventions with local musical tradition by design (Ibiyemi et al., 2022). The Great Beginnings project, by contrast, is not itself music-based; its inclusion here serves as a comparative case for stakeholder-driven design rather than as evidence on musical structure specifically, which limits how directly this dimension can be compared across the two cases.

3.5.4 Embedded Values and Social Structures: The Great Beginnings for Healthy Native Smiles project, from which the Kirby et al. (2025) curriculum emerged, extends the community-origination

model further by treating community members as active co-designers of the intervention rather than end recipients of it. Developed over a six-year partnership with Hopi and Crow tribal communities, the project incorporated formative assessment data, caregiver interviews, and quarterly feedback from Community Advisory Boards to design culturally tailored oral health sessions addressing locally identified barriers to care (Kirby et al., 2025). Kirby et al. (2025) reported that the intervention was delivered by local community health workers using adapted motivational interviewing techniques rather than externally trained clinicians, and found that this approach produced self-reported behavioral change among caregivers. The authors specifically highlighted the importance of trusted community health workers in delivering culturally tailored oral health messaging, suggesting that the messenger, not solely the message, constitutes an imperative variable in adaptation depth. Taken together, the Nigerian and Great Beginnings cases show that effective cultural adaptation is not achieved through a single modification at the content level, but through a cumulative design process involving community-originated content, culturally embedded imagery and format, and delivery by familiar local figures embedded within the target population. These findings collectively suggest a layered structure through which music-based oral health interventions could achieve comparable depth of adaptation. Rather than viewing cultural adaptation as a single translation step applied after an intervention's core content has already been finalized, evidence from the Nigerian and Great Beginnings cases shows that adaptation must occur across at minimum four dimensions operating simultaneously: linguistic content, visual and symbolic imagery, musical or rhythmic structure aligned with local auditory conventions, and the values and social structures embedded within the material itself, including family roles and community-embedded stakeholders. No existing music-based oral health intervention identified in this review has been designed or evaluated against all four of these dimensions concurrently. Such a gap constitutes the foundation for the MBCA framework proposed in this review: a multidimensional adaptation model in which music-based oral health education is constructed collaboratively within a target community from its earliest design stages, incorporating culturally specific imagery, musically congruent structure, and delivery through trusted community figures, rather than adapted retroactively from pre-existing, externally developed products. As shown in Figure 4, this kind of layered adaptation process—moving from community assessment, through iterative decision-making and production, to ongoing advisory board review—reflects the collaborative, multi-stage design the MBCA framework calls for across its four dimensions; the ADAPT-ITT and CBPR structure depicted here offers a concrete model of how such adaptation could be operationalized in practice, rather than left as a conceptual standard alone.

The MBCA framework's practical demands warrant acknowledgment. The interventions demonstrating the deepest cultural adaptation in this review—a locally composed song developed over months of stakeholder collaboration, and a multi-year tribal partnership involving formative research and ongoing Community Advisory Board input—required substantially more time, funding, and specialized personnel than a standardized program adapted primarily through translation. This resource asymmetry plausibly explains why models like Brush Day and Night, despite weaker cultural specificity, have achieved far broader geographic reach: a single standardized curriculum scales more easily across many populations than does a co-designed, community-specific one. The MBCA framework, in proposing deep cultural adaptation as a standard, must therefore also address scalability—for instance, by identifying which of the

four adaptation dimensions yield the greatest gains relative to their resource cost, so that programs with limited budgets can prioritize accordingly rather than treating deep adaptation as all-or-nothing.

How CBPR and ADAPT-ITT Inform and Enhance Each Other

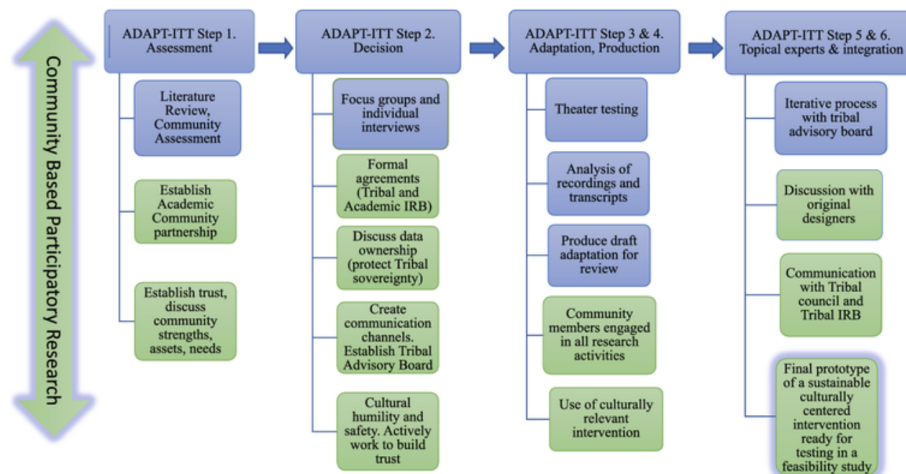


Figure 4: Community-Engaged Intervention Development Emphasizing Repeated Advisory Board Feedback and Iterative Revision. Adapted from [Wilson et al., 2023]

Figure 4 illustrates that effective cultural adaptation is an iterative process involving community participation throughout intervention development rather than a single translation step.

4. LIMITATIONS

Several limitations should be acknowledged within this literature review. First, this review's central argument lies on a narrow set of directly comparable cases—principally the Nigerian folk song intervention and the Great Beginnings for Healthy Native Smiles project as examples of deep adaptation, against the Brush Day and Night program as a surface-adaptation comparison. This scarcity is itself a finding: despite the theoretical and empirical case for deep cultural adaptation established in adjacent fields, music-based oral health interventions that are both culturally adapted and empirically evaluated remain rare in the published literature (Bernal et al., 1995; Day et al., 2023). The small evidence base limits the strength of causal claims this review can draw about adaptation depth and effectiveness specifically within music-based interventions, and instead should be read as identifying a gap that future empirical work needs to fill rather than as a settled comparative finding. Second, because so few music-based studies exist, this review synthesizes evidence from adjacent fields including music-based hygiene education, behavioral health promotion, and cross-cultural intervention science; though this interdisciplinary approach broadens the theoretical foundation of the proposed framework, it also limits

direct comparison among studies because of differences in intervention design, outcome measures, and target populations. Third, much of the literature evaluates behavioral or knowledge-based outcomes rather than long-term clinical measures such as caries incidence, making it difficult to determine the sustained effectiveness of culturally adapted music-based interventions. Finally, the MBCA framework proposed in this review is conceptual and has not yet been empirically validated against any music-based intervention.

5. CONCLUSION

This literature review examined the extent to which music-based oral health interventions for children reflect deep cultural adaptation rather than linguistic translation alone. Evidence indicates that pediatric oral disease represents a significant global health burden affecting children across widely divergent economic and healthcare contexts, underscoring the urgency of effective and early preventive education. Established behavioral change models, including the HBM and SCT, provides a strong theoretical foundation for pediatric oral health education, yet standard interventions frequently apply these frameworks inconsistently. Music-based education has been independently validated as an effective medium across various domains of child health, including hygiene behavior, suggesting that its underlying mnemonic mechanism functions reliably when implemented appropriately. Cross-cultural adaptation science, formalized through Bernal's Ecological Validity Model, distinguishes surface structure adaptation from deep structure adaptation. Adjacent literatures, including parenting interventions for South Asian families, have compared outcomes between surface and deep-adapted programs, offering one lens for examining adaptation depth. Whether a comparable pattern would emerge specifically for music-based interventions remains an open and untested question. Cases such as the Nigerian oral hygiene song and the Great Beginnings for Healthy Native Smiles project illustrate what deep adaptation looks like in practice—content originating within the target community, imagery and structure aligned with local cultural conventions, and delivery through trusted community figures rather than externally imported material—but neither case includes the kind of controlled, comparative outcome data needed to assess effectiveness relative to standardized alternatives. These cases inform the Four-Dimension Music-Based Cultural Adaptation (MBCA) framework proposed in this review, which should accordingly be read as a conceptual synthesis built from adjacent literatures rather than a model validated within its own domain. Existing programs demonstrate that standardized content applied uniformly across culturally distinct populations remains common practice, even as comparable fields show that this approach tends to yield weaker outcomes—a pattern with direct consequences for populations experiencing the highest rates of dental caries, including American Indian and Alaska Native children, who are frequently served by materials developed outside their own cultural context.

In the interim, and pending such direct evidence, resource-constrained implementers need not treat deep cultural adaptation as a binary construct: entities adapting existing music-based curricula for new populations should prioritize community-authored lyrical content and locally congruent melodic-rhythmic structure over linguistic translation alone, though this is offered as a conceptual suggestion drawn from adjacent literatures rather than a claim supported by direct evidence within music-based interventions.

Future research should test the MBCA framework directly through a comparative trial: two music-based oral health interventions delivered to matched populations, one developed through the four-dimension adaptation process outlined here (community-originated content, locally congruent imagery and musical structure, and value-aligned messaging) and one consisting of a standardized, translated program such as the Brush Day and Night program. Comparing knowledge, behavior change, and—ideally, with sufficient follow-up—caries incidence between the two arms would offer the first direct empirical test of how adaptation depth relates to outcomes specifically within music-based interventions. Until such evidence exists, the MBCA framework should be understood as a conceptual model grounded in adjacent literatures, not a demonstrated finding: whether the mnemonic advantages documented for music-based education depend on the depth of cultural design applied to them remains to be shown, particularly for underserved populations currently reliant on imported or translated materials.

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