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# One billion more people benefiting from universal health coverage: where is early childhood caries prevention in the African vision?

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## Abstract

**Background** Early childhood caries (ECC) is one of the most common and preventable childhood conditions, yet it remains systematically excluded from Africa's Universal Health Coverage (UHC) agenda. This study identified the systemic barriers to embedding equitable and cost-effective ECC prevention into the continent's UHC agenda and proposed an actionable, multi-level framework to overcome these barriers.

**Methods** We conducted a critical review, guided by a conceptual framework integrating the Tanahashi coverage framework, the Socio-Ecological Model, and the UHC principles. The review synthesized evidence from searches of PubMed, Scopus, Web of Science, AJOL, and grey literature. We compared the ECC surveillance capacity of Africa and the World by quantifying data availability. We also developed an implementation framework to facilitate the integration of ECC prevention in UHC.

**Results** A surveillance gap renders ECC invisible to African health systems, with only 9.3% of countries having any prevalence data for children under 36 months, compared to 33.1% globally. However, feasible integration pathways exist through multi-sectoral collaboration, with platforms like the maternal and child health offering a scalable entry point for task-shifted interventions that can reduce the risk for ECC. Integrating ECC prevention into UHC requires a multi-pronged strategy: generating epidemiologic and local cost-effectiveness evidence, harnessing digital health innovations, embedding prevention within early childhood development programs, and conducting implementation research to secure political commitment for sustainable inclusion in UHC frameworks.

**Conclusion** This review establishes that integrating ECC prevention into Africa's UHC is an essential yet overlooked opportunity. To bridge this gap, policymakers must prioritize making ECC visible by embedding indicators into national health surveys and surveillance systems and integrating preventive care into child health-focused platforms. In addition, researchers must build a local evidence base with cost-effectiveness and implementation data.

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**Keywords** Africa, Health coverage, Surveillance, Economic evaluation, Horizontal integration

## 1 Introduction

The continued commitment of African health ministers to one billion more people benefiting from universal health coverage [1] represents a monumental step for the continent's oral health agenda. The deliberation at the 75th meeting of the Regional Committee for Africa builds on the United Nations' member state resolution to Universal Health Coverage (UHC) in 2015 [2] and 2023 [3], the United Nations' political declaration in 2019, and the World Health Organization's (WHO) actions in 2015 [4], and 2019 [5]. It also builds on the adoption of resolution WHA74.5 on oral health in 2021 [6], the Global oral health action plan 2023–2030 endorsed in 2023 [7, 8], and the Bangkok Declaration in 2024 [9]. The commitment of member states at the 2025 regional meeting was to scale up essential health services, focusing on primary health care (PHC), financial protection, and health promotion as part of the Sustainable Development Goals (SDGs) [10].

However, this ambition is undermined by the systematic exclusion of early childhood caries (ECC), one of the most common and preventable childhood conditions [11], from the data reported and discussed at the meeting. ECC is a growing silent epidemic in the region [12], affecting 37.9% of children < 72 months in Africa [13]. It is defined as the presence of caries in the primary teeth of children under 71 months [14], causing pain, infection, malnutrition, and developmental delays, with consequences that qualify it as a disabling condition [15]. The burden extends beyond the child, imposing significant socioeconomic costs on households, communities, and health systems [16–18].

Despite this substantial burden, ECC remains politically invisible in Africa. Regional surveillance systems lack indicators for young children's oral health, and there is a clear data deficit. For example, only 5 of 54 African countries have any ECC prevalence data for children under 36 months [19]. Effective UHC requires evidence-based planning to set targets, allocate resources, and target vulnerable populations. Without ECC data, countries cannot design benefit packages or monitor progress, rendering the UHC promise of leaving no one behind unattainable for the continent's youngest children.

This critical review evaluates the alignment of ECC prevention strategies with UHC in Africa. It is driven by our conceptual framework (Fig. 1), which integrates three complementary models to provide a comprehensive roadmap for addressing ECC. The Socio-Ecological Model.

(SEM) [20] forms the central axis, identifying the multi-level targets for intervention at individual to national policy levels. However, these interventions face health system barriers, categorized by Tanahashi [21] into availability, accessibility, acceptability, utilization, and effectiveness problems. The role of UHC is to overcome these barriers through its core functions: strategic financing, policy coordination, promotion of equity, and robust accountability mechanisms. This study identifies the systemic barriers to integrating cost-effective ECC prevention into the continent's PHC systems and UHC agendas, and proposes an actionable, multi-level framework to overcome these barriers. The framework posits that effective ECC prevention requires implementing interventions across all SEM levels and using UHC tools to resolve the Tanahashi barriers.

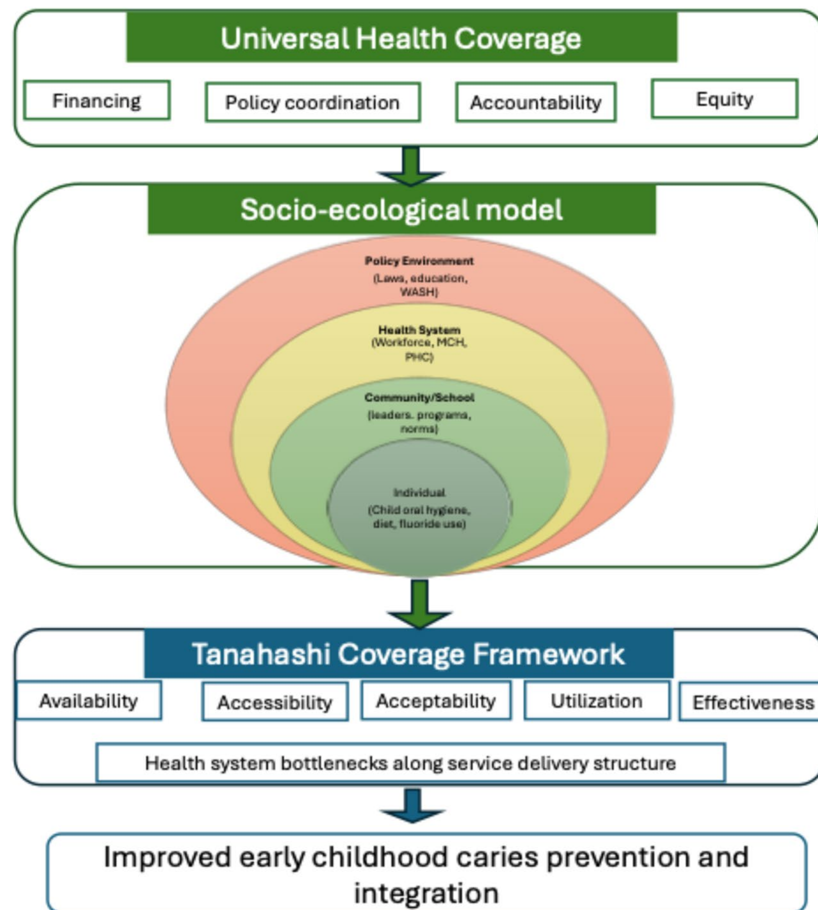


**Fig. 1** Conceptual framework for integrating ECC prevention into Universal Health Coverage in Africa

## 2 Methods

We synthesized and appraised evidence from diverse sources to inform policy and practice. We iteratively searched grey literature such as the WHO's reports, regional committee documents, and national health strategies, together with peer-reviewed publications on ECC burden, determinants, interventions, and health systems research in Africa, retrieved from databases including PubMed, Scopus, Web of Science, and African Journals Online (AJOL). We also included global policy frameworks, such as the SDGs and the WHO Regional Strategy on Oral Health for Africa [1]. We examined accessible information to highlight surveillance capacity, policy neglect, and opportunities for integrated ECC prevention within UHC. We then organized the evidence into a conceptual framework that illustrates the relationship between policy recognition, health system enablers, and practical interventions delivered through maternal and child health, school, and community platforms.

To quantify and compare the availability of ECC prevalence data in Africa and the rest of the world, we extracted from a worksheet listing countries and their corresponding ECC prevalence values for children under 36 months and those 36 months and above [22]. We categorized countries as either "Africa" or "Rest of the World" based on the African Union list of 54 member states. For each age group (< 36 months, 36–71 months), we classified countries based on data availability into "Has ECC Data" or "No ECC Data." The category "Has ECC Data" included countries with prevalence estimates

from 2007 to 20,017 and before 2007 to reflect research effort and infrastructure relevant to ECC surveillance, and calculated the percentage of countries with data relative to the subtotal/total. We focused on the presence or absence of data rather than prevalence estimates to demonstrate surveillance capacity and research activity rather than disease burden.

Our approach did not include a systematic review or a meta-analysis. Instead, we built an evidence-based, policy-relevant argument to inform strategic integration of ECC into UHC in Africa. We also did not seek ethical approval because we relied exclusively on publicly available documents and cited all sources to ensure academic integrity.

### 2.1 Limited data for effective universal health coverage planning to control early childhood caries

African health systems cannot integrate ECC prevention into UHC frameworks without reliable data. Evidence-based planning requires epidemiological and economic information. However, surveillance of ECC in Africa remains limited [22, 23]. This absence of data leaves the disease largely invisible, despite its high and growing prevalence and preventable nature.

A global analysis of 2018 ECC data across 193 countries illustrates that Africa is disproportionately underrepresented [22]. Only 5 of 54 African countries (9.3%) reported prevalence data for children under 36 months, compared with 33.1% of countries elsewhere. For children aged 36–71 months, 15 African countries (27.8%) had data, compared to 68.3% of countries globally (Table 1).

For instance, Nigeria, Africa's most populous nation [24], has national surveys tracking immunization and malnutrition [25, 26] but no nationally representative data on ECC prevalence. This forces policymakers to rely on sub-national studies, which show highly variable prevalence rates, ranging from 9% to over 50% in different settings [27]. As a result, ECC remains unmanaged within national health priorities as realistic ECC reduction targets cannot be set, ECC high-risk populations cannot be identified, and resources cannot be efficiently allocated without baseline measurements [28–30]. Prevention programs cannot demonstrate effectiveness or justify sustained funding if outcomes cannot be monitored. This absence of national ECC-related data renders invisible those whom UHC equity commitments are designed to protect [31, 32].

Despite these challenges, promising pilot programs within Africa demonstrate that contextually appropriate ECC surveillance is feasible. Countries like Rwanda, Tanzania, Uganda, Kenya, Ghana, and Zambia have conducted surveys using the WHO guidelines and research initiatives [33]. Egypt, Namibia, and South Africa are also countries that conduct surveillance of dental caries in 0–5-year-olds [34]. These surveys are, however, often ad hoc, and the push for periodic national surveys, including using a standardized, integrated module within routine Demographic and Health Surveys (DHS), is ongoing [33]. These examples underscore that weak ECC surveillance can be overcome

**Table 1** Data availability: Africa versus global overview

| Region | All Countries | Countries with Data *N* (%) | |
|---|---|---|---|
| | | Children < 36 Months: | Children 36–71 Months: |
| Africa | 54 | 5 (9.3%) | 15 (27.8%) |
| Rest of the World | 139 | 46 (33.1%) | 95 (68.3%) |
| Global | 193 | 51 (26.4%) | 110 (57.0%) |

by targeted, innovative approaches. Although increasing the number of countries in the region with a national oral health policy document is a strategic action of the WHO Africa region to drive evidence-based programming for oral health, not all national oral health policies are child-friendly, and not all UHC programs provide services for ECC management [34].

There is also a scarcity of data on ECC risk factors, such as fluoride exposure. The Progress Report on the Regional Oral Health Strategy (2016–2025) for Africa notes the increase in caries prevalence in the primary dentition, the low population coverage of fluoridated toothpaste use [35, 36], and the low affordability of fluoride toothpaste for the poorest 15% of the population in countries of Sub-Saharan Africa [37]. This recognition of the problem, with a lack of ECC surveillance indicators, highlights the gap between awareness of the problem and implementing targeted, effective interventions.

Furthermore, the lack of context-specific cost-effectiveness analyses compounds the epidemiological data deficit. While studies from high-income countries and theoretical models suggest that ECC prevention is highly cost-effective, there is a paucity of economic evaluations in African countries [38, 39]. The available economic evidence documents the cost of untreated ECC to the household, including direct treatment costs for emergency care and rehabilitation under general anesthesia, and the indirect costs from lost productivity and income disruption [40, 41]. These costs are exacerbated by limited health insurance coverage and high out-of-pocket expenses, which delay care-seeking and complicate treatment. Without cost-effectiveness analyses, ECC prevention competes poorly against other child health interventions supported by stronger economic data.

Closing this evidence gap is urgent. African governments and research institutions must prioritize oral health surveillance as a foundational component of UHC implementation. ECC indicators should be embedded within national health information systems using electronic platforms such as the District Health Information System 2 (DHIS2) and integrated into household surveys, including DHS [42] and the Multiple Indicator Cluster Surveys [43]. In parallel, economic studies must quantify the return on investment of ECC prevention, building on evidence that preventive care is both feasible and cost-effective in low-resource contexts [44, 45]. Reliable epidemiological and economic data are not optional extras. They represent the foundation for making ECC prevention visible, fundable, and actionable within UHC frameworks.

### 2.2 Policy and program response for early childhood caries control in Africa

Effective ECC control within Africa's UHC frameworks requires deliberate policy shifts that integrate preventive oral health into PHC and leverage existing service delivery platforms. This approach aligns with UHC principles by reducing reliance on specialized dental care, expanding access for underserved populations, and demonstrating cost-effectiveness through proven interventions [46–48]. Health systems often treat oral health as a vertical program, but embedding ECC prevention within broader health infrastructure will produce stronger and more sustainable results [49].

Maternal and child health (MCH) platforms offer the most immediate and scalable opportunity for ECC integration. Studies show that embedding oral health across the continuum of maternal care, from antenatal to postnatal services, enables preventive messaging, routine screening, and clear referral pathways [50]. For example, integrating

screening for ECC and fluoride varnish applications into vaccination schedules is particularly effective, with a reported benefit–cost ratio of 16:1 and associated reductions in ECC risk [44, 45]. Improving maternal oral health during pregnancy also supports child outcomes by establishing positive health behaviors [51, 52].

In addition, expanding the roles of community health workers and nurses through task-shifting offers a practical mechanism to deliver these services in the resource-constrained systems of African countries [53–55], while school- and community-based programs offer the opportunity to strengthen oral health literacy [56–64]. However, the effectiveness of these programs varies across settings due to socioeconomic disparities, service delivery variability, and contextual influences on implementation [65–68].

Also, pediatricians, general practitioners, and other frontline providers often see children before dentists do. Yet, many of these providers lack adequate training in oral health promotion, early caries detection, and fluoride use [69, 70]. Strengthening educational curricula and continuing education programs for these providers can improve interdisciplinary collaboration, promote early referral, and reinforce person-centered care [71].

### 2.3 Strengthening early childhood caries control approaches in Africa

Effective integration of ECC prevention within UHC depends on investing in health systems to develop contextually relevant evidence and innovative delivery mechanisms adapted to African realities. We identified five related strategies that provide the foundation for sustainable prevention programs. These five strengthening approaches provide a comprehensive strategy for embedding ECC prevention sustainably within Africa's evolving UHC systems. Each approach contributes to system resilience, while their combined effect supports the broader goals of equity, comprehensiveness, and sustainability in UHC.

**Generating local and contextual evidence** Studies highlight the need to evaluate the cost-effectiveness and scalability of interventions such as fluoride varnish application, use of fluoridated toothpaste, and silver diamine fluoride within African populations [72–74]. This research must also address environmentally related risk factors. For example, the groundwater fluoride levels exceed the WHO's safety thresholds in at least 14 countries, increasing the risk of fluorosis if this evidence is not factored into topical fluoride access programs [75–81]. Efforts must also be invested in strengthening indigenous research capacity to produce evidence that is both relevant and actionable.

**Harnessing technology and innovation** Africa's rapid growth in mobile phone penetration provides a platform for mobile health initiatives that deliver preventive education directly to caregivers [51]. Telehealth-enabled screening and referral can connect specialists with underserved communities and address geographic and workforce shortage barriers [52]. Adapting digital tools to diverse socioeconomic contexts and integrating them within culturally relevant approaches, including community-based participatory research that acknowledges traditional healing systems, is important [82–85]. These innovations can help expand access while reinforcing UHC's commitment to equitable service delivery.

**Conducting implementation research** Implementation research is critical to ensure that ECC prevention strategies move beyond isolated pilot projects and become embedded within national systems. Analyses of oral health policies across African countries reveal variable legislative support, limited financing, and persistent human resource shortages [86–88]. Research must therefore identify which policy instruments and delivery models can be adapted, scaled, and sustained across sub-regional contexts [89, 90]. Building this evidence base will enable governments to make context-sensitive decisions that align ECC prevention with broader UHC reforms.

**Integrating ECC prevention into early childhood development programs** This positions oral health as central to the overall child well-being. ECD interventions improve nutrition, school readiness, and long-term development outcomes, and embedding oral health into these platforms can amplify impact [91–93]. Combined health and nutrition interventions can yield significant gains without reducing service quality, provided integration is carefully designed [94, 95]. Recognizing ECC as a child development issue rather than a narrow dental concern will also strengthen cross-sectoral support and expand the political constituency for action.

**Building a strong locally-relevant economic case** Finally, building a strong locally-relevant economic case remains essential to securing political commitment and sustained investment. Global evidence demonstrates that early childhood programs, including oral health interventions, generate long-term benefits far exceeding their costs, with returns estimated at 8–19 times the initial investment [96, 97]. Economic models similarly project that preventive ECC programs improve educational attainment, increase productivity, and reduce future healthcare expenditures [98–101]. However, these conclusions are derived from studies in high-income countries and may not directly translate to the African context. Positioning ECC prevention as a strategic economic investment within UHC, therefore, requires African-specific economic evaluation. Such evidence will be crucial for justifying budget al.locations and competing effectively within national health priority setting.

## 3 Discussion

This critical review highlights a contradiction in Africa's approach to UHC. Leaders pledged to expand services to one billion more people, but strategic actions for ECC prevention were left behind. The barriers to integration operate at multiple levels. Politically, ECC remains absent from national health agendas and monitoring systems, signaling weak recognition and limited accountability [102, 103]. Technically, severe data deficits, both epidemiological and economic, undermine evidence-based planning and resource allocation. In particular, the near-absence of African economic evaluation studies for ECC prevention leaves policymakers without a critical tool for priority setting. Structurally, workforce shortages and the historical separation of oral health from PHC hinder the delivery of preventive services through UHC [102, 103]. These weaknesses collectively create an environment that undermines the ECC management.

There are, however, clear opportunities for integration. MCH services, immunization platforms, and PHC delivery systems already provide feasible entry points for preventive interventions, including fluoride varnish application and caregiver counseling [50–105].

Task-shifting to community health workers and nurses expands coverage in resource-constrained systems [53–55], while school- and community-based programs strengthen oral health literacy and preventive practices [56–64]. Digital innovations, such as mHealth education and telehealth consultation, offer additional tools for bridging access gaps [51, 52]. These integration opportunities suggest that ECC prevention can be incorporated into UHC without additional infrastructure.

Also, pediatricians, general practitioners, and other frontline providers often see children before dentists do. Yet, many of these providers lack adequate training in oral health promotion, early caries detection, and fluoride use [69, 70]. Strengthening educational curricula and continuing education programs for these providers can improve interdisciplinary collaboration, promote early referral, and reinforce person-centered care [71].

Strengthening ECC prevention requires more than adding services. Building indigenous research capacity will generate locally relevant data and avoid reliance on external findings that may not apply to African contexts [106–108]. Implementation research can identify financing, workforce, and legislative mechanisms that make integration scalable [86–90]. Embedding oral health into ECD programs reframes ECC as part of a holistic child welfare agenda and strengthens multi-sectoral partnerships [91–95]. Economic evaluation links oral health to social and economic development [96, 97]. These findings confirm that ECC prevention is not only a health imperative but also a strategic investment for UHC systems.

Our conceptual framework synthesizes these insights. It models point to the feasibility of concrete accountability metrics. It also explains why ECC prevention requires political recognition, robust data systems, expanded workforce capacity, and multi-sectoral engagement to achieve meaningful integration. Based on our critical review, we propose three immediate, feasible actions for ministries of health: (1) add ECC indicators and include oral health modules in global surveys conducted in African countries; (2) enable task-shifting for fluoride varnish application and caregiver counseling during immunization and MCH contacts; and (3) subsidize fluoridated toothpaste and issue national fluoride use guidelines informed by groundwater-fluoride mapping. These short-term steps demonstrate equity in action while longer-term system reforms advance. Table 2 highlights a suggested implementation framework.

To ensure sustainability and scalability within Africa's complex and resource-constrained settings, countries should adopt a phased scale-up approach anchored in strong governance, continuous learning, and proactive barrier mitigation. This requires national leadership complemented by multi-sectoral coordination to align resources and integrate oral health into broader health and development agendas. Robust monitoring and adaptive management systems are essential to refine implementation and respond to challenges in real time. Finally, addressing potential barriers, such as professional resistance to change, logistical constraints, and financial sustainability, is critical for long-term success.

Successful implementation of this framework would require securing a committed political champion to advocate for the program at the highest levels. This leader should empower a multi-sectoral committee, founded on clear terms of reference and decision-making protocols, to steer the initiative with purpose and accountability. With this governance foundation in place, the work begins on the ground through a carefully phased

**Table 2** Implementation framework for integrating early childhood caries prevention into universal health care

| Domain | Key Actions | Responsible Stakeholders | Expected Outcomes |
|---|---|---|---|
| Agenda Setting | Develop policy briefs<br>Convene high-level advocacy meetings<br>Include ECC indicators in UHC compacts | WHO, Ministries of Health, Dental Associations, NGOs | ECC is recognized as a problem and its prevention as a measurable target in national health policies and UHC monitoring reports |
| Data Systems | Integrate ECC indicators, country national surveillance systems, and oral health modules into global surveys | Ministries of Health, National Statistics Bureaus, WHO, UNICEF | Reliable national ECC prevalence data for children under five to guide program design and evaluation |
| MCH Integration | Train nurses and community health workers on fluoride varnish application and caregiver counselling<br>Develop integrated job aids | Ministries of Health, Training Institutions, and WHO | Children attending immunization clinics receive preventive oral health services |
| Fluoride Scale-Up | Subsidize fluoridated toothpaste<br>Establish national fluoride guidelines<br>Map groundwater fluoride levels | Ministries of Health, Commerce, Environment, and Regulatory Agencies | Increased population use of fluoridated toothpaste<br>Safe and equitable rollout of fluoride varnish programs |
| Community Engagement | Develop culturally tailored messaging<br>Engage traditional leaders, educators, and influencers | Ministries of Health, Education, and Civil Society Organizations | Greater parental knowledge and demand for preventive ECC services<br>Improved community acceptance and uptake |

pilot in selected regions. To build trust and ensure quality, the new ECC-related data fields integrated in the national surveys are first tested in a few districts, where health information officers receive specialized training. Potential professional resistance should be proactively addressed by involving all stakeholders in an inclusive process to co-develop guidelines for clinically assessing ECC in the field. Concurrently, efforts should turn to securing essential supplies and understanding the environment. Action may require integrating fluoride toothpaste into national essential medicines lists, while collaboration with water-testing ministries begins the critical work of mapping natural fluoride levels.

Finally, the strategy should ensure community ownership from the outset. Health messages should be co-designed and disseminated with community leaders to guarantee cultural acceptability and then shared through trusted channels of local languages and media. This comprehensive, collaborative approach weaves the program into the fabric of the health system and society it aims to serve.

## 4 Conclusion

This review establishes that integrating ECC prevention into Africa's UHC frameworks remains both a pressing gap and a strategic opportunity. The evidence shows that ECC prevention aligns with UHC principles of equity and service integration, yet political neglect, data deficits, and structural workforce constraints continue to exclude young children from essential oral health services. Meaningful progress requires explicit political recognition of ECC as a priority, robust surveillance and economic evaluation systems, and integration of preventive interventions into MCH platforms, schools, and community programs. Achieving this integration will reduce disease burden, improve child development, and strengthen UHC's promise of equity. Prioritizing ECC

prevention demonstrates that African health systems can move beyond aspirational commitments to deliver genuine universal coverage that protects the continent's youngest and most vulnerable populations.

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**Author contributions**
M.O.F. conceived the study. The Project was managed by M.O.F., A.B., and M.E.T. M.O.F. curated the data. Data analysis was conducted by M.O.F. M.O.F. developed the first draft of the document. A.A. drew the visualisation. A.A., A.B., and M.E.T. read the draft manuscript and made inputs before the final version. All authors approved the final manuscript for submission.

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**Consent to participate**
Not applicable.

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