



CLINICAL RESEARCH:

Prevalence and Severity of Dental Caries in Children and Adolescents in Rapa Nui, 2023-2024 Prevalencia y severidad de la caries dental en niños y adolescentes en Rapa Nui, 2023-2024

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Received: 17-IX-2025

Accepted: 7-X-2025

ABSTRACT: Dental caries is one of the most prevalent chronic diseases in childhood, affecting quality of life and overall development. Easter Island, due to its insular condition, presents social, cultural, and geographical characteristics that may influence the oral health status of its population, including isolation, language barriers, and a rapid dietary transition. To determine the prevalence and severity of dental caries among children and adolescents on Easter Island between 2023 and 2024. Observational ecological study based on data from the Monthly Statistical Registry (REM) of the Ministry of Health. The study included children and adolescents aged 0 to 14 years who received dental care during the specified years. Variables analyzed included service coverage, caries prevalence, severity (number of affected teeth), age, sex, and age group. Statistical analysis involved proportion comparisons, coefficients of determination (R^2), and distribution by severity. A significant decrease in overall caries prevalence was observed, from 63.31% in 2023 to 40.00% in 2024. In the 0-5-year age group, caries prevalence decreased from 35.21% to 20.50%, and in the 6-14-year group from 92.65% to 82.43%. Caries severity also decreased, with an increase in caries-free cases and a reduction in cases with multiple affected teeth. The findings suggest a positive impact of preventive strategies, particularly in early childhood. However, the high prevalence in the 6-14-year age group indicates the need to intensify targeted interventions for this population. It is recommended to consider the cultural and geographical context when designing oral health policies and to establish a permanent epidemiological surveillance system on the island.

KEYWORDS: Dental caries; Oral health; Dental health services; Adolescent; Epidemiologic surveillance; Geographic isolation.

RESUMEN: La caries dental es una de las enfermedades crónicas más prevalentes en la infancia, afectando la calidad de vida y el desarrollo integral. Isla de Pascua, por su condición insular, presenta características sociales, culturales y geográficas que pueden influir en el estado de salud bucal de su población, como el aislamiento, barreras idiomáticas y una rápida transición alimentaria. Determinar la prevalencia y severidad de la caries dental en niños y adolescentes de Isla de Pascua entre los años 2023 y 2024. Estudio observacional, ecológico basado en datos del Registro Estadístico Mensual (REM) del Ministerio de Salud. Se incluyeron niños y adolescentes de 0 a 14 años que ingresaron a atención odontológica en los años señalados. Se analizaron variables como cobertura de atención, prevalencia de caries, severidad (número de dientes afectados), edad, sexo y grupo etario. El análisis estadístico incluyó comparación de proporciones, coeficientes de determinación (R^2) y distribución por severidad. Se observó una disminución significativa de la prevalencia de caries en la población total (de 63,31 % en 2023 a 40,00 % en 2024). En el grupo de 0 a 5 años, la caries disminuyó de 35,21 % a 20,50 %, y en el grupo de 6 a 14 años de 92,65 % a 82,43 %. La severidad también se redujo: aumentaron los casos libres de caries y disminuyeron los casos con múltiples dientes afectados. Los resultados sugieren un impacto positivo de las estrategias preventivas, especialmente en la primera infancia. Sin embargo, la alta prevalencia en el grupo de 6 a 14 años indica la necesidad de intensificar intervenciones específicas en este grupo. Se recomienda considerar el contexto cultural y geográfico en el diseño de políticas de salud oral y establecer un sistema de vigilancia epidemiológica permanente en la isla.

PALABRAS CLAVE: Caries dental; Salud bucal; Servicios de salud dental; Adolescentes; Vigilancia epidemiológica; Aislamiento geográfico.

INTRODUCTION

Dental caries is one of the most prevalent chronic diseases worldwide and represents a significant public health issue in both developed and developing countries (1). It is a multifactorial, chronic, and complex condition that affects dental structures, primarily enamel and dentin, and can lead to localized destruction (2). Its consequences extend beyond oral health, negatively impacting general health and quality of life, particularly in childhood. In children, it can cause pain, discomfort, sleep and feeding disturbances, and may interfere with physical growth, development, and family dynamics (3).

Beyond its health implications, dental caries poses a substantial economic burden on families and healthcare systems, especially when treatment requires general anesthesia (4). A child with caries in the primary dentition is at high risk of develop-

ping additional lesions in both primary and permanent teeth (5).

A particularly severe form during early childhood is Early Childhood Caries (ECC), defined as the presence of one or more decayed, missing, or filled tooth surfaces in children under six years of age (6). This condition is influenced by various sociocultural and environmental factors that shape oral hygiene behaviors (6,7). Major risk factors include poor oral hygiene, frequent consumption of sugars and fermentable carbohydrates, inadequate fluoride exposure, and practices such as nighttime feeding or prolonged breastfeeding without proper oral hygiene (1,8,9).

In 2017, more than 530 million children worldwide were affected by caries in their primary dentition, with an average prevalence of 43% (10). In Chile, the situation is similarly concerning between 2007 and 2010, 17.5% of 2-year-olds

and 50.4% of 4-year-olds presented with dental caries (11). Marked inequalities in oral health persist, disproportionately affecting children from lower socioeconomic backgrounds, rural areas, or geographically isolated territories (12-15).

Rapa Nui, also known as Easter Island, is a Chilean territory with unique challenges in health-care delivery due to its geographical isolation. A 2012 study reported that 58% of schoolchildren aged 6 to 15 years had a history of caries in their permanent dentition, with a mean DMFT index of 1.19 (16). However, there is limited up-to-date information regarding the current oral health status of the island's population. In 2024, a study characterized malocclusions among schoolchildren on the island (17), highlighting the urgent need to update epidemiological data on dental caries.

Given the island's unique environmental conditions and limited access to specialized dental care, generating local and current evidence is essential to guide public health policies, preventive strategies, and treatment programs tailored to the needs of this population. In this context, the aim of this study is to determine the prevalence and severity of dental caries in children and adolescents aged 0 to 14 years on Rapa Nui during the years 2023 and 2024.

METHODOLOGY

An observational ecological study was conducted, based on secondary data obtained from the Monthly Statistical Summaries (REM), an official tool of the Chilean Ministry of Health that records, consolidates, and publishes activities carried out in public healthcare facilities. This information is centralized by the Department of Health Statistics and Information (Departamento de Estadísticas e Información de Salud, DEIS) and supports the monitoring of public health programs, agreements, and health targets. It is publicly accessible via the Ministry's official website.

The study population included all children aged 0 to 14 years who were beneficiaries of the public healthcare system (Fondo Nacional de Salud, FONASA) and who received dental care at Hanga Roa Hospital during the years 2023 and 2024. This hospital belongs to the care network of the Metropolitan Eastern Health Service (SSMO) and is the only healthcare facility on Rapa Nui that provides dental services.

As this study involved a secondary analysis of administrative data, no sample size calculation was performed, since all records available during the study period were considered. This approach allowed for a representative estimation of the prevalence and severity of dental caries in the target population. Caries history records were included for children aged 0 to 14 years who were enrolled for the first time in the Caries Risk-Oriented Control Program (CERO), obtained from the institutional database of the island's public health center for the period 2023-2024. These records were consistently completed in person by a dentist: the dmft index was recorded for children under 7 years of age, and the DMFT index for those aged 7 years and older. Children who did not receive dental care at the public hospital during the study period, as well as those who sought private care either on or off the island, were excluded, which may constitute a potential source of selection bias.

The primary data source was REM Series A-09, which includes information on dental care activities performed in both primary health care (PHC) and secondary care settings. Specifically, Section C of this series provides data on entry and discharge from dental treatment, as well as caries indices: the deft index (ceo-d) for primary dentition and the DMFT index (COP-D) for permanent dentition. These indicators reflect caries history at the time of admission and are calculated as the sum of decayed, filled, or missing teeth due to caries. The values were categorized into the following groups: "0" (caries-free), "1-2", "3-4", "5-6", "7-8", and

“9 or more” affected teeth. For the purposes of this study, the ceo-d index was used for children under 7 years of age, and the COP-D index for children and adolescents aged 7 to 14 years.

As a complementary data source, records from the Open Data Portal of FONASA were used, which provide annual information on the insured population, disaggregated by age, sex, and municipality. This database was utilized to estimate the number of FONASA beneficiaries aged 0 to 14 residing in the municipality of Easter Island in 2023 and 2024.

The main variables analyzed were:

- Dental caries prevalence: defined as the number of individuals with a ceo-d index > 0 (for children under 7) or a COP-D index > 0 (for children aged 7 to 14) (18). For statistical analysis, this variable was disaggregated by sex (male/female) and age group (0-5 years/6-14 years).
- Dental caries severity: estimated by the number of teeth affected by caries at the time of treatment admission, categorized into four groups: “0” (caries-free), “1-2”, “3-4”, and “5 or more” carious teeth.

To assess differences in caries prevalence by sex, age, and year, the Pearson Chi-square (χ^2) test was applied. Additionally, the coefficient of determination (R^2) was used to analyze the proportion of variability explained by age. A significance level of $p < 0.05$ was considered statistically significant. Dental care coverage was also estimated and calculated as the percentage of children and adolescents aged 0 to 14 years who received dental care at Hanga Roa Hospital in relation to the total FONASA beneficiary population in the same age group for each year analyzed (19). Furthermore, the Annual Percentage Variation (APV) in dental care coverage between 2023 and 2024 was evaluated. APV is commonly used in economics and epidemiology to measure the percentage

change in time series data. It was calculated using the following formula:

$$\frac{\text{Final dental care coverage} - \text{Initial dental care coverage}}{\text{Initial dental care coverage}} \times 100$$

This study used anonymized, secondary, and publicly accessible data obtained from the *Monthly Statistical Summaries* (REM) of the Chilean Ministry of Health. Since no identifiable patient information was accessed and no direct interventions were conducted, the study did not require individual informed consent or approval by a Scientific Ethics Committee, in accordance with current national regulations governing research based on public databases.

RESULTS

During the 2023-2024 period, a total of 374 children and adolescents aged 0 to 14 years received dental care at the Hanga Roa Health Center, which is part of the Metropolitan Eastern Health Service (SSMO).

Dental care coverage was 7.45 children and adolescents per 100 FONASA beneficiaries in 2023, increasing to 12.56 per 100 beneficiaries in 2024. This represents an Annual Percentage Variation (APV) of 68.6%, as shown in Table 1.

Figure 1 shows a significant decrease in the overall prevalence of dental caries between 2023 and 2024, both in general terms and when disaggregated by sex. Among males, prevalence decreased from 59.72% in 2023 to 38.79% in 2024, representing a reduction of approximately 21 percentage points. In females, prevalence dropped from 67.16% to 41.18% over the same period, equivalent to a reduction of nearly 26 percentage points.

When analyzed by age group, a notable decline in caries prevalence was observed among children aged 0 to 5 years, decreasing from

35.21% in 2023 to 20.50% in 2024. Conversely, the 6 to 14 years group exhibited an extremely high prevalence, although a slight decrease was noted across the study period.

In the total population analyzed, the prevalence of dental caries decreased from 63.31% in 2023 to 40.00% in 2024. However, the differences in caries prevalence between males and females were not statistically significant in either year ($p > 0.05$).

Regarding caries prevalence by age, Figure 2 shows a steady and increasing trend of caries-related damage as age increases, with a coefficient of determination of $R^2 = 0.9163$ in 2023.

In 2024, this trend persists, although with a slight decrease in the strength of the relationship ($R^2 = 0.8895$). This pattern remains consistent across both study years. Notably, in 2023, 100% of children aged 8 to 9 years presented with caries-related damage, whereas in 2024 this figure decreased to 89.5%.

To assess the severity of dental caries in the study population, Figure 3 compares the distribution of caries according to the number of affected teeth in two age groups (0-5 years and 6-14 years) for the years 2023 and 2024.

In the 0 to 5 years age group, an increase was observed in the proportion of caries-free children ($ceo-d=0$), rising from 64.8% in 2023 to 79.5% in 2024. A decrease was observed across all categories of affected teeth between 2023 and 2024.

In the 6 to 14 years age group, positive changes were also noted, though to a lesser extent. The proportion of caries-free individuals increased from 7.4% in 2023 to 17.6% in 2024. Likewise, the percentage of children with 3 to 4 decayed teeth decreased from 51.5% to 37.8%, and a slight reduction was seen in those with 5 or more affected teeth (from 26.5% in 2023 to 24.3% in 2024). On the other hand, the percentage of children with 1 to 2 carious teeth increased from 14.7% to 20.3%, suggesting a possible shift from more severe stages of the disease toward milder forms.

Table 1. Dental Care Coverage at Hanga Roa Hospital, Rapa Nui, 2023-2024.

Study Year	Number of Cases	Validated FONASA Population (VFP)	Coverage (%)	APV (%)
2023	139	1,864	7.45	--
2024	235	1,871	12.56	68.6

Number of cases: Children and adolescents aged 0 to 14 who received dental care.

VFP: Validated FONASA population aged 0 to 14 for each respective year.

APV: Annual Percentage Variation in dental care coverage.

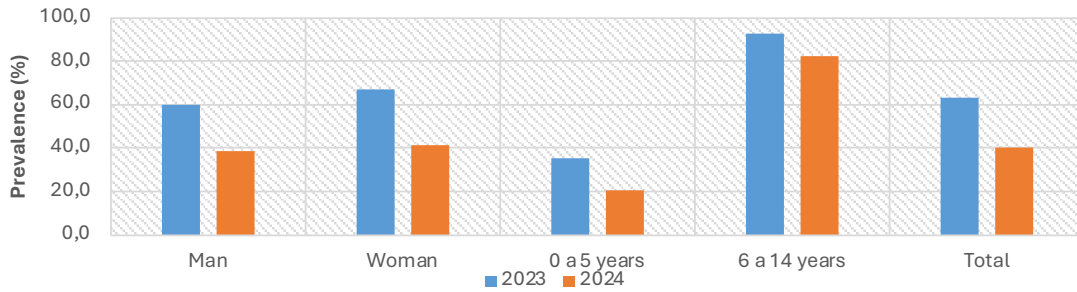


Figure 1. Prevalence of dental caries by sex and age group in the Rapa Nui population, 2023 and 2024.

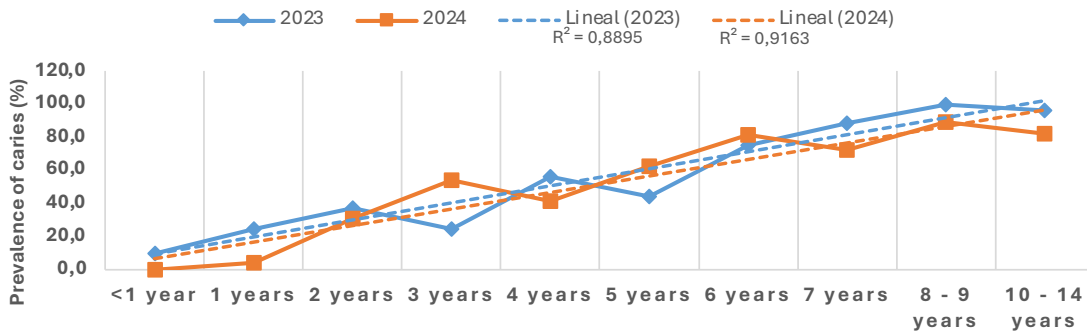


Figure 2. Prevalence of dental caries by age in the Rapa Nui population, 2023 and 2024.

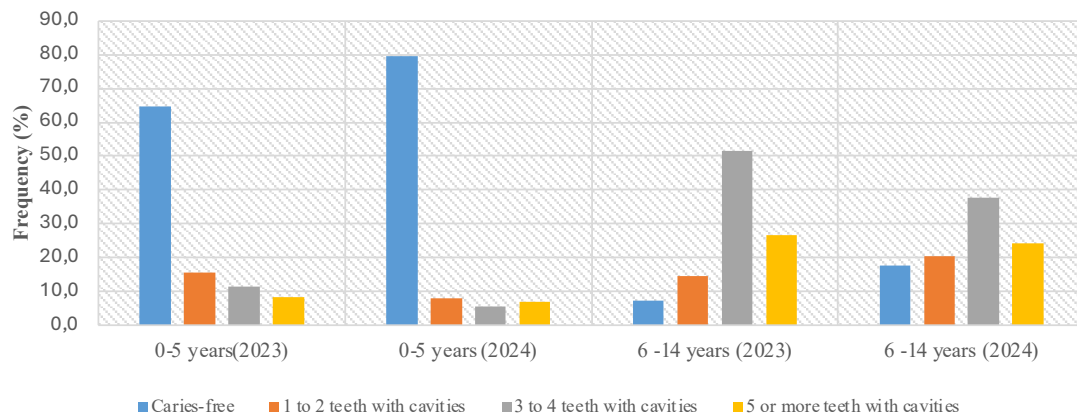


Figure 3. Severity of dental caries in the pediatric population of Rapa Nui, 2023 and 2024.

DISCUSSION

The present study aimed to determine the prevalence and severity of dental caries among the pediatric and adolescent population of Isla de Pascua (Rapa Nui), a geographically isolated and unique territory where epidemiological data on oral health are notably scarce. The results obtained for the period 2023-2024 provide updated and relevant evidence for a population that has historically been underrepresented in national oral health studies.

One of the key findings was the 69.0% increase in dental care coverage between 2023 and 2024, which may reflect improved accessibility or enhanced documentation of dental services. This increase may be linked to local health promotion and prevention strategies, as well as the implementation or strengthening of the CERO Program, which in its most recent version expanded coverage to include not only children but also adolescents (20). To prevent and control dental caries, it is necessary to shift from a restorative approach to one focused on maintaining oral health. In this context, the CERO Program (Caries Risk-Oriented Control) was launched in 2017 by the Ministry of Health, with the aim of improving the health and quality of life of the pediatric population. The program seeks to ensure access to diagnosis, timely treatment, and oral health education, factors that are expected to promote the early detection of carious lesions and timely intervention. In this context, the increased service coverage likely contributed to the observed improvement in oral health indicators during the study period (21).

Regarding the prevalence of dental caries, the results of this study demonstrate a significant reduction among children and adolescents in Isla de Pascua between 2023 and 2024, decreasing from 63.31% to 40.00%, which represents a

reduction of more than 23 percentage points. A similar downward trend has been reported in the Mexican population aged 0 to 15 years, where a sustained decline in caries prevalence has been observed over recent decades (2).

Furthermore, the prevalence found in this study is lower than the 49.0% reported among children and adolescents treated under the National School Assistance and Scholarship Board (JUNAEB) Oral Health Program in Chile (14). It is also below the national indicators reported by the Chilean Ministry of Health (MINSAL), which show a caries prevalence of 70.4% in 6-year-olds and 62.5% in 12-year-olds (21).

This decline reflects a general improvement in oral health status, which may be associated with the increased dental care coverage in 2024, as well as the reinforcement of preventive strategies such as the CERO Program (20).

When comparing the present findings with those reported in other Indigenous populations, both similarities and epidemiologically relevant differences are observed. In Indigenous communities in Australia, the prevalence of childhood caries has been described as approximately twice that observed in non-Indigenous children. In primary dentition, prevalence ranged from 52% to 77%, whereas in permanent dentition it varied between 36% and 60% (22). Furthermore, the presence of enamel defects has been documented to double the risk of developing caries in the affected teeth (23).

In the Latin American context, available evidence confirms a high burden of dental caries in Indigenous communities. In Ecuador, the prevalence in primary dentition ranged from 15.9% to 52.3%, with an average of two affected teeth per child; in permanent dentition, prevalence reached 75%, with approximately three affected teeth on average (24). In Brazil, among the Potiguara Indigenous

population, a similarly high prevalence and need for dental treatment have been reported: children aged 18 to 36 months presented an average of 2.5 ± 3.7 decayed primary teeth, increasing to 5.8 ± 4.3 by the age of 5 years (25). In the Xukuru do Ororubá community, only 27% of children aged 10 to 14 years were caries-free, with a mean DMFT index of 2.38 (2.04-2.72) (26).

In this context, the findings obtained on Easter Island acquire relevance. The reduction observed in the 0-5-year age group (from 35.21% to 20.50%) represents a significant finding; however, the prevalence among children aged 6-14 years remains high (82.43%), at levels comparable to those reported in other Indigenous communities in the region. These results underscore the need to implement sustainable and culturally appropriate preventive strategies, as well as to ensure timely and equitable access to dental care, in order to reduce oral health disparities in vulnerable populations.

When analyzing prevalence by sex, both boys and girls experienced a substantial decrease. Although girls consistently exhibited a higher prevalence, these differences were not statistically significant, suggesting that sex is not a determining factor for the presence of caries and that the burden of disease affects both sexes similarly. The interventions implemented appear to have benefited both boys and girls equally, consistent with findings reported by other authors (2, 13, 27).

The age-group analysis revealed a consistent decline in caries prevalence, although the magnitude of reduction varied by age. Among children aged 0 to 5 years, prevalence decreased from 35.21% in 2023 to 20.50% in 2024, suggesting a potential cumulative effect of primary prevention strategies implemented during early childhood. These include regular fluoride use, caregiver-

focused oral health education, and timely access to dental check-ups.

Caries at this age is often linked to risk factors such as frequent consumption of free sugars and poor oral hygiene (28). The observed reduction aligns with previous studies highlighting the high vulnerability of children to early childhood caries (ECC), particularly in contexts of social and economic inequality, where structural determinants hinder effective prevention (12, 15, 27, 29).

In contrast, among children and adolescents aged 6 to 14 years, a decrease in caries prevalence was also observed, from 92.65% to 82.43%, although this rate remains alarmingly high. These results reinforce the notion that this age group continues to be highly susceptible to the disease. This persistence may be attributed to a combination of biological, behavioral, and socioeconomic factors that hinder adherence to sustained preventive measures (2).

Multiple studies have demonstrated that this high caries burden in school-aged children is associated with unhealthy dietary patterns, low use of fluoridated toothpaste, and limited coverage of preventive programs in school settings (30-33). Therefore, despite the positive reduction observed, it is necessary to intensify targeted interventions in this population, particularly through comprehensive strategies combining education, topical fluoridation, and regular clinical follow-up.

Although the observed decrease represents a positive advancement, the fact that over 80% of the 6 to 14 years group still presents dental caries highlights the urgent need to strengthen preventive interventions. In this context, the expansion of the Program CERO to include adolescents since 2021 has enabled the incorporation of syste-

matic oral health education activities, ensured regular access to dental check-ups, and promoted integrated prevention strategies within school environments (20).

The increasing trend of dental caries with age, supported by high coefficients of determination ($R^2=0.9163$ in 2023 and $R^2=0.8895$ in 2024), reaffirms that dental caries is a cumulative disease when effective preventive measures are not implemented. This relationship has been extensively documented in the scientific literature. For example, in Brazil, a study showed that among children aged 1 to 5 years, 5-year-olds had more than six times the prevalence of caries compared to 1-year-olds (34). Similarly, a comparative analysis conducted in England and Wales, the United States, Japan, and Sweden demonstrated a strong age effect on caries experience: despite a recent decline in childhood prevalence, caries levels consistently increase with age and remain high in adults (35).

This evidence supports the need to intensify preventive efforts from the earliest years of life to avoid the progressive deterioration of oral health during childhood and adolescence. Although a slight reduction in the strength of this correlation was observed in 2024, the overall trend persists, emphasizing the importance of early and sustained intervention strategies over time.

Easter Island presents particular conditions that may influence the observed results, such as its geographical isolation, dietary transition, and linguistic or cultural barriers that could hinder access to dental care or adherence to oral health recommendations (36). Additionally, the influence of modern dietary patterns, characterized by high consumption of sugars and processed foods, may be accelerating the onset of caries in the pediatric population, as has been documented in other indigenous or rural communities (37,38). Given

this sociocultural complexity, it is essential that oral health public policies are designed considering the cultural, social, and geographical characteristics of the insular territory, ensuring cultural relevance and long-term sustainability.

On the other hand, the interpretation of the presented data may be limited by potential biases related to healthcare system access, as a portion of the pediatric population might not have attended dental check-ups at the health center, thereby compromising the representativeness of the entire community. In this regard, it becomes necessary to deepen the study of social and environmental factors, such as socioeconomic status, parental education, access to fluoridated water, and sugar consumption, through longitudinal, qualitative, or mixed-method studies.

Having a permanent epidemiological surveillance system on the island would allow for a more precise evaluation of the impact of preventive interventions, as well as the timely detection of changes in oral health trends. Overall, this study not only provides an updated overview of the oral health status of the pediatric and adolescent population on Easter Island but also highlights the urgent need to strengthen health surveillance and develop prevention strategies tailored to the local context.

These findings underscore the importance of strengthening the CERO Program as a national caries control strategy, particularly in socioculturally distinct territories such as Easter Island. The evidence highlights the need for public policies that prioritize prevention, universal access, and culturally appropriate oral health interventions. Given that similar social and cultural determinants affect Indigenous and rural communities across Latin America, the CERO model could be adapted and replicated in other countries, contributing to improved child oral health, reduced inequities, and greater sustainability of oral health programs.

CONCLUSION

The results of this study demonstrate a significant decrease in the prevalence and severity of dental caries among the pediatric and adolescent population of Easter Island between 2023 and 2024. This positive trend suggests a possible cumulative effect of the preventive strategies implemented within the framework of the CERO Program, especially following its expansion to include adolescents in 2021. However, the persistently high rates in the 6 to 14-year-old group indicate that this population remains highly vulnerable and requires more intensive, integrated, and sustained interventions.

Additionally, a strong correlation was identified between age and caries experience, reaffirming the cumulative nature of this disease when effective preventive measures are not applied from early stages. Despite the improvements observed, the particular conditions of Easter Island—such as its geographic isolation, dietary transition, and cultural barriers—represent structural challenges that must be considered when designing public policies and local oral health strategies.

Finally, this study highlights the importance of establishing permanent epidemiological surveillance systems to more accurately monitor the evolution of oral health in territories with unique characteristics like Rapa Nui. Only through a contextualized, intersectoral, and culturally relevant approach will it be possible to advance oral health equity and effectively reduce the disease burden in childhood and adolescence.

AUTHOR CONTRIBUTION STATEMENT: Conceptualization and study design: P.N.M.R. and S.R.Z.V.; Literature review: P.N.M.R.; Methodology and validation: P.N.M.R. and S.R.Z.V.; Formal analysis: S.R.Z.V.; Investigation and data collection: S.R.Z.V.; Resources: P.N.M.R.; Data analysis and interpretation: P.N.M.R. and S.R.Z.V.; Writing-original draft preparation: P.N.M.R.; Writing-review and editing: P.N.M.R. and S.R.Z.V.; Supervision: P.N.M.R.; Project administration: P.N.M.R.; Funding acquisition: None.

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