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Dental caries prevalence, prospects, and challenges for Latin America and Caribbean countries: a summary and final recommendations from a Regional Consensus

Abstract: Dental caries can be effectively managed and prevented from developing into cavitated lesions while preserving tooth structure at all levels. However, the strong correlation between caries and socioeconomic factors may compromise the efficacy of preventive strategies. The high prevalence of persistent inequalities in dental caries in Latin American and Caribbean countries (LACC) is a matter of concern. The estimates of the burden of disease in some countries in this region are outdated or absent. This paper aims to summarize and present the final recommendations of a regional Consensus for Dental Caries Prevalence, Prospects, and Challenges for LACC. This consensus is based on four articles that were written by a team of Latin American experts, reviewed by dental associations, and presented and discussed in two consensus events. The following domains were explored: epidemiology, risk factors, prevention strategies, and management of dental caries with a focus on restorative procedures. Dental caries can manifest throughout the lifespan of an individual, making it a matter of concern for infants, children, adults, and older people alike. The prevalence rates of untreated caries in deciduous and permanent teeth are high in many parts of the world, including LACCs. Previous evidence suggests that the prevalence of dental caries in 12-year-olds is moderate to high in most Latin American countries. Moreover, the prevalence of treatment needs and dental caries in the adult and elderly population can also be regarded as high in this region. The risk/protective factors (e.g., sugar consumption, exposure to fluoride, and oral hygiene) probably operate similarly in all LACCs, although variations in the interplay of these factors in some countries and within the same country cannot be ruled out. Although salt and water fluoridation programs are implemented in many countries, there is a need for implementation of a surveillance policy. There is also room for improvement with regard to the introduction of minimal intervention techniques in practice and public health programs. Dental caries is a marker of social disadvantage, and oral health promotion programs and interventions aimed at reducing the burden of dental caries in LACCs must consider the complexity of the socioeconomic dynamics in this region. There is an urgent need to promote engagement of stakeholders, policymakers, medical personnel, universities, dental

associations, community members, and industries to develop regional plans that enhance the oral health agenda for LACCs. A list of recommendations has been presented to underpin strategies aimed at reducing the prevalence and severity of dental caries and improving the quality of life of the impacted LACC population in the near future.

Keywords: Dental Caries; Epidemiology; Policy Making; Latin America; Caribbean Region.

Introduction

Our understanding of the interplay between the initiation and progression of carious lesions in deciduous and permanent teeth and the associated risk and protective factors has improved considerably over the past few decades. As previously reported, dental caries is a biofilm-mediated, multifactorial, dynamic disease driven by increased sugar consumption and characterized by phasic demineralization and remineralization of dental hard tissues.^{1,2} It currently represents a major public health problem globally despite a steady decline in prevalence rates in several countries; extensive, well-designed research; and increased comprehension of its pathology and management.^{3,4}

Untreated carious lesions of permanent teeth were the most prevalent health condition in 2010, affecting >2 billion people (approximately 35% of the population) globally whereas carious lesions of deciduous teeth were the 10th most prevalent condition, affecting 9% of the global population.³ The Global Burden of Diseases Study recently estimated that the prevalence rates of untreated dental caries decreased by only 4% globally in the last decade, suggesting that the marked decline observed over the past 30 years was slowing down. Moreover, the relative stability of these global numbers raises questions about the reduction of prevalence over the past 30 years.^{4,5,6}

The first paper published from this consensus focused on the burden of dental caries in Latin American and Caribbean countries (LACC), particularly in socioeconomically deprived populations as dental caries often acts as a marker of social disadvantage, and its effect on the quality of life of the Latin American and Caribbean population. The second article⁷ of this consensus explored our understanding of the mechanisms by which

risk factors operate in great detail, as much of the available epidemiological evidence from LACCs is inconsistent.¹ Lastly, a lack of robust epidemiological evidence on dental caries can seriously jeopardize the ability to develop effective preventive and restorative strategies for the control of dental caries, and these key themes have been discussed further in articles 3 and 4 of this consensus.^{8,9}

Like much of the developing world, some of the key challenges faced by LACCs include persistent inequality, poverty, high levels of corruption, and over-burdened public healthcare systems. This is further aggravated by a recent unprecedented migration crisis in Venezuela and Central America, creating a complex inhospitable scenario that complicates management of this multidimensional disease. Promoting engagement with stakeholders, policymakers, medical personnel, universities, dental associations, community members, and industries will allow development of tailored regional plans and enhancement of the oral health agenda. Cariologists, epidemiologists, and researchers must share best practice measures for effective management of dental caries as well as successful innovative approaches used to reduce the prevalence and severity of dental caries, taking regional challenges into consideration.

The current consensus contributes to this discussion and, most importantly, attempts to highlight the fact that dental caries is a preventable disease. There is sufficient available evidence on the prevention and control of this disease, even in deprived communities such as those in LACCs. Therefore, the aim of this paper is to present and summarize the final recommendations of the Latin American Consensus, "Dental Caries Prevalence, Prospects and Challenges for Latin American and Caribbean countries".

Latin America in numbers

The LACC region includes 33 countries with 650 million inhabitants who speak a Romance language (derived from Vulgar Latin). Fifteen autonomous territories or Areas of Special Sovereignty (USA, UK, and The Netherlands) have been included in many statistical surveys conducted within this geographical region.^{10,11,12}

The LACC region represents 9% of the global population, with projections estimating approximately 730 million inhabitants by 2050.¹⁰ It is the fourth most populated region in the world, with a predominantly urban population as a result of high urbanization rates (82.5%) comparable to that of the developed world. However, in contrast to wealthy urbanized countries, LACCs face several challenges such as structural constraints on the economy, under-funded and over-burdened public healthcare systems, and perhaps most importantly, persistently high levels of social inequality.¹³ In fact, various political and anthropological analyses have concluded that, despite economic reforms and social progress in some areas over the past few decades, the fundamental tenets of socioeconomic inequalities have not been substantially challenged in the region as yet.¹⁴

The current prevalence rates of oral health treatments and dental caries in the LACC region is worrying despite steady declines in the rates of caries in permanent teeth as observed in countries such as Brazil, Mexico, and Colombia. Moreover, the prevalence of dental caries in the primary dentition continues to remain high in the majority of LACCs, with > 50% of children and > 85% of the adult population being affected.^{1,6} A recent study showed that only five countries (Brazil, Colombia, Panama, Chile, and Uruguay) in the region had implemented oral health surveys of nationally representative samples of adults between 2000 and 2015.¹⁵ In 2018, Mexico published a national survey summarizing the status of dental caries in 32 federative entities in the country, with samples being collected from individuals belonging to different age groups over a period of two decades.¹⁶

The lack of epidemiological data in LACCs suggests that health planning in the region is largely based

on considerable levels of uncertainty. Therefore, Edgar Morin's advice, "*we should learn to navigate on a sea of uncertainties, sailing in and around islands of certainty,*" appears particularly relevant when planning regional oral health strategies taking uncertainties in educational issues in LACCs into consideration.¹⁷

Rural areas are typically faced with remarkable social challenges, requiring the development of audacious initiatives that deliver effective evidence-based care to the population. Currently, it is estimated that more than 400 different indigenous groups live in the LACC region, the majority of which are found in Bolivia, Guatemala, Peru, Ecuador, and Mexico.¹⁸ Therefore, oral health promotion programs should take into consideration the specificities and cultural characteristics of these communities as their participation is crucial for success.

It is also important to observe how rural populations and vulnerable urban communities understand oral health, as low literacy rates can delay caries detection, hinder adherence to preventive strategies, and jeopardize well-designed oral health promotion programs.^{19,20} Increased community involvement and research approaches that cater to traditionally excluded and marginalized sections of the society are essential, particularly in the context of the extensive internal and cross-national migration crisis being observed in Latin America. This displacement crisis is motivated by a number of reasons, including political and economic factors, security issues, natural disasters, and development projects (*e.g.*, mining concessions).^{10,11} Humanitarian operations being carried out in the border areas will soon prove to be inadequate for the provision of good health conditions to the migrants, and a combined regional and national response must be organized, particularly in countries such as Colombia and Mexico where the public healthcare systems are already overburdened and the number of refugees and migrants is escalating steadily.

Public health approaches used to reduce the burden of dental caries in LACCs must tackle the "causes of the causes" by addressing the historical and cultural aspects of the disease burden in addition to its social determinants. LACCs have a strong historical link to the production and consumption of sugar, accounting for approximately 40% of the global sugar output,

and this is expected to remain stable until 2028.²¹ The global consumption of sugar is increasing and has doubled (from 80 to 160 million tons/year) since the late 1970s. The LACC region too has exhibited a rising trend in consumption, despite numerous campaigns aimed at reducing intake. In 2015, a global analysis of the estimated daily calorie intake from sweetened sugar beverages per capita found that Chile, Mexico, Argentina, and Brazil exhibited the highest rates in the LACC region,²² and this could partly be attributed to strong opposition by the sugar industry to anti-obesity regulations such as soda taxes and front-of-package nutrition labeling.²³ According to the International Diabetes Federation, more than 26 million inhabitants of Latin America are expected to develop type 2 diabetes by 2025²⁴ representing an 85% increase in the prevalence rates. Estimating the prevalence of dental caries between the years 2025 and 2030 based on general trends from the LACC region showed that this region is undergoing a transition in development. The complexity of the social and economic environment in the region highlights the need for international efforts to advance regional plans for controlling dental caries.

Trends of and risk factors for dental caries in LACCs: summary of articles 1 and 2 of this Consensus

There is limited epidemiological evidence on the prevalence of dental caries in children and adults in LACCs, and although reliable national data is available for a few countries, the remainder either do not have any epidemiological evidence on prevalence rates or rely on small-scale studies for the same.¹⁵ Moreover, much of this evidence may be outdated despite being representative and significant. Although the guidelines proposed by the World Health Organization (WHO) have been available since the 1970s, there is a lack of standardization in dental epidemiological studies. Furthermore, many countries have not established a standardized database and system to monitor changes in dental caries prevalence rates.¹

Article 1 of this consensus¹ showed the existence of a wide range in reported mean DMFT scores of

12-year-old children, and recent evidence suitable for appropriate interpretation and regional comparisons is only available in a few countries. Till date, only two systematic reviews conducted in 1970 and 2016 have examined caries trends in 12-year-old children in the LACC region, making it difficult to ascertain whether the disease burden is increasing or decreasing in this region.^{6,25}

A few studies examining 12-year-old children in LACCs showed that the symptoms of dental caries and associated functional alterations often led to psychological issues that negatively affected the oral health-related quality of life of the LACC population. Moreover, these effects generally presented as a cumulative experience that worsened with disease progression, with severe cases impeding the patient's daily activities as well as that of their family members.¹

Caries risk assessment comprises of a range of factors that are not stable and also interact with one another, and a few epidemiological surveys in LACCs investigating some of the main risk factors of dental caries have corroborated the findings of previous systematic reviews.⁷ Non-white ethnicity, low educational levels exhibited by the parents, low family income, availability of a health insurance scheme, and old age have been associated with higher dental caries prevalence in the LACC population.²⁶ Additionally, behavioral risk factors such as a cariogenic diet, high frequency of sugar intake, additional sugar consumption, and poor oral hygiene have also been associated with increased risk of dental caries in this population. Other studies carried out in the LACC population demonstrated that the saliva buffering capacity, presence of *S. mutans* in the saliva, presence of erupting primary and permanent molars, and enamel defects were also related to the prevalence of dental caries.⁷

Previous studies have reported that the key risk factors of dental caries can occur at various stages of life. In older people, some factors that indicate a higher risk of caries include exposed root surfaces, increased root caries, gingival recession, poor oral hygiene, and lower socioeconomic levels. However, these findings have not been investigated in the LACC population.⁷

Potential strategies for preventing and controlling dental caries: summary of articles 3 and 4

Individual and context-driven healthy behaviors such as controlled sugar consumption and regular contact with fluorides are regarded as effective ways to prevent dental caries across all ages. Two additional strategies, application of dental sealants and oral health education, may also be implemented in order to achieve this objective⁸. However, synergistic implementation of these strategies is essential for effective caries control in the long term.

The LACC region is a powerhouse of the global sugar industry, with sugar plantations forming a major part of the local economy. Approximately half of the sugar produced in the region is destined for domestic consumption whereas the remainder is exported. Global sugar consumption is increasing, lowering associated costs and making it more widely available. In 2018, the average per capita consumption of sugar was 39.9 kilos/year in Central America and the Caribbean, 41.8 kilos/year in South America, and 34.7 kilos/year in Mexico. These values are considerably higher than those observed in Asia (18.2 kilos/year) and Africa (15.3 kilos/year), highlighting the need for population-based strategies aimed at reducing and controlling sugar intake to manage the risk of non-communicable diseases such as dental caries in LACCs. However, implementation of such strategies will be challenging due to the high rates of sugar consumption in the LACC region, and will be further complicated by limited available evidence on the efficacy of such strategies in this region.⁷

Although community-level fluoridation programs (such as fluoridated water or salt) are widespread in LACCs,⁸ the strategy is limited by several factors such as discrepancies in the areas covered within a country, unequal access to its benefits, and the need for efficient surveillance systems to monitor fluoride concentrations. This has led to discontinuation of the strategy in some regions. The use of fluoridated milk has also been reported,⁸ although less frequently compared to water and salt. Fluoride dentifrices, a popular individual-level strategy for caries control, may be more effective in its reach compared to

community approaches in areas not covered by water or salt fluoridation. However, adequate provision of information on the frequency of use of fluoride dentifrices and the release of soluble fluorides from the formulation into the mouth during tooth brushing is necessary in order to achieve an anti-caries effect.²⁷ Unfortunately, the majority of the population remains unaware of this information, making selection of appropriate commercially available fluoridated dentifrices difficult, particularly in the context of easily available poor-quality formulations with insufficient fluoride concentrations resulting in questionable anti-caries effects. On the other hand, incorporation of additives in fluoride toothpastes (*e.g.*, arginine) has shown promising results as these new technologies can enhance the effects of fluoride. Therefore, strategies targeting increased accessibility and affordability of high-quality formulations may guarantee the regular use of fluoride toothpastes in this region.

While some LACCs have clear policies on fluoride use,⁸ others do not, and proper regional legislations addressing soluble fluoride content in dentifrices along with effective surveillance programs monitoring different sources of fluoride exposure are necessary.⁸

The benefits of using of pit and fissure sealants in permanent teeth is well-established; however, there is limited evidence on its efficacy in primary molars.⁸ Several systematic reviews have reported substantial effectiveness of sealants in the prevention and control of occlusal caries when compared to no intervention although this may have been affected by the incidence of caries in the population. Community-based strategies promoting the use of occlusal sealants are scarce in the LACC region.

Educational interventions carried out by health professionals have the potential to promote good oral health at the individual and community levels.²⁸ The strong influence of social and behavioral risk factors on the incidence of dental caries highlights the importance of educational interventions targeting sugar consumption, regular contact with fluorides, issues for the appropriation of self-knowledge about the health-disease process, stimulating the autonomy and change in health behaviors leading to prevention and oral health promotion.

The management of a caries lesion is particularly challenging in the LACC region as many countries lack sufficient public health services and equitable access to their benefits.⁹ While improving access to benefits is desirable the primary goal is not just the restoration of a single lesion but the stabilization of the general oral function.

Another challenging aspect of caries lesion management is the selection of appropriate treatment measures, which vary with the stage of the lesion, its localization, and activity. The positive aspect is that most of the options are based on minimal intervention techniques.²⁹ Unfortunately, there is limited evidence on the most commonly used caries management strategies in the LACC region.⁹ While frequent use of a fluoridated toothpaste and restricted sugar intake may suffice for initial caries without cavity formation (ICDAS1&2), professional fluoride application (varnish, gel, or mousse) is recommended for high-risk patients. Silver Diamine Fluoride (SDF) may be used for surfaces where esthetics are not mandatory whereas glass ionomer cement or resin sealants can be used on occlusal surfaces.^{30,31,32}

Moderate caries may extend into the dentine (ICDAS 3&4), and lesions with localized enamel breakdown may be treated using sealants or SDF on occlusal surfaces. SDF has been shown to be an effective treatment option for caries control on any tooth surface in the primary dentition,^{33,34} although there is limited evidence of its efficacy in permanent teeth.³⁵ Buccal lesions can be controlled using a combination of fluoridated toothpastes, restricted sugar intake, and professional fluoride application. However, in case of no enamel breakdown but presence of an underlying dark shadow in the dentine, the treatment options are dependent on the extent that the dentine is affected. Dental sealants may be used in case of involvement of the external part of the dentine only, whereas cavity preparation, removal of infected dentine, and restoration using glass ionomer cement or resin is recommended in case of greater dentin involvement. The appropriate treatment option should be selected using an X-ray where possible.

Severe carious lesions (ICDAS 5 & 6), which represent the majority, should be treated using either Atraumatic Restorative Treatment (ART) or

the Hall technique if the cavity is too large. However, radical strategies including endodontic approaches or extraction of teeth that cannot be restored continue to be popular in the LACC and the use of preventive strategies must be supported in order to minimize the need for invasive interventions at more advanced stages of caries.⁹

The core curriculum for cariology in Latin American and Caribbean countries

The European Organization for Caries Research (ORCA) and the Association of Dental Education in Europe published the results of the first consensus workshop on the development of a European curriculum in cariology ten years ago.³⁶ The European Core Curriculum in Cariology (CCC) for undergraduate dental students included five educational domains focusing on basic sciences, concepts of evidence-based dentistry, epidemiology, public health, risk assessment, disease detection, diagnosis, decision-making, preventive therapy, and minimally invasive and advanced surgical treatment measures. The impact of the European CCC is noteworthy as it was further developed after a thorough survey of dental schools across Europe.³⁷

The CCC was implemented in universities in Brazil, Colombia, Chile, Venezuela, Dominican Republic, and Puerto Rico.³⁸⁻⁴² A survey on the inclusion of cariology education in Spanish-speaking dental schools in LACCs showed that non-operative caries management strategies were not implemented on a regular basis. Moreover, the majority of schools reported focusing on all of the main topics of cariology except those related to behavioral sciences, microbiology, saliva and systemic diseases, caries risk factors, root caries, erosion, and early caries management strategies.⁴³ In Brazil (a Portuguese-speaking country with more than 200 dental schools), the proportion of universities that provided a specific discipline of cariology seemed to be higher than those reported in Europe and other Latin American countries.⁴⁴ Apart from these initiatives, there is no regional discussion about the CCC in LACC.

It is important to note that cariology is currently not only strictly confined to caries-related aspects

but also includes all problems related to the hard tissues of the teeth.^{36,44}

A sustainable, comprehensive cariology curriculum that takes local, regional, and national challenges into consideration may prove useful in supporting future programs aimed at reducing the prevalence of dental caries in LACCs. It is essential to recognize that dental graduates represent future dental practitioners who have the potential to operate as valuable stakeholders and policymakers involved in working toward caries control in the near future.⁴⁵ The current COVID-19 pandemic has resulted in the development of a myriad of remote/virtual educational strategies, and a structured agenda based on a CCC in LACCs, which has the potential to boost new initiatives for the control of dental caries, generate opportunities to share successful experiences, and create favorable educational environments using virtual platforms.

Proposal of a dental caries surveillance program for LACC

Previous studies as well as a pan-European Consensus have highlighted the variations in thresholds and systems used for dental caries detection and recording.^{7,46} An individual's dental caries experience, fluoride exposure, and sugar intake may change over their lifetime, making epidemiological data representative of different age groups essential for the development of effective oral health promotion programs and strategies that can be used to monitor the prevalence and severity of the disease.

As mentioned previously, there is a need for high-quality studies that provide a clear picture of the prevalence of dental caries in LACCs and, in order to achieve this at the national level, this consensus

proposes a classification of countries according to the following criteria: a) the availability of epidemiological data on dental caries at the national level (*i.e.*, the caries data must be representative of the country [external validity criterion]); b) how up-to-date the data is (less than 10 years old) for valuable interpretation (temporal proximity criterion); and c) ease of availability from representative institutions (*e.g.*, Ministry of Health) or as published official documents (visibility and accessibility criteria).

Based on the above criteria, a dental caries monitoring or surveillance ranking system was proposed for LACCs (Tables 1, 2, and 3), and the countries were classified as follows: Green: if all criteria were fulfilled (Table 1); Yellow: if only one criteria was not fulfilled (Table 2); and Blank (Table 3): if none of the criteria were fulfilled.⁴⁷⁻⁶⁵

Table 1 shows that only three countries (Colombia, Mexico, and Paraguay), accounting for only 30% of the LACC population, have recent official national epidemiological survey data on dental caries (mean DMFT < 3.0 in 12-year-old children) available.

Tables 2 and 3 show that 30 countries, comprising 70% of the LACC population, have official data on dental caries that is more than 10 years old, highlighting the need for national epidemiological surveys in the near future. This is a matter of concern, particularly for the 22 countries (Table 3) comprising approximately 130 thousand inhabitants where the national epidemiological data is over 20 years old. Between 1986 and 2004, the DMFT scores of 12-year-old children were recorded at the national level in many LACCs in support of the implementation of salt fluoridation programs. However, our findings suggest that no regional systematic surveillance was carried out during implementation of these salt fluoridation

Table 1. Population, density of dentists, and mean DMFT of 12-year-old children in Latin American and Caribbean countries following the surveillance of dental caries via official national surveys since 2011. LAOHA, 2020.

Countries	Population*	Density of dentists 1:10.000 (year)**	Mean DMFT of 12-year-old children (year)	References
Colombia	50,339,443	9.60 (2015)	1.50 (2013)	47
Mexico	127,575,529	1.00 (2016)	2.65 (2018)	16
Paraguay	7,044,636	1.63 (2018)	2.07 (2017)	48
Total/range years	184,959,608	1.00–9.60 (2015–2018)	1.50–2.65 (2013–2018)	-

*World Bank; United Nations Population Division. World Population Prospects: 2019 Revision; **https://www.who.int/gho/health_workforce/dentistry_density/en/; <https://sites.usp.br/iberoamericanoralhealth/>

programs, and the efficacy of the program in reducing the prevalence of dental caries in the target age groups was not evaluated.^{1,8} Reliable and representative data

on caries prevalence in older children, adults, and the elderly is also largely absent, warranting further research in this area.

Table 2. Population, density of dentists, and mean DMFT of 12-year-old children in Latin American and Caribbean countries reported following the surveillance of dental caries via official national surveys conducted from 2001 to 2010 (inclusive). LAOHA, 2020.

Countries	Population*	Density of dentists 1:10.000 (year)**	Mean DMFT of 12-year-old children (year)	References
Antigua and Barbuda	97,929	1.67 (1997)	0.90 (2006)	49
Brazil	211,049,527	12.36 (2017)	2.07 (2010)	50
Chile	18,952,038	1.60 (2016)	1.90 (2007)	51
Costa Rica	5,047,561	0.10 (2017)	2.57 (2006)	52
Ecuador	17,373,662	3.20 (2016)	1.61 (2010)	53
Guatemala	16,604,026	0.10 (2018)	5.18 (2002)	54
Haiti	11,263,077	0.21 (2018)	0.65 (2005)	55
Panama	4,314,767	2.79 (2016)	3.72 (2008)	56
Peru	32,516,453	1.80 (2016)	3.67 (2001)	57
Trinidad and Tobago	1,399,488	3.59 (2015)	0.61 (2006)	58
Total/range (years)	318,618,528	0.10–12.36 (1997–2018)	0.90–5.18 (2001–2010)	-

*World Bank; United Nations Population Division. World Population Prospects: 2019 Revision; **https://www.who.int/gho/health_workforce/dentistry_density/en/; <https://sites.usp.br/iberoamericanoralhealth/>

Table 3. Population, density of dentists, and mean DMFT of 12-year-old children in Latin American and Caribbean countries reported following the surveillance of dental caries via official national surveys conducted before 2000 (inclusive). LAOHA, 2020.

Countries	Population*	Density of dentists 1:10.000 (year)**	Mean DMFT of 12-year-old children (year)	References
Argentina	44,938,712	9.19 (2004)	3.40 (1987)	59
Bahamas	393,244	2.58 (2017)	1.56 (2000)	60
Barbados	287,375	3.08 (2017)	4.40 (1983)	61
Belize	397,628	1.54 (2017)	6.00 (1989)	61
Bolivia	11,513,100	2.23 (2016)	4.70 (1995)	62
Cuba	11,333,483	16.60 (2017)	1.62 (1998)	61
Dominica	71,986	0.67 (2017)	2.50 (1990)	63
Dominican Rep.	10,738,958	2.10 (2017)	4.40 (1997)	64
El Salvador	6,486,205	7.64 (2008)	5.10 (1989)	61
Grenada	112,523	1.57 (2017)	5.50 (1991)	61
Guyana	786,552	0.35 (2018)	1.30 (1995)	61
Jamaica	2,961,167	0.90 (2017)	1.10 (1995)	65
Nicaragua	6,624,554	0.40 (2018)	5.90 (1988)	61
Panama	4,314,767	2.79 (2016)	4.20 (1989)	61
Saint Lucia	183,627	2.26 (2014)	2.70 (1961)	61
St. Kitts and Nevis	53,199	3.68 (2015)	5.50 (1979)	61
St. Vincent and Grenadines	110,94	1.19 (2004)	3.20 (1991)	61
Suriname	586,632	0.48 (2009)	4.90 (1978)	61
Uruguay	3,461,734	14.79 (2017)	2.40 ^a (1999)	61
Venezuela	28,515,829	5.48 (2001)	3.60 (1986)	61
Total/range (years)	129,557,448	0.40–16.60 (2001–2018)	1.10–6.00 (2010–2018)	-

*World Bank; United Nations Population Division. World Population Prospects: 2019 Revision; **https://www.who.int/gho/health_workforce/dentistry_density/en/; <https://sites.usp.br/iberoamericanoralhealth/>; ^a12- and 13-year-old children.

Epidemiological data also shows a very unbalanced distribution of dentists within the LACC region, with some countries (*e.g.*, Guatemala, Costa Rica, Haiti, Nicaragua, Guyana, and Suriname) having very low numbers of professionals per inhabitants and others (Cuba, Brazil, Colombia, Argentina, and Uruguay) exhibiting a moderate or high density of professionals. This suggests a trend toward concentration of professionals in high-income urban areas.

The classification presented here must be interpreted with caution due to several reasons. Firstly, the data were obtained from different sources and years of publication, focused on 12-year-old children only, and a time period of ten years was arbitrarily selected. Moreover, the classification did not take into account the potential economic limitations of some countries with regard to the collection of epidemiological data on a regular basis. However, despite these limitations, the outcomes of the classification system presented here may be viewed as warning signs for all countries, including those in the green level, as surveillance of risk factors and levels of inequality are very important in all 33 LACCs.

Dental caries is a preventable disease and directing efforts toward controlling it will allow minimization of associated costs in the future. Therefore, epidemiological surveys should be viewed as profitable investments instead of costly endeavors. Finally, health authorities must also bear in mind that the dynamic nature of the carious process provides us with an opportunity to prevent and control it in the early stages. Initiation of long-term regional projects aimed at reducing the burden of dental caries and its impact on the quality of life of the LACC population are necessary.

The Pan-American Health Organization and World Health Organization (WHO) are firmly committed toward supporting countries in their efforts to improve oral public health and sustain health development.^{66,67,68} Oral health was included in the Political Declaration on Universal Health Coverage in 2019, and this decision is of particular importance for LACCs as diseases of the oral cavity are the fourth most expensive to treat in terms of out-of-pocket expenditure.⁶⁹ Moreover, this new commitment paves the way for a regional and strategic oral health plan in LACCs in the near future.

The International Association of Pediatric Dentistry (IAPD) launched an Early Childhood Caries: IAPD Bangkok Declaration in 2019 to gain support for efforts aimed at reducing the prevalence and burden of early childhood caries (ECC) globally. The four main recommendations were as follows: a) raise awareness of ECC among parents/caregivers, dentists, health professionals, and other stakeholders; b) limit sugar intake for children under two years of age; c) brush teeth twice daily using a fluoridated toothpaste; and d) provide initial preventive guidance in the first year of life.⁷⁰ ECC is preventable and affects millions of children in LACCs, highlighting the importance of these recommendations. The first year of the child's life represents an excellent window of opportunity to educate families on the chronic, cumulative nature of dental caries and emphasize the fact that the adult's oral health is dependent on their early life conditions.

The Fédération Dentaire Internationale (FDI) World Dental Federation, which has been investigating dental caries for over 20 years, recently issued a policy statement supporting a shift in caries management from restorative measures to those aimed at monitoring and arresting disease progression, and preventing further lesion development. This document highlights the need to consider disease stage and activity, the patient's condition, their risk of caries, and their aesthetic demands before opting for invasive treatment methods. However, if invasive treatments are unavoidable, a minimum intervention approach should be adopted. The FDI is engaged in improving oral health and the practice of dentistry globally, and this may prove to be very useful for LACCs.^{71,72}

The International Caries Detection and Assessment System (ICDAS; 2002) was modified into the International Caries Classification and Management System (ICCMSTM) in 2012 and subsequently presented as a clinical practice-friendly version, Caries Care International, in 2019. This charity has been carrying out evidence-based work in collaboration with clinical practices, dental researchers, dental public health officials, and the dental education system to build a health outcomes-focused system that aims to maintain oral health and preserve tooth structure in the long term.⁷³⁻⁷⁶

The Alliance for a Cavities-Free Future (ACFF), initiated in 2010 and made up of a group of experts

from around the world, joined the efforts to promote integrated clinical and public health actions to prevent disease initiation and progression, and move toward a caries-free future for all age groups. Their goals include ensuring a caries-free future for all children by 2026; changing and improving the caries curriculum of dental schools; working collaboratively with organizations worldwide; promoting integrated, comprehensive, and locally appropriate caries prevention and management systems; and monitoring these approaches. The ACFF consists of 28 Chapters in 540 countries around the world, and the LACC chapters are located in Brazil, Colombia, Mexico, and Venezuela. Furthermore, the ACFF, in collaboration with King's College London and three Dental Policy Labs, have been working toward the development of policies aimed at achieving a caries-free future through allocation of increased resources for disease prevention, paying for health in dentistry, and moving toward better oral and dental health through partnership.⁷⁷⁻⁸⁰

Therefore, it is now time to join these efforts and create opportunities from challenges put forth by the COVID-19 pandemic. Despite its impact on future epidemiological studies and health systems, this is a good opportunity for dental associations, policymakers, academic staff, and stakeholders to rethink caries control strategies, endeavor to develop robust oral health plans, and take consistent actions toward achieving sustainable caries-free communities in all LACCs.

Final recommendations

To reduce the prevalence of caries and tackle inequalities, the Latin American Oral Health Association (LAOHA) Dental Caries Prevalence, Prospects, and Challenges for Latin America and Caribbean countries - Caries Consensus made the following recommendations for governments, policymakers, health authorities, professionals, academic staff, industry, and stakeholders.

General recommendations

a. Oral health should be considered a human right. The existence of social gradients in

diseases of oral health, including dental caries, requires policies and interventions to ensure access to quality healthcare, safe and a healthy environment, life opportunities and access to resources that are important for health (social determinants of health). This consensus recommends that government and policymakers should be committed to creating and implementing economic and social policies that raise living standards using a proportionate universal approach, particularly for the indigenous population and the most vulnerable groups of LACCs.

- b. Develop an agenda in collaboration with dental and health associations, clinicians, dental students, community members, policymakers, and representatives of the general public to promote adoption of evidence-based guidelines for the prevention and comprehensive management of dental caries, taking into consideration the social determinants of health and the specific needs, challenges, and prospects of the LACC region.
- c. Develop systematic national epidemiological surveys using comparable caries detection indices with the aim of standardizing comparisons across countries and improving the understanding of caries and its impact on the quality of life of the LACC population. Ideally, these surveys should be conducted around the same period to facilitate cross-national and subregional comparisons over time.
- d. Encourage high-quality studies to investigate the interplay between various risk and protective factors on dental caries, particularly among the most vulnerable groups in LACC.
- e. Provide evidence on appropriate low-cost therapeutic and restorative techniques for the provision of comprehensive continuous care for the LACC population.
- f. Government and food industries should develop policies aimed at reducing sugar concentration in processed and ultra-processed foods in order to reduce the incidence of dental caries and other chronic diseases.
- g. Government and health care industries should work together to make effective anti-caries

fluoridated toothpastes easily available for the LACC population.

Specific recommendations

- a. Create a dental caries surveillance program for LACCs that can allow classification of countries based on the burden of dental caries and level of inequalities, monitor prevalence of dental caries and its risk factors regularly on a regional level, and allow sharing of successful experiences
- b. Implement a Core Cariology Curriculum for dental faculties in LACCs that is based on the provision of additional preventive care and takes the oral health conditions of the region into consideration.
- c. Promote upstream measures to limit sugar intake through food and drinks while taking oral health literacy and the social determinants of dental caries into consideration (e.g., by limiting soft drinks and promoting a healthier food environment in schools and workplaces, regulation on advertising and promoting the inclusion of sugar content information on food labels, and sugar taxation).
- d. Support efficacious and safe strategies for caries control through the use of fluorides at the community level (e.g., salt or water fluoridation), taking into consideration the local, regional, and national suitability of the strategy.
- e. Encourage regular use of fluoridated toothpastes (minimum concentration of 1000 ppm F) at least twice a day at the community level, taking the oral health literacy and economical sustainability of the region into consideration.
- f. Considering the effectiveness of fluoridated toothpaste for caries control and the regional water supply issues, particularly in rural areas and city slums, this consensus endorses regular use of fluoridated toothpastes as the main vehicle for topical fluoride application. Additionally, it makes an urgent call to improve access to drinking water in the region, given its importance for general health and well-being.
- g. Implementation of a regional legislation that ensures a minimum concentration of soluble fluorides in toothpastes for achievement of appropriate anti-caries effect in LACCs.
- h. Implementation of local surveillance systems that guarantee optimal fluoride concentrations in water or salt to provide appropriate anti-caries effects and prevent dental fluorosis.
- i. SDF and ART should be considered as population strategies for the treatment of dental caries.
- j. Encourage widespread dissemination of high-quality information on the rational use of fluorides and their benefits for controlling dental caries. Additionally, promote provision of information on the drawbacks of excessive sugar intake and its impact on general and oral health.

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