Oral Health Status of Older Adults in the Americas

Decade of Healthy Aging in the Americas

situation and challenges

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Abbreviations and acronyms

CPI   community periodontal index

CPITN   community periodontal index of treatment needs

DALY   disability-adjusted life year

DMFT   decayed, missing, and filled teeth

PAHO   Pan American Health Organization

WHO   World Health Organization

YLD   years lived with disability

Acknowledgments

Aging and oral health

At any point in an individual's lifetime, the oral health status represents the cumulative effect of risk indicators, social determinants, personal and familial beliefs, knowledge, health literacy, disease risk factors, and preventive and care behaviors. Thus, oral diseases measured at any point in life represent a snapshot of the individual's life course. Life course has been defined as the study of the long-term effects of risk factors and social exposures from gestation through life, including biological, behavioral, and psychosocial pathways (*1*). Furthermore, oral diseases, mainly dental caries, periodontal diseases, and their sequelae (tooth loss and edentulism), share common risk factors with other chronic diseases and are preventable (*2*).

Despite the availability of efficacious and efficient preventive interventions, the risk of oral disease remains throughout the lifetime. Critical life stages with increased risk include early infancy, school age, entering college or university, entering (and leaving) the labor force, and older adult years (*3*). This publication offers a glance at the oral health status of older adults among countries in the Region of the Americas.

The starting point for this review was an analysis of the literature in PubMed, Medline, and Google Scholar after 2005 using keywords for oral diseases, sequelae, and the names of the countries in the Region. The following sections present the findings for adults aged 60 or 65 years and older on disease occurrence and utilization of dental care services. The evidence table includes the most relevant information on national or regional oral health data from selected studies. Supporting studies not included in the evidence table are included in the discussion of the major findings.

The World Health Organization (WHO) defines healthy aging as "the process of developing and maintaining the functional ability that enables well-being in older age" (*4, 5),* where functional ability means having the capacity to be and do what people value (*5*). Functional ability involves the environment, the intrinsic capacity, and the relationship between them. Different health factors, including oral health, might influence specific domains within intrinsic capacity, including mobility, vitality, and psychological, cognitive, and sensory capacities.

Aging also brings changes to the oral tissues and their function (*6*) such as changes in the quality and amount of saliva (hyposalivation). Dryness of the mouth (xerostomia) is a clinical presentation of Sjögren's

syndrome and post-radiation treatment for cancer; it is also a side effect of therapeutics for systemic conditions in older adults. Both hyposalivation and xerostomia are considered risk factors for dental caries, conditions that can be alleviated using artificial saliva.

With age, the supporting tissues around the tooth (gingiva, periodontal ligament, and alveolar bone) migrate toward the tooth's apex. This condition is known as gingival recession and exposes the tooth root to the intraoral environment. The tooth root is covered by cementum, over which biofilm can increase its susceptibility to dental caries. Regular dental visits and fluorides can keep exposed roots free of dental caries. In these examples, team coordination with other healthcare professionals is essential in delivering effective interventions (*7*).

Aging is also associated with functional limitations that may affect the ability of individuals to hold a toothbrush and clean their teeth, especially in the interdental areas. These limitations put the individual at a higher risk of dental caries and periodontal diseases. The changes may be incremental with age and may affect the functional abilities of older adults but are also modifiable or controllable. One example is the availability of electric toothbrushes for those with functional inability to hold the toothbrush due to an underlying impairment (*8*).

Aging is also associated with social determinants that create barriers and limitations in seeking and receiving appropriate dental care. Lack of proper dental care for dental caries and periodontal diseases leads to pain and infection. When dental services are inadequate, both diseases progress toward tooth loss and sometimes to edentulism (missing all teeth). Tooth loss impacts daily living and quality of life, impairing chewing, nutrition, and social interaction with others (*3, 9*) and demands prostheses and dentures (*10*). Tooth loss may also affect choice of diet due to an inability to cut and chew. Therefore, the effects of social determinants earlier in life, which increase the risk of disease and affect access to appropriate care, may lead to functional disability to cut and chew and impact nutrition later in life.

Another characteristic affecting the oral health of older adults is their domestic/living circumstances. Many functional older adults live in their own homes (independent living, community dwelling). In contrast, others live in long-term care settings (nursing homes, institutions) due to physical or mental limitations. The oral health of older adults in long-term care facilities is affected by the severity of disease and sequelae prior to moving into the facility and the ability of the long-term care to provide or organize appropriate dental care for the residents.

Furthermore, most residents may have only limited dental coverage, and services need to be paid out of pocket. Therefore, older adults in long-term care have poorer oral health (*11*), lower utilization of dental services, higher prevalence of tooth loss and untreated tooth decay, increased need for urgent care and prosthetic appliances, and a higher rate of edentulism than independent-living older adults (*12–14*). A 2021 review suggested that people in long-term care often experience a rapid decline in their oral health after moving into the facility, even if their dentition was stable upon admission (*15*).

A related and concerning issue among the health of older adults is frailty. A consensus paper defined frailty as a "syndrome with multiple causes and contributors that is characterized by diminished strength, endurance, and reduced physiologic function that increases an individual's vulnerability for developing increased dependency or death" (*16*). Frail individuals may not live independently and require assistance to perform everyday activities, including oral hygiene. Oral frailty has been defined by including characteristics such as the number of teeth, chewing inability, loss of motor skills, low tongue pressure, and difficulties in eating and swallowing (*17*). Many of the studies described later in this chapter exclude frail adults because they were not able to respond to questionnaires or follow instructions during an examination. Thus, information on the oral health of frail older adults is limited. Some studies have focused on dementia and oral health. For example, a systematic review (*18*) reported higher rates of root caries and gingival bleeding in older adults with dementia, which may be associated with cognitive and behavioral impairment. The reviewers noted that cognitive decline, loss of memory, learning disabilities, attention deficits, deterioration of motor skills, reduction in salivary flow, and difficulties with eating and swallowing were associated with an increase in oral diseases. In a three year cohort study in Mexico, the incidence of frailty among home-dwelling older adults was associated with loss of teeth and severe periodontitis (*19*).

A further issue is the delivery of dental care. Dental treatment is expensive and many adults lose their dental benefits upon retirement. If they have received complex and costly treatment before retirement, the cost of maintaining and replacing therapies needs to be paid from personal funds—thus, the call for the inclusion of dental care within older adults' medical benefits (*20*). A recent systematic review reported that culturally and linguistically diverse older migrants have greater oral health needs and poor oral status and face barriers in accessing dental care in their host countries (*21*).

These biological, personal, familial, psychosocial, and societal factors exert burden and determine inequalities in oral health within and between countries. They are critical in older populations because of their cumulative effect over the life course. However, many of these effects may be prevented or controlled with appropriate interventions supported by upstream policies and regulations and cost-effective restorative interventions.

Oral health status

Country data

Some national and regional oral health surveys in the Americas have included data specifically focused on older adults (Table 1), but data are lacking for most countries. The data provided are comparable because countries have used the decayed, missing, and filled teeth (DMFT) index recommended by the WHO *Oral Health Surveys Basic Methods* (*22, 23*) and the national health and nutrition examination surveys protocols (*24, 25*). Table 1 shows the countries for which data are available: Brazil, Canada, Chile, United States of America, Mexico, Puerto Rico, and Uruguay.

Table 1. Dental caries, root caries, periodontal status, number of teeth, and edentulism among older adults in selected countries of the Americas

Author, year of publication	Country (data collection)	Age (years)	Sample	No.	Coronal caries prevalence	Caries severity	Root caries	Periodontal status[a]	No. of teeth	Edentulism
Álvarez et al., 2015	Uruguay (2010–2011)	35–44 & 65–74	National survey	769	P_{65-74} = 99.6%	DT_{65-74} = 0.7 MT_{65-74} = 20.9 $DMFT_{65-74}$ = 24.1				
Beck et al., 2014	United States (2008–2011)	18–74	Cross-sectional study of Latinos	15 848		DS_{65-74} = 0.61 DMS_{65-74} = 16.3 $MT_{65-74:}$ = 9.0	12% (all age groups)			4.1% (all age groups)
Bidinotto et al., 2018	Brazil (2004–2008)	60+	Prospective cohort; four year outcomes	T0 = 388 T4 = 273			ID = 4.9 per 100 root-year. 47% had new lesions			33% became edentulous during follow-up

[a] Includes only periodontal pocket (probing depth) data because it is the most comparable measurement in different methods. Measures are restricted to population estimates, not quadrants, teeth, or periodontal sites. Ppdxx denotes the sample (population) prevalence of periodontal depth at age xx. In addition, the values indicating the probing depth used as cut-off point are within parenthesis. For example Ppdxx(4+) means the prevalence at age xx years with at least one periodontal pocket of 4 mm or more. For studies reporting the community periodontal index (CPI), we are reporting the proportion giving 4–5 mm or 6+ mm as the worst score in all six sextants.

Centers for Disease Control and Prevention, 2019	United States (2021.)	65+	National survey	2011–2016: 3514 1999–2004: 3539	2011–2016: DFT >0 P_{65+} = 96% DT >0 P_{65+} = 16% 1999–2004: DFT >0% P_{65+} = 93% DT >0 P_{65+} = 18%	2011–2016: DT_{65+} = 0.3 MT_{65+} = 6.6 FT_{65+} = 9.8 DFT_{65+} = 10 $DMFT_{65+}$ = 17 1999–2004: DT_{65+} = 0.4 MT_{65+} = 8.8 FT_{65+} = 8.7 DFT_{65+} = 9.1 $DMFT_{65+}$ = 18			Mean = 21 (range 16–22)	2011-2016: P_{65+} = 17% $P_{65–74}$ = 13% P_{74+} = 23% 1999–2004: P_{65+} = 27% $P_{65–74}$ = 24% P_{74+} = 31%
Dye et al., 2015	United States (2011–2012)	50–64 65–74 75+	National survey		DFT >0: $P_{50–64}$ = 97% $P_{65–74}$ = 96% P_{75+} = 97% DT >0 $P_{50–64}$ = 26% $P_{65–74}$ = 19% P_{75+} = 19%					$P_{65–74}$ = 13% P_{75+} = 26% P_{NHW} = 17% P_{NHB} = 29% P_H = 15% P_{NHA} = 24%
Eke et al., 2016 and 2018[b]	United States (2009–2012) (2009–2014)	≥65	National survey	1983, with 1511 dentate				2009–2012: $P_{pd65–74}(4+)$ = 51% $P_{pd65–74}(6+)$ = 13% $P_{pd75+}(4+)$ = 45% $P_{pd75+}(6+)$ = 10% 2009–2014:[c] $P_{pd65+}(4+)$ = 41% $P_{pd65+}(6+)$ = 9%		$P_{65–74}$ = 14% P_{75+} = 24%
Griffin et al., 2019	United States (1999–2004 and 2011–2016)	65+	Comparing two national surveys and state-based self-reported data (BSS)	1999–2004: 3539 2011–2016: 3514	DT >0 $P_{65–74}$ = 15.4% $P_{≥75}$ = 16.5%	$MT_{65–74}$ = 5.6 $MT_{≥75}$ = 7.9 $DT_{65–74}$ = 0.3 $DT_{≥75}$ = 0.3				$P_{65–74}$ = 13% $P_{≥75}$ = 23% Variation among states from 25% (Minnesota) to 43% (Arkansas), median 32%[d]

[b] All reports on nationally representative data from the United States using NHANES measure pocket depth and attachment loss on all or a selected number of periodontal sites. Different case definitions have been used and are not included in this review. Two reports of four and six years are included.

[c] The 2018 report including all six years of data did not stratify estimates by age group among older people.

[d] Included only adults aged 65 years and over living in long-term care, assisted living facilities, or home limited.

Lorenzo S et al., 2015	Uruguay (2010–2011)	65–74	First Oral Health Survey (national)	411				P_{bleed} = 35%[e] $P_{3–5mm}$ = 28.5% $P_{moderate}$ = 34%[f] P_{severe} = 17%		
Mariño et al., 2015	Chile (2009–2010)	60+	National survey of living older adults. Secondary analysis	4213						20% (self-reported)
Mariño & Giacaman, 2014	Chile (2011.)	65–74	Regional Oral Health Survey, Maule	438		DMFT$_{65–69}$ = 24.4[g] DMFT$_{70–74}$ = 26.9 FT$_{65–74}$ = 2.0 MT$_{65–74}$ = 22.4 DMFT$_{65–74}$ = 25.7		CPI$_{healthy}$ = 0% CPI$_{bleed}$ = 1.5% CPI$_{calculus}$ = 68% CPI$_{4–5mm}$ = 25.5% CPI$_{>5mm}$ = 4.6%	No. of teeth: 1–10 = 34% 11–20 = 25% >20 = 16%	25% both 40% maxilla 34% mandible
Mariño et al., 2015	Chile (2011.) [h]	65–74	Regional Oral Health Survey, Maule	328 dentate 231 with gingival recession		MT$_{65–74}$ = 19.1 DRS = 0.21 FRS = 0.55	Root caries index = 8.2%	Exposed root surfaces = 70.4% (gingival recession)		
Mariño et al., 2011	Chile (2006–2007)	60+	Regional study, Valparaiso Region	354		DMFT = 21.6 MT = 17.9 FT = 2.9 DT = 1.9		CPI$_{healthy}$ = 3.3% CPI$_{bleed}$ = 11.4% CPI$_{calculus}$ = 42.3% CPI$_{4+mm}$ = 43% (57% rural, 18% non-metro, and 47% urban)	No. of teeth: 1–10 = 34% 11–20 = 33% >20 = 13%	20%; geographical variation from 14% in non-metro centers, 21% in urban municipalities and 29% in rural areas

[e] This study in Uruguay reports the prevalence of having one or more sextants for each periodontal income separately, not by the highest score as originally designed by the community periodontal index and the community periodontal index of treatment needs.
[f] This study in Uruguay used a different classification for moderate/severe periodontal disease and a separate one for severe disease using the combination of periodontal pockets and clinical loss of attachment. In the table, the prevalence of severe is defined as having one or more sextants with an index tooth with pockets ≥ 4 mm and at least one sextant with clinical attachment loss of ≥ 6 mm. The prevalence of moderate/severe disease expanded the clinical attachment loss to ≥ 4 mm
[g] This study in Chile reported over a total of 32 permanent teeth. Most studies in the literature do not include the four third molars, so the maximum would be 28 teeth. Also, some data in the table were obtained from a companion publication (Quinteros et al., 2014 [83]). Ninety-eight percent of the Maule population received fluoridated water in the range of 0.6—1.0 mg/L (only 51% in the rural areas).
[h] Same study as reported in Mariño & Giacaman 2014 (32) but focused on root caries and including only 328 dentate participants. According to Katz (35), the root caries index is the ratio of the sum of decayed and filled root surfaces divided by the sum of all root surfaces, including sound, and multiplied by 100 with one or more caries lesions in the roots. Severity was expressed as the mean number of decayed (DRS) or filled (FRS) tooth surfaces. All measures are calculated among those with gingival recession (n = 231).

Massachusetts Department of Public Health, Office of Oral Health, 2010	United States, 2009	60+ long-term care and meal sites	ASTDD protocol[i]	1046	DT >0 35% in meal sites 59% in long-term care			Gingival inflammation 35% in meal sites, 74% in long-term care.		19% in meal sites, of these, 50% of these had no dentures 35% in long-term care, of these 50% had no dentures
Ministério da Saude, 2004	Brazil (2002–2003)	65–74	National survey	5349	P_{65-74} = 99.5%	$DMFT_{65-74}$ = 27.8		$P_{pd65-74}(4+)$ = 6%	≥ 20[j] = 10%	58% had upper total dentures and 16% need 34% had lower total dentures and 24% need
Ministério da Saúde, 2012	Brazil (2010.)	65–74	National survey	7509	P_{65-74} = 91.9%	DT = 0.62 MT = 25.29 FT = 1.62 DMFT = 27.53	DT_{root} = 0.23 FT_{root} = 0.10	P_{bleed} = 18.1%k P_{hard} = 28.3% P_{3-5mm} = 15.8% P_{6+mm} = 3.3%		63% use total upper dentures, 18% need 37.5% use total lower dentures, no data on need
Ministry of Health Canada, 2010[l]	Canada (2007–2009)	60–79	Canadian Health Measures Survey	1093	$P_{DMFT>0}$ = 100% $P_{DT>0}$ = 16%	DMFT = 15.7 MT = 5.6 FT = 9.7 DT = 0.4	P_{root} = 43% DT_{root} = 0.3 FT_{root} = 1.3 DFT_{root} = 1.6	$P_{pd}(4+)$ = 31% $P_{pd}(6+)$ = 78% $CPI_{healthy}$ = 3% CPI_{bleed} = 23% $CPI_{calculus}$ = 44% CPI_{4-5mm} = 24% $CPI_{>5mm}$ = 7%		22%
Montero-Aguilar et al., 2012	Puerto Rico (2007.)	70–97	Cohort from San Juan	183				$P_{pd70-79}(5-6)$ = 34% $P_{pd80+}(5-6)$ = 20% $P_{pd70-79}(7+)$ = 13% $P_{pd80+}(7+)$ = 5%	Mean = 15.8	
Phipps et al., 2020	United States (2017.)	55+	State telephone survey							P_{65-74} = 5.2% P_{75+} = 10%
Sánchez-García et al., 2007	Mexico (2007.)	60+	Social security beneficiaries	698	P = 99.7%	DT = 2.4 MT = 12.2 FT = 2.6 DMFT = 17.3	P_{root} = 44% DT_{root} = 1.2 FT_{root} = 0.1 DFT_{root} = 1.4			

[i] The ASTDD protocol is the Basic Screening Survey: An approach to monitoring community oral health, 2008. Available at www.astdd.org. The target population was adults who are residents of long-term care facilities (nursing homes) and those who participate in congregate meal sites (subsidized meals in senior centers or clubs).
[j] The WHO goal for 2000 was 50% of the population aged 65–75 years having 20 or more teeth present.
[k] This study reports the prevalence of having one or more sextant for each periodontal level separately, not by the highest score as originally designed by the community periodontal index and the community periodontal index of treatment needs.
[l] This study included participants from a cohort of the Puerto Rican elderly from the San Juan area. It used the NHANES criteria but examined four sites on all teeth.

Coronal dental caries

Dental caries is a chronic disease generated from an imbalance in the process of demineralization and remineralization of the tooth hard tissues (enamel, dentin, and cementum). Demineralization is caused by organic acids from bacterial metabolism in the biofilm surrounding the tooth. Remineralization is the reverse effect and is led by saliva buffering and presence of fluorides. When the balance is broken, a caries lesion is formed. Initial lesions that are not allowed to remineralize may develop a cavity.

The prevalence of dental caries in older adults (DFT >0 or DMFT >0) was consistently over 90% across all countries. Fewer countries reported the prevalence of untreated decay (DT >0). Canada and the United States reported similar estimates for untreated decay, between 15% and 26%. The most recent figure for the United States for adults aged 65 years and older is 16% (*26*). However, a 2009 study in Massachusetts reported a prevalence of 35% among older adults at meal sites and 59% among residents of long-term care facilities (*13*). A systematic review (based on six studies) of dental caries among adults aged 60 years and older by the Centers for Disease Control and Prevention (CDC) Division of Oral Health estimated an incidence rate of one coronal carious surface per person per year (*27*).

Brazil and the United States had data for at least two data points to assess changes in time. In Brazil, the prevalence of dental caries in older adults aged 65–74 years decreased from 99.5% in 2002–2003 (*28*) to 91.9% in 2010 (*29*). In the United States, the prevalence of dental caries increased from 93% in 1999–2004 to 96% in 2011–2016. However, the prevalence of untreated decay decreased from 18% to 16% in the same period (*26*). These findings reflect small population changes in disease occurrence.

The severity of dental caries was reported by either the mean number of decayed, missing, and filled teeth (DMFT) or excluding the "missing" component (DFT). The difference in reporting relies on the difficulty of determining whether the missing tooth was lost due to dental caries or other reasons (*24*). The lowest mean DMFT was 10 in Canada in 2007–2009 (*30*), followed by 17 in the United States in 2011–2016 (*26*). In Canada, the mean number of missing teeth due to caries was 5.6. In comparison, the mean DMFT in Brazil was 27.5 in 2002–2003 (*28*) and 27.8 in 2010 (*29*). A similar estimate (24.1) was reported for Uruguay in 2010–2011 (*31*). Chile published a similar estimate for Maule (25.7) (*32*) and a slightly lower one for Valparaíso (21.6) (*33*). The mean DMFT

in Mexico (17.3) corresponded to a selected sample of social security beneficiaries (*34*).

The main difference across countries is the differential contribution of the DMFT components. While in Canada and the United States filled was the main contributor to DMFT, missing teeth was the main contributor in the other countries. These represent opposite options in dental treatment for dental caries in both groups.

Root caries

Data for root caries are sparser and less comparable. One study reported using the root caries index (*35*). Some studies counted the number of decayed and filled teeth or surfaces while others reported just prevalence. A study among social security beneficiaries in Mexico (*34*) reported a 44% prevalence and an average of 1.4 decayed and filled roots. Similar estimates were reported in Canada at 43% and DFT was 1.6. Even lower values were reported in Brazil (0.33 teeth). Three additional studies in the literature reported a 12% incidence among Hispanic and Latino populations in the United States (*36*) and Katz's root caries index of 8.2% in Chile (*33*). Two studies evaluated root caries incidence. In a prospective study in Brazil, Bidinotto et al. reported an incidence density of 4.9 per 100 root-year, with 47% of the cohort developing new lesions after four years (*37*). In 2004, CDC reported an annual increment of half a surface from a systematic review of 11 studies in Australia, Canada, Sweden, and the United States (*38*).

Periodontal diseases

There is still a lack of agreement on a case definition for the epidemiological evaluation of periodontal diseases and what measurements should be included (*39*). WHO has made efforts to systematize the epidemiological data by using standard instruments such as the community periodontal index (CPI) or its predecessor, the community periodontal index of treatment needs (CPITN), described in the WHO *Oral Health Surveys Basic Methods* (*22, 23*). In addition, periodontologists have proposed clinical case definitions to grade the severity of the diseases (*40, 41*). A common approach is to use a periodontal probe to measure periodontal depths in millimeters (pocket depth) or the migration of the periodontal attachment toward the apex of the tooth (clinical attachment loss). The CPI and CPITN simplified the periodontal measurements into categories of pocket depths, i.e., less than 3.5 mm, between 3.5 and 5.5 mm, between 5.5 and 8.5 mm, and more than 8.5 mm using a periodontal probe with

color bands. (*22, 23*). Most oral epidemiologists would agree that clinical attachments of 3 mm or less would be considered "normal" or within the margin of error (*42*). In addition, the original CPITN measured hard deposits around the tooth (calculus) and gingival bleeding on probing (*22*).

There has been extensive discussion on the validity of measurements based on partial examination of the mouth's periodontal sites, teeth, or anatomical sections based on quadrants or sextants (*39*). The most recent edition of the *Oral health surveys basic methods* (*23*) recommends applying the CPI to all teeth and separating bleeding from periodontal probing. A further recommendation is to supplement the pocket depth information with clinical attachment loss measurements using sextants (*22*). Self-reported measures of periodontal status have been described (*43–45*) and validated (*46*) but have not been used extensively in epidemiological surveys. For detailed information on periodontal assessment at the epidemiological level, see Beltrán-Aguilar et al., 2012 (*39*).

Mariño et al. published two epidemiological studies in Valparaíso and Maule, Chile, using the CPITN protocol (*32, 47*). In both studies, calculus had the highest prevalence, 42% and 68%, respectively. Probing depths greater than 3 mm were observed in 43% of participants in Valparaíso and 30% in Maule. A subsequent study by the same team in Maule reported 70% of adults with exposed root surfaces (gingival recession) (*33*).

The most recent data from Brazil (*29*) reported the prevalence for each category of the CPITN score, not the highest value of all sextants as recommended by WHO (*22*). The highest prevalence was for calculus (28%), followed by probing depths greater than 3 mm (19%) and bleeding on probing (18%).

In Uruguay, Lorenzo et al. used the same approach as Brazil (*48*). They reported 35% of adults aged 65–74 years had bleeding, and 29% had one or more teeth with probing depths of 3 mm or more. In addition, they reported that 17% had severe disease, which they defined as having one or more teeth with periodontal probing of 4 mm or more and one with clinical attachment loss of 6 mm or more.

A 2012 study in Puerto Rico reported estimates for participants aged 70–79 and 80+ years. The prevalence for periodontal depths of 5–6 mm was 34% and 20%, respectively. The prevalence of periodontal depths of 7 mm or more was 13% and 5%, respectively (*49*).

Health Canada used CPITN in their 2007–2009 Canadian Health Measures Survey (*30*). They reported a prevalence of 23% for bleeding on probing, 44% for calculus, 24% for periodontal depths of 4–5 mm, and 7% for pocket depths of 6 mm or more.

In the United States, the most recent national data were collected in three cycles of the National Health and Nutrition Examination Survey between 2009 and 2014 and measured six sites per tooth on all teeth (*50*). Among adults aged 65–74 years, the prevalence of periodontal depths of 4+ mm was 51%, and for depths of 6+ mm was 13%. Among adults aged 75 years and older, the prevalence of depths 4+ mm was 45%, and for 6+ mm was 10%. The decrease in prevalence with age reported in this study and the values reported in Puerto Rico (*49*) could be explained by the increased number of missing teeth, many of which may have been affected by periodontal disease.

A study of long-term care and meal sites in Massachusetts reported that gingival inflammation was twice as prevalent in long-term care residents than in those living independently (*13*). The inability to consistently clean the teeth may be associated with higher levels of gingival inflammation among long-term care residents.

Some studies have compared prevalence and severity among countries. Gjermo et al. (*51*) identified six studies (most carried out in the 1990s) reporting periodontal status in the Latin American region and the Caribbean using the CPITN index. The prevalence of moderate periodontal disease (one or more teeth) ranged from 29% to 40%, while severe periodontal disease ranged from 7% to 71%. Gjermo et al. (*51*) assigned Brazil into the low-level category (<10%), Argentina and El Salvador in the medium level (10%–49%), and Chile in the high category (≥50%). Recent national and regional studies in Brazil (*29*) and Chile (*32, 47*) support the earlier estimates, indicating little change in periodontal status in these two countries. A recent review by Kossioni et al. (*52*) included data from Canada and the United States but not from Latin American countries.

In summary, most countries with available data show some level of periodontal sequelae, calculus, or bleeding, the last being a sign of gingival inflammation. More severe levels were observed in older populations and those living in long-term care, but they are less prevalent than milder forms. The lack of an agreed universal case definition makes comparison across countries difficult. However, across all these studies, older adults may experience a higher prevalence and more severe levels of periodontal diseases than younger adults.

Tooth loss

If teeth with dental caries or periodontal diseases are not treated, the disease progresses and eventually the tooth has to be extracted due to infection. Indeed, the ultimate goal of dental treatment is to prevent tooth loss and maintain functional ability. The dental practitioner has the final decision for extracting a tooth, and in some healthcare systems, extraction may be the only treatment choice. Keeping the natural teeth is also a cultural and generational issue. Baby boomers and later generations expect to keep their natural teeth for as long as possible. The number of natural teeth has been used to indicate inequalities among older adults (*53*). Another cause for tooth loss is dental injury, but this tends to occur earlier in life.

Missing teeth are replaced using prosthetics and, more recently, implants. Contrary to what was once a standard procedure, not all missing teeth need to be replaced for functional reasons (*54*). This finding led to the development of the ¨shortened arch length" concept; that is, most people can chew with a complete set of anterior teeth and premolars (*55, 56*). The shortened arch length concept led to the international goal of having at least 20 teeth (*57*) and the Japanese 80/20 goal (20 teeth at age 80) .

The studies in Maule (*32*) and Valparaíso (*47*) provide a detailed explanation of tooth retention in Chile. Both populations had similar distributions: 34% having 1–10 teeth; 25% (Maule) and 33% (Valparaíso) having 11–20 teeth, and 16% (Maule) and 13% (Valparaíso) having 20 or more teeth. The researchers concluded that Chile was experiencing an epidemiological transition, with higher rates of tooth retention, which may require more dental care services.

Ten percent of older adults in Brazil had 20 or more teeth (*28*). However, in that study, remnants and root tips were included in counting the number of teeth, and these would be eventually extracted (*52*). In a 2007 study in Puerto Rico, the mean number of teeth was 15.8 (*49*), while the most recent NHANES survey in the United States reported a mean of 21 teeth. In the United States, there was an increase of two teeth on average from 1999–2004 (*26*). These data suggest variability in the number of teeth present in selected countries. Still, the epidemiological direction—probably an effect of preventive and curative efforts—is toward retaining more natural teeth in the younger generations. Evidence from Australia and Norway supports retaining 20 or more permanent teeth as a workable target for public health interventions (*58, 59*).

Edentulism

The clinical decision to extract all remaining teeth is complex and based on the individual needs and available dental services. Some people who retain a handful of teeth seek extraction of the remaining teeth to replace all missing teeth with dentures. Others could be edentulous only in one dental arch for prolonged periods. A common clinical option is to retain some of the roots after endodontic treatment or insert dental implants to increase the retention of dentures and reduce the loss in alveolar bone height with aging. These are known as overdentures. Edentulism can be measured using clinical assessments (*26*) or by asking study participants whether they have lost all their teeth (*60*).

Mariño et al. reported that in 2009–2010, 20% of Chileans identified themselves as having no teeth (*61*). Clinical surveys by the same team reported normative estimates of 20% in Valparaíso in 2006–2007 (*47*) and 25% in Maule (*32*). In the former, the investigators reported geographical variations ranging from 14% to 25%.

In Canada, the prevalence in 2007–2009 was 22% among people aged 60–79 years (*30*). In the United States in 2011–2016, the prevalence was 17% among those aged 65 years and older (*26*); this represented a 10% point reduction in edentulism since 1999–2004. Reduction in edentulism is a trend that has been reported in the United States (*62*) and other countries (*63*). CDC also reported variations in edentulism by race/ethnicity, with the highest prevalence among non-Hispanic blacks (29%) and non-Hispanic Asians (24%) and the lowest among Hispanics (15%) (*26, 64*). The lower prevalence among Hispanics, primarily of Mexican descent living in the United States, has been described as an epidemiologic paradox (*65*). In the 1982–1984 Hispanic HANES, 2.6% among Mexican Americans and 6.1% among Cuban Americans were edentulous (*66*). Researchers at CDC using self-reported data have reported variations at the state level, from 25% in Minnesota to 43% in Arkansas (*67*). In Massachusetts, the prevalence of edentulism was 19% among adults aged 60 years or older attending meal sites and 35% among adults living in long-term facilities (*13*). In Washington State, the self-reported prevalence was 5% among adults aged 65–74 years, and 20% among those aged 75 years and older (*68*). A cohort study of Latinos in the United States reported a prevalence of edentulism of 4% in 2008–2011, but this included all age groups (*36*).

A Brazilian study reported that 33% of a cohort examined after four years became edentulous over the 2004–2008 period (*37*). The two most recent national studies in Brazil reported on the use of and need

for dentures: in 2010, 63% of adults aged 65–74 used upper dentures and 16% needed dentures, while 24% had lower dentures and 24% needed dentures. These estimates represent a higher prevalence of edentulism.

Overall, most countries show estimates of edentulism around 20%, and a few reported a historical reduction in prevalence (secular trends). Other countries outside the Region have reported similar results (*14*). There is also evidence of inequalities in tooth loss and edentulism between and within countries. For example, living in rural areas (*69*) or families with a poor income (*25*) are associated with a higher prevalence of edentulism. However, in Valparaíso both rural and metropolitan areas had higher rates of edentulism (*47*).

Edentulism has been associated with systemic conditions. A CDC study reported that the rate of complete or partial tooth loss was greater among older adults with arthritis, cardiovascular disease, chronic obstructive pulmonary disease, diabetes, and low vision/blindness than among those without these conditions (*12*). Edentulism has also been associated with loss of body weight and waist circumference in community-dwelling Brazilian adults aged 60 years and older (*70*). In 2013, edentulism was the 24th ranked leading cause of years lived with disability (YLDs) according to the Global Burden of Disease (*71*). Edentulism is also included in the Global Burden of Disease assessment of disability-adjusted life years (DALYs). In the most recent update (*72*), a 64% increase in DALYS was estimated for oral diseases, including tooth loss, worldwide.

Utilization of dental services

An essential component of oral health is access to dental services for prevention, control, treatment, and evaluation. Access to dental care goes beyond urgent treatment needs or routine dental treatment. A more comprehensive concept is "dental home," defined as having access to routine, comprehensive, continuous, coordinated, and affordable dental services (*73*). Having a dental home implies not having barriers to dental care such as availability, proximity, traveling time, identification with the healthcare providers, and paying for the services received. In the United States, the extension of dental homes to older adults has started with calls for the modification and expansion of entitlements such as Medicare to reduce the financial barriers to health (*20*).

At the health service research level, having a dental visit is the global standard to measure the utilization of health services. It is generally accepted that people should have at least one dental visit per year for a check-up and tooth cleaning, or more often based on the person's needs. These time frames are based on clinical experience rather than on scientific evidence. Indeed, a recent multicenter randomized trial in the United Kingdom showed no difference in dental outcomes between six-month and 24-month recalls (*74*). These findings may suggest that having limited or alternative dental procedures during long periods of not receiving dental care would be appropriate, for example, during pandemic restrictions (*75, 76*). This section will provide information regarding the utilization and cost of dental services.

Education (*77*) and paying for services (*78*) are significant barriers to dental services. In Brazil, having more education and having higher levels of wealth were directly associated with greater utilization of dental services (*79*). In general, older adults living in rural areas face greater barriers to accessing dental services than those living in urban areas (*80*).

The earliest oral health evaluation among older adults in Latin America (*81*) reported 25% utilization rates across the region. Two decades later, a study in Peru (2015–2017) among adults 60 years and older reported a lower rate (18.5%) but within a six-month time frame (*82*). In the Peruvian study, a higher level of education was associated with dental visits.

In Brazil, the 2003–2006 national survey reported 6% of adults aged 65–74 had never had a dental visit in their life. Among those who had had a dental visit, 17% had a visit with the previous year. Pain was the main complaint in 48% of those having a dental visit (*28*). The proportion who had never had a dental visit increased to 15% in a similar national survey in 2012 (*29*).

A study of social security beneficiaries in Mexico City (*34*) reported 54% receiving dental health services in the previous 12 months. Of these, 81% sought private dental services, 13% social security services, and 6% public services. Being a woman, having six or fewer years of schooling, having dental caries or sequelae, and having 22 or more teeth were associated with more dental visits among beneficiaries. These may represent people with a higher need for dental care. The main reasons for a dental visit were dental examination (44%), dental restoration (35%), dental cleaning (32%), and dental extractions (23%).

Two studies from Chile reported on the consequences of not having regular dental visits. In the study by Mariño et al. (*47*) on older adults from the Valparaíso region, 44% of their treatment needs were unmet. Of the 282 participants (20%) who were fully edentulous, 40 (56%) needed both dentures. The Chilean study in Maule reported 41% of restorative needs as unmet (*32*). Of the 110 (25%) participants who were edentulous, only 14% had both appliances in good condition, and 72 (65%) needed both dentures. These two studies used comparable methods and highlighted regional similarities and differences. They also reported differences in the treatment received within administrative regions. In the Maule study, people in urban areas had more fillings than those living in rural areas, while there were more extracted teeth in the rural areas (*83*).

In the United States, 45% of adults aged 65 years and older reported a dental visit during 2006 (*84*) using data from the Medical Expenditure Survey. The most recent data among older adults in the United States (2016) reported by the American Dental Association Health Policy Institute (*85*) showed no change (43%).

Regarding payment of dental services, data from the Medical Expenditure Survey showed that 38% of adults aged 64 years and older were receiving dental coverage in 2015, an increase of less than 4% since 1996. This means that almost two-thirds of participants did not have dental coverage, public or private (*86*). Most participants who did hold dental coverage had personal coverage (24% including out-of-pocket expenditure). Among those receiving dental services, 29% were preventive, 42% diagnostic, 7% restorative, 14% prosthetic, and 4% surgical. From the same panel data, mean dental expenditures were lower among persons aged 75 years and older than among those aged 55 to 74 years, suggesting that they may have selected no treatment or lower-cost options such as tooth extraction (*12*).

Across all countries, at least 50% of older adults did not have a dental visit in the previous year, and in Brazil, 15% had never had a dental visit. Payment for services appears to be an essential factor in having a dental visit and the type of treatment received. For example, social security beneficiaries in Mexico had a wider variety of services than countries where fee-for-services or out-of-pocket payments are required. In the latter, a dental extraction may be the treatment of choice due to cost. Urban versus rural differences were a factor in Chile. Furthermore, a large proportion of edentulous adults require new dentures. In summary, these data suggest that older adults in the Americas do not have adequate access to dental care.

Discussion

The oral health status of older adults represents a life course event, where social determinants, societal expectations, and government interventions play a role and change throughout the lifetime. Oral diseases impact the functional abilities of older adults and their quality of life, and interfere with their healthy aging. In addition, oral diseases burden families, healthcare systems, communities, and societies and cause inequalities (*12*). Therefore, immediate actions and long-term upstream changes are required to relieve the current disease burden, improve functional abilities, and reduce inequalities.

This report has focused on the most common oral diseases, their sequelae, and the utilization of dental services. Maintaining a functional masticatory system is an essential aspect of healthy aging. Therefore, oral diseases, tooth loss, and inadequate utilization of dental services preclude healthy aging. Other conditions afflicting older adults but not included in the report are oral and pharyngeal cancers and physical and functional changes consequent to systemic diseases.

Access to care and how older adults seek, receive, and pay for dental services appear to be essential elements in improving the oral health of older adults. Older adults with greater dental needs but not receiving appropriate care exacerbate personal, familial, and societal burdens. Expansion of public health coverage for dental needs and other safety nets such as Medicare (*87*) in the United States may provide temporary relief. Still, system changes such as universal health coverage are needed for long-term effects. In Chile, the Explicit Health Guarantees (Garantías Explícitas de Salud, GES) guarantee citizens aged 60+ years access to high-quality care for 56 health conditions, including oral health. Also, some countries have integrated dental care into primary health care delivery, but there is a large backlog of accumulated needs to be addressed (*88*).

The 2021 World Health Assembly resolution (WHA74.5) about oral health, provides a pivotal starting point for such changes (*89*). Existing WHO policies for aging populations (*5, 90*) may guide the development of interventions for older adults. Other aspects include the determination of essential dental procedures (*91*), better dental practices for older adults (*34*), a set of global epidemiological indicators (*92*), and developing medical-dental integration approaches to maintain their oral health and functional abilities.

Some national and regional organizations have taken the lead on improving the oral health of older adults; for example, the Excellence Research Program on Healthy Aging (PIEI-ES) at the University of Talca, Chile (https://www.utalca.cl/), and the Michigan Coalition for Oral Health for the Aging (https://www.micoha.org/). Government agencies in the United States like CDC (*93*) and the National Institute of Dental and Craniofacial Research (*94*) have prepared materials for the public. Professional organizations such as FDI World Dental Federation have also published information for the public (*95*) and guidelines for dental practitioners (*96*).

Gaps in knowledge and methods

This review found a large volume of information on the oral health of older adults, but with gaps in the knowledge and limitations in the methods. For example, there are limited or no data on frail older adults, those living in long-term care, the Caribbean, and Indigenous populations outside Canada and the United States. In terms of surveillance, there was inconsistent reporting by age group despite WHO recommendations.

Most of the data summarized here used clinical or self-reported approaches with a wide range of representation, including local, regional, and national levels. However, except for Canada and the United States, no national objectives delineate the type of data needed to monitor the burden of oral diseases among older adults. Many of the studies in South America followed the WHO *Oral Health Surveys Basic,* which facilitated the comparison between countries. However, there were inconsistencies in applying case definitions, especially for periodontal status.

Regarding newer approaches for disease monitoring, in the United States, the Association of State and Territorial Dental Directors has developed a protocol to complete oral screenings on adults and older people in community-dwelling or long-term care facilities (*97*). In 2016, FDI World Dental Federation and WHO convened a panel of experts to discuss the oral health challenge of the aging population. One of the topics was identifying practical surveillance approaches for older adults (*98*). Still, these rely on the traditional approach of measuring disease, not function or health. Thus, new methods are needed to evaluate and monitor oral health and functional abilities among older adults and their progress toward healthy aging.

Tied to these limitations is the need for integration in the reporting, handling, and evaluating of existing and upcoming data. A few years ago, the leading depository of oral health data was the WHO Oral Health Data Bank at Malmö University. The PAHO Oral Health Program made quadrennial reports on oral health status. Both systems provide limited oral data on adults. There is a dire need for integrated system approaches to the oral health of older adults worldwide.

Another missing aspect of oral health for older adults is the skills and competencies of the dental provider. Graduates from dental schools are not yet ready to meet current and future general and oral health needs of older adults despite some positive integrating of competencies into the curriculum in the United States and Europe (*52*).

Conclusions

The evidence presented in this report calls for increasing actions to achieve healthy aging in the Region of the Americas by developing policies and interventions, including integrated delivery of dental care with medical and social care. Two frameworks for such initiatives are the 2021 WHO Resolution on Oral Health (*99*) and the Decade of Healthy Ageing 2020–2030 (*100*). These efforts should consider the heterogeneity of the older adult population within each country, region, and community, especially those most vulnerable.

A 2012 evaluation of the oral health of older adults in the United States (*12*) recommended the following actions:

- better integration of oral health care into medical care;

- implementing community programs to promote healthy behaviors and improve access to preventive services;

- developing comprehensive strategies to address the oral health needs of the homebound and long-term care residents;

- assessing the feasibility of a safety net covering all aspects of dental care to eliminate pain and infection.

In terms of care, specialized professionals in geriatric dentistry have proposed a conceptual framework (*7*) which includes*:*

- inserting minimal intervention dental procedures in the care of older adults;

- a focus on maintaining oral functionality instead of "treating all"—includes social care, preserving functional ability, and improving quality of life;

- patient-centered care: acknowledging the heterogeneity of needs instead of protocolized treatment;

- interdisciplinary teamwork as a critical aspect of care.

These recommendations underlie the following needs:

- having trained healthcare professionals, including primary care providers, delivering preventive and restorative care;

- establishing dental homes for older adults at community centers and long-term care facilities;

- integrating the economic evaluation of interventions;

- monitoring indicators as new generations move through their life-span.

Responsibility for these recommendations falls on local and national agencies, academic and research institutions, nongovernmental organizations, and international donors, a process that international agencies can facilitate.

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Oral Health Status of Older Adults in the Americas is part of a series of publications entitled "The Decade of Healthy Aging in the Americas: Situation and Challenges." In order to outline the current knowledge available on the situation of health and well-being of older persons in the Americas at the beginning of the United Nations Decade of Healthy Aging (2021–2023), this document presents data and existing evidence on oral health in the population of the Americas, especially older people, and calls for increasing actions to achieve healthy aging in the Region of the Americas by developing policies and interventions, including integrated delivery of dental care with medical and social care. Oral health is related to different aspects of health and directly influences older adults' intrinsic capacity, especially because of the close relationship with the vitality domain. Maintaining and improving intrinsic capacity is key to achieving healthy aging. The accelerated population aging of Latin America and the Caribbean will shape the capacities of countries and health systems to respond to the specific demands of the population. Therefore, in order to design inclusive and sustainable systems, it is necessary to have updated and effective accurate information. The Decade of Healthy Aging 2021–2030 is a period to guide action toward data generation and monitoring, and this document contributes to that strategy.

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Decade of healthy aging in the Americas

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