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The oral health status of 4,732 adults with intellectual and developmental disabilities

John P. Morgan, DDS,
Associate professor, Department of Public Health and Community Service, Tufts University School of Dental Medicine, 1 Kneeland St., 1534 F, Boston, Mass. 02111

Paula M. Minihan, PhD, MPH,
Assistant professor, Department of Public Health and Community Medicine, Tufts University School of Medicine, Boston

Paul C. Stark, MS, ScD,
Professor, Department of Research Administration, Tufts University School of Dental Medicine, Boston

Matthew D. Finkelman, PhD,
Assistant professor, Department of Research Administration, Tufts University School of Dental Medicine, Boston

Konstantina E. Yantsides, BS,
Research assistant, Department of Public Health and Community Service, Tufts University School of Dental Medicine, Boston

Angel Park, MS, MPH,
Research analyst, Department of Research Administration, Tufts University School of Dental Medicine, Boston

Carrie J. Nobles, MPH,
Research assistant, Department of Public Health and Community Medicine, Tufts University School of Medicine, Boston

Wen Tao, MA, MM, and
Research analyst, Department of Research Administration, Tufts University School of Dental Medicine, Boston

Aviva Must, PhD
Professor, Department of Public Health and Community Medicine, Tufts University School of Medicine, Boston

Abstract

Address reprint requests to Dr. Morgan. john.morgan@tufts.edu.

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Background—Two reports by the U.S. surgeon general noted the disproportionate impact of oral disease on and lack of oral health information regarding people with disabilities.

Methods—In this retrospective study, the authors used clinical and demographic data (from April 1, 2009, through March 31, 2010) from electronic dental records of 4,732 adults with intellectual and developmental disabilities (IDDs) who were receiving dental care through a state-supported system of dental clinics. The authors used these data to investigate the oral health status of, and associated risk factors for, adults with IDD.

Results—The prevalence of untreated caries in the study population was 32.2 percent, of periodontitis was 80.3 percent and of edentulism was 10.9 percent. The mean (standard deviation) numbers of decayed teeth; missing teeth; and decayed, missing and filled teeth were 1.0 (2.2), 6.7 (7.0) and 13.9 (7.7), respectively.

Conclusions—Management of oral health presents significant challenges in adults with IDD. Age, ability to cooperate with dental treatment and type of residence are important considerations in identifying preventive strategies.

Clinical Implications—The study population demonstrated a high burden of dental disease. Further research is required to identify effective interventions to improve oral health in adults with IDD.

Keywords

People with disabilities; intellectual disability; developmental disability; oral health; special-care dentistry

Information concerning the oral health status and treatment needs of adults with intellectual and developmental disabilities (IDDs) is essential to create best practices for inclusion in dental treatment guidelines and to develop compensatory strategies to promote and protect the oral health of this vulnerable population. The term “intellectual disability” (ID), formerly “mental retardation,” refers to significant limitations in both intellectual functioning and adaptive behavior, with onset before age 18 years.[1] ID is a type of developmental disability (DD), a broader category representing various severe chronic conditions associated with physical impairments, mental impairments or both that are identified during childhood. An estimated 4.6 million Americans have an intellectual or a developmental disability.[2]

The results of studies in which investigators describe the experiences of people with IDD with particular characteristics (including children, people living in institutions, members of certain ethnic and racial groups and Special Olympics athletes) suggest that people with IDD are more likely to have poor oral hygiene, periodontal disease and untreated dental caries than are members of the general population.[3,4] Many characteristics associated with IDD may contribute to an increased risk of experiencing oral disease. These include the presence of cognitive, physical and behavioral limitations that make it difficult to perform daily oral care and cooperate during dental visits[5–9]; medications that affect oral health[5–11] and elevated rates of poverty.[12] These factors may be exacerbated in older adults who lacked access to dental care across the lifespan.[5,13,14] Factors associated with oral health status of people with IDD include type of residence and the role of family members or paid

caregivers in supporting daily preventive home care and regular dental visits.[6,7,9,15,16] Inadequate access to dental care owing to financial disincentives, including some associated with Medicaid; the scarcity of dentists and dental hygienists trained to serve patients with special needs[9,17,18]; and issues of consent, sometimes involving legal guardianship, also may present barriers to dental care.[9,19]

Several federal reports have called attention to the disproportionate impact of oral disease on people with disabilities, including IDD. In each report, lack of information about the complex issues involved in meeting the needs of this group was identified as a significant barrier to efforts to understand and improve their oral health.[9,17,18,20] In Closing the Gap: A National Blueprint to Improve the Health of Persons with Mental Retardation, the U.S. surgeon general called for better health-related surveillance for this vulnerable population.[17,20] The paucity of information documenting the oral health status of people with DD was referenced in Oral Health in America: A Report of the Surgeon General.[9]

Efforts to better understand the oral health status of, and associated risk factors for, the IDD population are challenging. Although some U.S. studies have helped elucidate determinants of oral health for adults with IDD, such factors as sample sizes smaller than 325, study populations limited to people able to cooperate with dental examinations and evolving definitions of IDD[7,16,21] make it difficult to extrapolate their findings more broadly. The few U.S. studies with larger sample sizes (as many as 12,099 participants) involved the use of oral health screening data and neither included people with IDD who live in institutionalized settings nor identified the type of residence.[3,22,23]

We conducted a retrospective study to address these issues by using existing clinical electronic dental records to describe patterns of oral disease observed in 4,732 adults with IDD who received dental care from the Tufts Dental Facilities Serving Persons with Special Needs (TDF), a statewide network of dental clinics in Massachusetts designed specifically to provide comprehensive oral health care to this population. We analyzed the prevalence of caries experience; untreated caries; decayed, missing and filled teeth (DMFT); and periodontal disease in relation to age and sex. The research team analyzed information regarding the participants' ability to cooperate with dental care (as reported by TDF dental practitioners) and type of residence (as reported by the Massachusetts Department of Developmental Services [MA DDS]). Our results represent the first study of this magnitude involving the use of data derived from clinical records to describe the oral health status of a large heterogeneous adult population with IDD. Our findings serve as foundational information necessary to begin investigating the substantial oral health care needs of adults with IDD.

METHODS

Study design

In this retrospective study, we used clinical and demographic information entered into the electronic health record (EHR) (axiUm, Version 4.32, Exan Group, Las Vegas) at the time of the dental examination.

Setting

The TDF program, established in 1976, is administered by the Tufts University School of Dental Medicine, Boston, and supported by the Commonwealth of Massachusetts through the state Department of Public Health (MA DPH) and MA DDS and revenues from third-party payers, including MassHealth (Massachusetts Medicaid). TDF is staffed by general dentists, dental specialists, hygienists, dental assistants and health educators, as well as administrative and support personnel. All are trained in the special oral health needs of people with IDD. Patients in the TDF system receive comprehensive general dental services that include annual dental examinations, dental prophylaxis, restorative dentistry, periodontal care, endodontic care, prosthetic dentistry and tooth extraction. Dental specialty support and a full spectrum of patient care management modalities—including desensitization, sedation and general anesthesia—are available to support the care provided by dental clinicians.

Inclusion criteria

We chose dental records for adults 20 years or older who had had at least one initial or periodic dental examination visit at a TDF clinic between April 1, 2009, and March 31, 2010. To be included, we required that participants qualify for services from the MA DDS, thus ensuring a diagnosis of ID. People 18 years or older are eligible for MA DDS services if they reside in Massachusetts and have a diagnosis of ID; they also may have other developmental disabilities.[24]

Clinical information

The dental examination is the diagnostic intraoral and extraoral head and neck evaluation of the hard and soft tissues with the goal of identifying the patient's treatment needs. All dental examinations were recorded in axiUm by one of the 25 general dentists in the TDF system, all of whom had received specialized training in dental care for the IDD population. These dentists represent 10 full-time equivalent positions and have a mean of 14.5 years of service in the TDF system. The dentists used dental mirrors, explorers, periodontal probes, intraoral radiographs and instrumentation during examinations as tolerated by the patients. The dentists completed all examinations in dental operatories designed to manage the oral health of patients with special needs. General anesthetic was provided for patients unable to cooperate with dental examinations and treatment.

Variables measured

TDF dental providers entered clinical data into the axiUm EHR at the time of the dental visit. We merged these data with demographic information collected at patient registration. Demographic information, including age and sex, race or ethnicity and eligibility for dental benefits, was reported by patients and caregivers. MA DDS provided data regarding type of residence for entry in the axiUm data system. Information concerning comorbidities and level of disability was provided in patient medical records and entered into axiUm by TDF dental providers. Dental conditions and cooperation levels were recorded by TDF dentists and retrieved from the most recent dental examination in the study year. Variables included

the following: decayed teeth (DT), missing teeth (MT), filled teeth (FT) and presence or absence of a diagnosis of gingivitis or periodontitis.

Variable definitions

We defined our variables of interest as follows:

- dentate status—one or more natural permanent teeth, excluding third molars;
- edentulism (complete tooth loss)—no natural permanent teeth, excluding third molars;
- mean number of teeth—calculated for the permanent teeth of dentate adults;
- caries experience—one or more decayed or filled surfaces in the teeth of dentate adults;
- untreated caries—one or more decayed surfaces in the teeth of dentate adults;
- mean number of DT—calculated for the permanent teeth of dentate adults;
- mean number of MT—calculated for the permanent teeth of dentate adults;
- mean number of FT—calculated for the permanent teeth of dentate adults;
- mean number of DMFT—calculated for the permanent teeth of dentate adults;
- gingivitis—diagnosis reported for dentate adults consistent with the presence of gingival inflammation without a concurrent diagnosis of periodontitis;
- periodontitis—diagnosis reported for dentate adults consistent with the presence of one or more of the following: periodontal pockets, loss of clinical attachment, alveolar bone loss, tooth mobility or a combination of these;
- cooperation level—score on a seven-point scale (developed by TDF dental clinicians to guide the evaluation of a patient's ability to accept dental evaluation and treatment procedures during dental clinic visits) on which "0" indicates the least cooperative and "6" the most cooperative (Box);
- type of residence—one of six general types of residential settings for adults eligible for MA DDS: community settings funded or certified by MA DDS, private home with family, facilities or institutions operated by MA DDS, nursing homes or other longterm care settings, private home independently, other residential settings that are not part of the MA DDS system (Table 1).

The research study protocol received approval from the institutional review board of the Tufts University Health Sciences Campus, Boston, and from the research and review committee of the Department of Developmental Services of the Massachusetts Executive Office of Health and Human Services, Boston.

Analysis

We calculated descriptive statistics, including counts and percentages for categorical variables and means and standard deviations (SDs) for continuous variables. We assessed the statistical significance of bivariate associations between clinical outcomes and

independent variables (sex, age group, cooperation level and type of residence) by means of χ^2 tests for comparisons of proportions; we used independent-samples *t* tests and one-way analysis of variance (ANOVA) for comparisons of means. We used the Fisher exact test in place of the χ^2 test to analyze categorical data with insufficient expected cell counts. When data were not distributed normally, we used the Mann-Whitney *U* test and Kruskal-Wallis test in place of the independent-samples *t* test and one-way ANOVA, respectively. We considered *P* values of less than .05 to be statistically significant. For all analyses, we used statistical software (SAS 9.2, SAS, Cary, N.C.).

RESULTS

Profile of study population

As Table 2 shows, 4,732 adults with IDD (42.6 percent women and 57.4 percent men) received a dental examination between April 1, 2009, and March 31, 2010. The mean (SD) age was 49.3 (14.2) years (range, 20–98 years). The prevalence of edentulism in the population was 10.9 percent. The mean (SD) age of the dentate participants was 47.5 (13.5) years and of the edentulous participants 63.6 (11.1) years ($P < .01$). Fewer than one-half of caregivers (n = 2,153) voluntarily provided information concerning participants' race or ethnicity. Of those, 89.0 percent (n = 1,917) reported race or ethnicity as non-Hispanic white. Level of income, as indicated by eligibility for MassHealth (Medicaid) dental coverage, placed 97.2 percent of the population at 133 percent of the federal poverty guidelines or below. Table 2 presents selected unadjusted comorbidities recorded in the dental record, ranked from most common (epilepsy or seizure) to least common (Alzheimer disease).

Table 3 (page 843) reports the level of disability recorded in dental records for 2,926 (61.8 percent) of the participants in the study population; of those, 61.3 percent (n = 1,794) were reported to have "mild" or "moderate" levels of ID. Cooperation levels were reported for 96.5 percent of the study population. The vast majority of the dentate population (91.3 percent) allowed dental instruments to be placed intraorally (cooperation level of 3 or higher), thus facilitating dental examination and prophylaxis. Three-quarters (75.9 percent) of the dentate participants allowed dental treatment (cooperation levels 4, 5 and 6) with or without assistance. Type of residence, also reported in Table 3, shows that 68.4 percent (n = 3,208) of participants lived in community settings, funded or certified by MA DDS. Those living in facilities operated by MA DDS represented 12.4 percent of the sample and those living with family 13.3 percent. For patients in our study population, 4 percent of the dental examinations were initial examinations and 96 percent were recall examinations; the mean (SD) number of annual preventive visits during the study year for the dentate population was 4.6 (2.8).

Dental conditions

Number of teeth—The study population had a mean (SD) number of 21.4 (7.0) teeth (Table 4, page 844). The number of teeth varied significantly with age ($P < .01$). The mean (SD) number of teeth was highest for those aged from 20 through 39 years (25.9 [3.5]) and lowest for those 60 years and older (15.1 [7.4]).

Caries

Overall, 87.8 percent of the dentate participants were reported to have caries experience and 32.2 percent had untreated caries (Table 5, page 844). Caries experience varied significantly with age ($P < .01$) and was highest in those aged 40 through 59 years (90.5 percent). Untreated caries also varied by age ($P < .01$); the prevalence was 33.2 percent in those aged 20 through 39 years, 33.5 percent in those aged 40 through 59 years and 26.9 percent in those 60 years and older.

Decayed, missing and filled teeth

Table 4 shows that the mean (SD) number of DT varied significantly with age ($P < .01$) and was highest (1.2 [2.7]) among those aged 20 through 39 years. The mean number of MT also varied significantly with age ($P < .01$) and was highest (12.9 [7.4]) among those 60 years and older. The mean (SD) number of FT, which also varied significantly with age ($P < .01$), was highest (8.0 [5.5]) in those aged 40 through 59 years. The DMFT was higher in the two oldest age groups, reflecting a high burden of missing teeth.

Periodontitis

The overall prevalence of periodontitis was 80.3 percent (Table 6, page 845) and varied significantly with age ($P < .01$). Prevalence was highest in those 60 years and older (92.6 percent) and lowest in the youngest age range of 20 through 39 years (55.8 percent).

Gingivitis

The overall prevalence of gingivitis (without a concurrent diagnosis of periodontitis) (Table 6) was 18.0 percent and varied significantly with age ($P < .01$). Prevalence was higher in the younger age groups (40.6 percent for those aged 20 through 39 years and 10.5 percent for those aged 40 through 59 years) and considerably lower in the older age group (5.8 percent for those 60 years and older).

DISCUSSION

The results from our study population, representing 4,732 dental patients with IDD and representing a wide range of cooperation levels, a variety of medical and dental profiles, and diverse living arrangements indicate that even with access to comprehensive dental services, this vulnerable population faces significant challenges in terms of dental disease. Nearly 88 percent of participants had caries experience; 32.2 percent had untreated dental caries; 80.3 percent were diagnosed with periodontitis; and 10.9 percent were edentulous. To our knowledge, this is the first retrospective study involving the use of clinical and demographic information to profile the oral health status of such a large and heterogeneous group of adults with IDD. These findings indicate that the study group falls far short of the oral health objectives set for the nation in Healthy People 2020.[25]

Nearly one-quarter of the participants had only a limited ability to accept any dental intervention without the application of advanced behavior management techniques, and nearly 40 percent required some form of behavioral assistance to receive dental treatment. One-third of the participants were able to receive dental treatment without these modalities.

Behavioral challenges associated with dental care for patients with disabilities pose difficulties for dental practitioners when performing diagnostic and therapeutic procedures.[10,26] In this population, examination and treatment depend on the use of appropriate behavioral management techniques, including general anesthesia.[10,26–34] An objective assessment of the limitations and the capabilities of the IDD population in terms of cooperating with dental examination, accepting dental treatment and visiting dentists has important implications for designing studies that ensure a comprehensive assessment of the IDD population and assessing oral health surveillance information. The seven-point cooperation scale used at TDF (Box) to assess behavioral issues affecting dental care, although not validated, is based on the objective measure of whether dental instruments can be placed and dental procedures performed.

One must consider clinical practice limitations when evaluating data regarding missing teeth and edentulism as an indication of dental disease in the study population. Tolerating complex or time-consuming dental treatments to preserve teeth may not be possible for some people with physical and cognitive disabilities. Compromised teeth in the IDD population may be retained to preserve lip support and facial contour. Removal of teeth may be deferred in this population owing to the patient's behavior or medical fragility.[35]

Assessing the prevalence of periodontal disease presents challenges for all populations. Numerous case definitions for periodontitis have been used in the literature for population-based studies, and there is no accepted standard.[36] Eighty percent of the participants in this study were diagnosed with periodontitis according to accepted definitions for periodontal disease described in the current literature.[36] Severe periodontal disease often results in tooth loss, which can diminish quality of life and is related to poorer general health in adults.[37] This pattern is reflected in the prevalence of periodontitis and the number of missing teeth in the study population. Associations between periodontal disease and certain systemic diseases and disorders are becoming increasingly evident.[38] Efforts to estimate the prevalence of the spectrum of periodontal diseases and to identify ways to prevent and manage this disease process in the IDD population have beneficial health consequences for this already compromised group.

Previous reports link the type of residence with prevalence of dental disease, although the nature of this relationship is not well understood.[7,8,29,39] One must consider characteristics associated with residence type—such as residents' age, residents' level of disability, staffing ratios, oral health supports, diet and values associated with evolving philosophies of community-based living—in relation to oral health outcomes. In our study, most participants resided in community settings, with the majority living in residences supported by the state DD agency. Further investigation is required to better understand the relationship between living environments and their effect on such factors as preventive oral health care at home and use of professional dental care to optimize oral health outcomes in the IDD population.

To create an accurate picture of the oral health of a large IDD population, we chose a convenience sample of TDF patients, specifically records of those who had received a dental examination in the study year. Most, but not all, TDF patients of record seek care annually. We did not include those who did not seek services during the study year or receive a dental

examination during that period. The IDD population's limitations in access to dental care are well documented and include such factors as financial disincentives, limited availability of trained dental personnel and location of treatment facilities.[9,18,40] The availability of the TDF clinic system enabled patients to overcome financial barriers that prevent many people with IDD from receiving dental care on a regular basis. Participants in the TDF program are eligible for dental benefits through MassHealth, private insurance or private payments and have access to comprehensive dental care. We acknowledge that the oral health outcomes reported here may not be representative of adults with IDD who lack access to services such as those available in the TDF system.

The results of this study add to evidence from previous studies that the oral health needs of people with IDD are complex. Physical conditions required for clinical examination, demographic and clinical variables, study population size and inclusion criteria vary greatly throughout studies reported in the literature in which investigators evaluated the oral health of adults with IDD and may account for variability in the reported prevalence of oral health problems. Variation in study design, the demographics of the study population and definitions of oral health status indicators limit our ability to compare our results directly with those of other studies of people with IDD or of the general population. The U.S. Centers for Disease Control and Prevention,[41] Atlanta, reported that for the general population 20 years or older, the prevalence of untreated caries is 22.7 percent; the prevalence of edentulism is 7.6 percent; the mean number of DT is 0.7; the mean number of MT is 3.6; and the mean number of DMFT is 11.6. Our study population, with access to dental care, demonstrated a higher disease burden in each category.

CONCLUSIONS

This study offered us the opportunity to investigate demographic and clinical risk factors, as well as indicators of oral health in a large and heterogeneous population of adults with IDD. Even with access to a specialized dental program, our findings indicate that the study population had a high burden of dental disease. Further research is required to identify and develop risk-based preventive interventions to manage oral disease in people with IDD and maximize the role of the dental professional, patient and caregiver to maintain adequate oral health for people with IDD.

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ABBREVIATION KEY

DD	Developmental disability

DMFT	Decayed, missing, filled teeth
DT	Decayed teeth
EHR	Electronic health record
FT	Filled teeth
ID	Intellectual disability
IDD	Intellectual and developmental disabilities
MA DDS	Massachusetts Department of Developmental Services
MA DPH	Massachusetts Department of Public Health
MassHealth	Massachusetts Medicaid
MT	Missing teeth
NA	Not available
TDF	Tufts Dental Facilities Serving Persons With Special Needs

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BOX

Cooperation Level Scale.*

0 Does not enter clinic, dental chair or both

1 Sits in dental chair only

2 Allows brushing of teeth, visual examination or both

3 Allows dental examination and practitioner to place dental instruments intraorally; requires behavioral assistance from caregiver, dental assistant or both

4 Allows dental procedures; requires behavioral assistance from caregiver, dental assistant or both more than 50 percent of time

5 Allows dental procedures; requires behavioral assistance from caregiver, dental assistant or both less than 50 percent of time

6 Allows dental procedures; needs no assistance

*Developed by clinicians at Tufts Dental Facilities Serving Persons with Special Needs, Massachusetts.

TABLE 1

Types of residential settings in which study participants lived.

RESIDENCE TYPE	DESCRIPTION
State-Funded Community Setting	Community settings funded or certified by MA DDS*
Private Home, With Family	MA DDS may provide family with cash assistance to help with care expenses
State-Operated Facility	Facilities and institutions operated by MA DDS
Nursing Home	Nursing homes or other long-term care settings
Private Home, Independently	Individual lives independent of family, either alone or with housemates (some with MA DDS support)
Other	Residential settings that are not part of the MA DDS system

*MA DDS: Massachusetts Department of Developmental Services.

TABLE 2

Characteristics of the study population, according to dentition status.

CHARACTERISTIC	DENTITION STATUS, n (%)		TOTAL, n (%)	*P*
	Dentate	Edentulous		
Sex				
Male	2,454 (58.2)	260 (50.6)	**2,714 (57.4)**	< .01
Female	1,764 (41.8)	254 (49.4)	**2,018 (42.6)**	
Age, Years				
20–39	1,170 (27.7)	4 (0.8)	**1,174 (24.8)**	
40–59	2,286 (54.2)	185 (36.0)	**2,471 (52.2)**	< .01
60 or older	762 (18.1)	325 (63.2)	**1,087 (23.0)**	
Race or Ethnicity				
White, non-Hispanic	1,710 (40.5)	207 (40.3)	**1,917 (40.5)**	
Nonwhite[†]	227 (5.4)	9 (1.8)	**236 (5.0)**	< .01
N/A[‡]	2,281 (54.1)	298 (58.0)	**2,579 (54.5)**	
Payer				
MassHealth[§]	4,088 (96.9)	512 (99.6)	**4,600 (97.2)**	
Dual Coverage MassHealth/private	98 (2.3)	1 (0.2)	**99 (2.1)**	< .01
Self-payer	24 (0.6)	1 (0.2)	**25 (0.5)**	
Private	8 (0.2)	0 (0.0)	**8 (0.2)**	
Comorbidity				
Epilepsy or seizure	1,481 (35.1)	116 (22.6)	**1,597 (33.8)**	< .01
Cerebral palsy	698 (16.6)	26 (5.1)	**724 (15.3)**	< .01
High blood pressure	579 (13.7)	71 (13.8)	**650 (13.7)**	.96
Autism	532 (12.6)	11 (2.1)	**543 (11.5)**	< .01
Down syndrome	326 (7.7)	44 (8.6)	**370 (7.8)**	.51
Diabetes	278 (6.6)	41 (8.0)	**319 (6.8)**	.24
Asthma	274 (6.5)	27 (5.3)	**301 (6.4)**	.27
Pica	248 (5.9)	25 (4.9)	**273 (5.8)**	.35
Jejunostomy or gastronomy tube placed	262 (6.2)	22 (4.3)	**284 (6.0)**	.08
Alzheimer disease	74 (1.8)	18 (3.5)	**92 (2.0)**	< .01
TOTAL	**4,218** (89.1)	**514** (10.9)	**4,732** (100.0)	NA[¶]

[*] All *P* values derived from χ^2 tests, except for those for payer type, which is derived from a Fisher exact test, owing to sparse expected cell counts.

[†] Includes categories of Asian, African American, Hispanic/Latino, biracial or multiethnic.

[‡] Includes participants who did not respond and the response “not specified.”

[§] MassHealth: Massachusetts Medicaid.

[¶] NA: Not applicable.

TABLE 3

Developmental and behavioral level and residence type of study population, according to dentition status.*

CHARACTERISTIC	DENTITION STATUS		TOTAL, n (%)	*P*†
	Dentate, n (%)	Edentulous, n (%)		
Intellectual Disability Level‡				
Mild	696 (25.8)	46 (20.4)	**742 (25.4)**	< .01
Moderate	982 (36.4)	70 (31.1)	**1,052 (36.0)**	
Profound	1,023 (37.9)	109 (48.4)	**1,132 (38.7)**	
Cooperation Level§				
0	7 (0.2)	3 (0.7)	**10 (0.2)**	
1	31 (0.8)	10 (2.3)	**41 (0.9)**	
2	321 (7.8)	75 (17.0)	**396 (8.7)**	
3	635 (15.4)	55 (12.5)	**690 (15.1)**	< .01
4	960 (23.3)	53 (12.0)	**1,013 (22.2)**	
5	766 (18.6)	62 (14.1)	**828 (18.1)**	
6	1,409 (34.1)	183 (41.5)	**1,592 (34.8)**	
Type of Residence¶				
MA DDS# **community**	2,866 (68.6)	342 (67.1)	**3,208 (68.4)**	
Private home, with family	611 (14.6)	14 (2.7)	**625 (13.3)**	
MA DDS facility	452 (10.8)	131 (25.7)	**583 (12.4)**	< .01
Private home, independently	88 (2.1)	9 (1.8)	**97 (2.1)**	
Nursing home	54 (1.3)	3 (0.6)	**57 (1.2)**	
Other	106 (2.5)	11 (2.2)	**117 (2.5)**	
TOTAL	**4,218** (89.1)	**514** (10.9)	**4,732** (100.0)	NA**

*Percentages reported are valid percentages, excluding missing data.

†All *P* values derived from χ^2 tests.

‡Data regarding intellectual disability level were available for 2,926 participants, 2,701 dentate and 225 edentulous.

§Data regarding cooperation level were available for 4,570 participants, 4,129 dentate and 441 edentulous.

¶Data regarding type of residence were available for 4,687 participants, 4,177 dentate and 510 edentulous.

#Massachusetts Department of Developmental Services.

**NA: Not applicable.

TABLE 4

Number of teeth and permanent decayed, missing and filled teeth (DMFT) in the dentate study population (N = 4,218).

CHARACTERISTIC	NUMBER OF TEETH		NUMBER OF DECAYED TEETH		NUMBER OF MISSING TEETH		NUMBER OF FILLED TEETH		DMFT	
	Mean (SD*)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*
Sex†										
Male	21.4 (7.0)	.17	1.0 (2.2)	.07	6.6 (7.0)	.17	7.3 (5.5)	.25	13.9 (7.8)	.98
Female	21.2 (7.0)		1.0 (2.3)		6.8 (7.0)		7.1 (5.4)		13.9 (7.6)	
Age, Years‡										
20–39	25.9 (3.5)		1.2 (2.7)		2.1 (3.5)		6.8 (5.7)		9.1 (6.9)	
40–59	21.1 (6.5)	< .01	1.0 (2.0)	<.01	6.9 (6.5)	< .01	8.0 (5.5)	< .01	14.8 (7.2)	< .01
60 or older	15.1 (7.4)		0.8 (1.7)		12.9 (7.4)		5.5 (4.6)		18.3 (6.7)	
TOTAL	**21.4** (7.0)	NA§	**1.0** (2.2)	NA	**6.7** (7.0)	NA	**7.2** (5.5)	NA	**13.9** (7.7)	NA

*SD: Standard deviation.

†*P* values for sex derived from Mann-Whitney *U* tests.

‡*P* values for age derived from Kruskal-Wallis tests.

§NA: Not applicable.

TABLE 5

Presence of caries and untreated caries in the dentate population (N = 4,218).

CHARACTERISTIC	CARIES EXPERIENCE			UNTREATED CARIES		
	Yes, n (%)	No, n (%)	*P**	Yes, n (%)	No, n (%)	*P**
Sex						
Male	2,175 (88.6)	279 (11.4)	.06	822 (33.5)	1,632 (66.5)	.04
Female	1,530 (86.7)	234 (13.3)		537 (30.4)	1,227 (69.6)	
Age, Years						
20–39	981 (83.8)	189 (16.2)		388 (33.2)	782 (66.8)	
40–59	2,068 (90.5)	218 (9.5)	< .01	766 (33.5)	1,520 (66.5)	< .01
60 or older	656 (86.1)	106 (13.9)		205 (26.9)	557 (73.1)	
TOTAL	**3,705** (87.8)	**513** (12.2)	NA†	**1,359** (32.2)	**2,859** (67.8)	NA

*All *P* values derived from χ^2 tests.

†NA: Not applicable.

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TABLE 6

Prevalence of periodontal disease in the dentate population.*

CHARACTERISTIC	GINGIVITIS WITHOUT PERIODONTITIS (n = 4,197)			PERIODONTITIS (n = 4,198)		
	Yes, n (%)	No, n (%)	*P*†	Yes, n (%)	No, n (%)	*P*†
Sex						
Male	433 (17.8)	2,006 (82.2)	.64	1,961 (80.4)	478 (19.6)	.77
Female	322 (18.3)	1,436 (81.7)		1,408 (80.0)	351 (20.0)	
Age, Years						
20–39	472 (40.6)	691 (59.4)		650 (55.8)	514 (44.2)	
40–59	239 (10.5)	2,036 (89.5)	< .01	2,016 (88.6)	259 (11.4)	< .01
60 or older	44 (5.8)	715 (94.2)		703 (92.6)	56 (7.4)	
TOTAL	**755** (18.0)	**3,442** (82.0)	NA‡	**3,369** (80.3)	**829** (19.7)	NA

*Participants for whom data were missing are excluded.

†All *P* values derived from χ^2 tests.

‡NA: Not applicable.