Oral Disease in Immigrant Children Attending a University Dental Clinic

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Abstract

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Background: One-quarter of American children are born into immigrant families facing high risks of dental disease and barriers to care. The aims of this study are to describe immigrant children's oral health seeking care at a university pediatric dental clinic, to compare their level of dental disease with equivalent national levels utilizing the National Health and Nutrition Examination Survey (NHANES) and to assess preferences for behavior guidance techniques by region of origin.

Methods: This retrospective longitudinal study utilized interpreter use as a proxy for recent immigrant status. Eligible participants were healthy new patients requesting examinations between 09/2010-09/2016. Patient data on demographics, visits characteristics, dental caries variables, and time elapsed between initial and last visit was collected at baseline and at last examinations. Two-sample t-tests and Fisher's exact tests were utilized to evaluate differences within the sample and with NHANES data. Logistic regression with adjusted odds ratios (OR)

and 95% confidence intervals (CI) was utilized to evaluate associations between region of origin and preferred behavior guidance techniques ($p<0.05$).

Results: In our study population (N=285), the mean age of children was 5.8 years (SD: 2.6). Females represented 47.7% of the study population. Overall 97.5 % had public insurance. The majority were from Asia (40%) and Latin America (34.7%). Dental caries was present in 90.1% of children. At baseline visit, all age groups demonstrated over a 9-fold increase in the mean number of decayed teeth (dt, DT) compared to NHANES data (all $p<0.001$). At last visit, the mean dt and DT of children aged 12-19 years was not significantly different than NHANES data ($p=0.09$). After adjusting for confounding variables, preferences for restorative treatment under general anesthesia were significantly higher among Middle Easterners (OR=5.45;95%CI=1.36,21.91), Asians (OR=2.56;95%CI=1.22,5.37) and Latin Americans (OR=1.98;95%CI=1.02,3.82) compared to Europeans.

Conclusion: Immigrant children receiving care at our university pediatric dental clinic start with a significantly high level of dental caries that declines over time when compared with national averages. Preferences for behavior guidance techniques, in particular general anesthesia, may vary by region and should be taken into consideration when discussing behavioral management techniques.

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INTRODUCTION:

The Immigrant Child Population in the United States (US)

In the US, immigrant children include first and second-generation immigrants: children born outside the US who later immigrated to the US and children born in the US to a foreign-born mother and/or father (Hernandez 1998; Hernandez et al. 2008). Currently, close to one-quarter of the children living in the US are born into immigrant families becoming an increasing subset of children living within the US (Hernandez et al. 2008; Hernandez and Napierala 2012; Mendoza 2009). Regardless of political orientation or future immigration policy, these children (a majority of which are US Citizens) will certainly mature to influence and become the future of the US (Shields and Behrman 2004).

Overall Health of Immigrant Children in the US

Immigrant children have significantly worse overall health than non-immigrant children (Hernandez and Napierala 2012; Capps et al. 2004). While eligible for public insurance, immigrant children are less likely to have health insurance coverage compared to nonimmigrant children in the US (Hernandez and Napierala 2012; Hernandez et al. 2008; Capps et al. 2004). Similarly, when compared to non-immigrant US children, immigrant and refugee children are more than two times as likely to be without an established home for health care services, which is hypothesized to contribute to their worse general and oral health (Capps et al. 2004).

Both the American Academy of Pediatrics (AAP) and American Academy of Pediatric Dentistry (AAPD) have defined the importance of establishing both medical and dental homes in a patient-centered care model (PCMH) to provide care that is “accessible, continuous,

comprehensive, family centered, coordinated, compassionate, and culturally effective" to improve pediatric oral and general health (Pediatrics Policy 2004; AAPD Policy 2017).

Dental Health of Immigrant Children in the US

Oral diseases are among the most common unmet health need of US children (Dye et al 2007; Mouradian 2000; Newacheck et al. 2000). While overall dental disease is declining, dental caries rates vary by ethnicity and immigrant status; immigrant children represent a high-risk population with high disease burden (Dye et al 2007; Masejerian et al. 2008; Pollick et al. 1987). Recent public health efforts have endeavored to support financially-disadvantaged families by increasing insurance coverage for the pediatric dental patient (Mendoza 2009); however, there is little current research evaluating the dental care provided to the children born into immigrant families.

Evidence of high dental disease among immigrant children is observed through the US. A 1987 study of school-based screenings conducted in San Francisco found that recent immigrant children were three times as likely to present with dental treatment needs compared to children born in the US (Pollick et al. 1987). Among refugee children in Massachusetts, 63% arrived with active dental disease which was the most commonly identified health need (Geltman 2001). In a 2011 study, low income immigrant Chinese-American children presented with a significantly elevated diseased and filled primary teeth (dft) when compared to age-equivalent national data; in addition, children born outside the US had greater both overall prevalence of caries and untreated dental caries at subsequent examinations (Chinn et al 2011). In the New England Children's Amalgam Trial, the children of immigrants presented with increased dental caries and were more likely to be lost to follow-up (Masejerian 2008). However, among those who completed 5-year

follow-up, the effect of caregiver immigrant status on the development of new dental disease lost significance (Masejerian 2008).

National Health and Nutrition Examination Survey (NHANES)

The objective of the NHANES, a stratified, multistage, probabilistic population based survey, is to provide descriptive health information representative of the "civilian noninstitutionalized" US population (Dye et al. 2007). The following populations are excluded from the NHANES: individuals not living in the fifty US states or District of Columbia, institutionalized individuals, active military enrollees, and the family members of active-duty military personnel living internationally (Curtin et al. 2012; Johnson et al. 2013). The NHANES consists of an interview and physical examination with approximately 5000 participants sampled annually; each year participants are surveyed from a maximum of 15 visited counties comprising "primary sampling units" (Curtin 2012). Health information by the following ethnicities is reported: non-Hispanic White, non-Hispanic Black, and Mexican American (Dye 2007). No additional ethnicities are reported.

The Oral Health Examination, one component of NHANES, provides a national average level of oral disease. The 1999-2004 report, available currently both in written publication by the US Department of Health and Human Services Centers for Disease Control (CDC) and via online publication through the National Institute of Dental and Craniofacial Research (NIDCR), is the most recent publicly accessible report and thus was used for comparison in this study (Dye et al. 2007; NIDCR Dental Caries 2014). Extracted variables of interest in this study include dental caries related variables: the number of decayed and filled primary and permanent teeth in children and adolescents. During the NHANES Oral Examination, these values are recorded by

calibrated dental examiners under defined clinical examination criteria to promote precision and accuracy (Dye et al. 2007).

Study Purpose and Rationale:

The child immigrant population is known to suffer from high levels of dental disease. This population faces unique cultural and language barriers which include but are not limited to the adoption of a new language, culture, and diet. The purpose of this study is to describe immigrant children's oral health seeking care at a university pediatric dental clinic, compare their levels of dental disease with equivalent (NHANES) data and assess preferences for behavior guidance techniques by region of origin.

METHODS:

Study Design

A retrospective longitudinal study was conducted through a review of dental charts of new patients who utilized interpreter services presenting between September 2010 to September 2016 at the University of Washington (UW) Center for Pediatric Dentistry (UW CPD). This study was approved by the UW Institutional Review Board (Study ID #2281). Interpreter services was used as a proxy for recent immigrant status as it has been reported as an acculturation measure in previous studies (Lee 2008; Valencia et al. 2012).

Study Setting and Subjects

The UW CPD is a 20-chair dental clinic with two operating rooms located in Seattle, WA. Dental care is provided to all individuals up to 19 years of age and for special needs individuals up to 21 years of age. In 2017, approximately 20,000 patient visits occurred at the

UW CPD. Our inclusion criteria were new patients ASA I (healthy) or mild ASA II (not more than one medical co-morbidity) between the ages of 2 and 11 years with first examination conducted between September 2010 and September 2016 with at least one examination per calendar year during enrollment and with at least one use of interpretation services (as a proxy for recent immigrant status). Exclusion criteria included incomplete records, no use of spoken interpretation services, greater than one medical comorbidity, utilization of emergency care or specialty services (endodontics, orthodontics, oral surgery) only, less than 6 months of follow-up, or falling outside the age range (of 2-11 years of age) at the time of new patient examination.

Variables and Data Collected

Demographic variables extracted from the electronic dental record were date of birth, gender (male or female), date of baseline examination, date of last examination, duration of follow-up (years), age at baseline examination (years), age at last examination (years), insurance type (public, private, public & private, self-pay/none), and language of interpretation.

Dental related variables were mean number of decayed primary (dt) and/or permanent teeth (DT) at baseline and at last examination and mean number of filled primary (ft) and/or permanent (FT) teeth at baseline and at last examination. In order to simplify the definition, we classified dental visit type into two categories: *preventive* (examination, cleaning, topical fluoride application and/or sealants) vs. *restorative* (fillings, crowns and simple surgical procedures). The behavior guidance technique utilized during a restorative appointment was categorized as *clinic* (regular dental chair with or without nitrous oxide), *oral sedation*, or *general anesthesia*. We used NHANES data as a comparison group for dental disease at national levels.

Data Collection

Available electronic interpreter billing codes (N=2703) and dental records were reviewed; 285 records met the inclusion criteria and comprise the study sample. Age at baseline and last visits was calculated as the difference from the date of birth to the date of the visit. Age at both baseline and last visits was categorized as *2-5*, *6-11*, and *12 and above* (last examination only) to correspond to the following developmental stages: primary dentition, mixed dentition, and permanent dentition. A binary gender categorization of *male* or f*emale* was used. Languages of interpretation were grouped by region and categorized as follows: *Latin America* (Spanish), *Asia* (Cantonese, Mandarin, Korean, Vietnamese, Cambodian, Hindi), *Africa* (Somali, Amharic, Oromo, Tigrinya), *Europe* (Russian, Ukrainian, Bulgarian, Armenian, Italian), and *Middle East* (Arabic, Farci). When use of interpreter was recorded without a language indicated, this was recorded as *unknown* language. Insurance type was categorized as *public, private, public and private, and self-pay/none*.

Dental visit types were defined as described: *preventive* vs. *restorative*. Preventive visits included the following dental treatments: examination, child prophylaxis, topical application of fluoride, and sealants. Common to all preventive only treatments, these did not include surgical caries removal. The restorative visits included restorations (resin, amalgam, or stainless-steel crown restorations) and simple surgical procedures (dental extractions).

Behavior guidance modalities were defined as *clinic*, *oral sedation* and *general anesthesia*. Clinic only involved treatment in the clinic setting with or without nitrous oxide. Oral sedation involved restorative treatment completed with the adjunct of an orally administered sedation preparation (meperidine, midazolam, and/or hydroxyzine) to alleviate moderate anxiety and facilitate safe completion of dental care for moderate dental needs. General anesthesia was

administered by an anesthesiologist to facilitate the surgical treatment of dental caries. For a patient receiving multiple behavior guidance modalities, the most advanced treatment was used for categorization.

Data from dental related variables (dt/DT, ft/FT) was extracted at baseline and at last visit. Non-cavitated incipient caries were not included in the decay score. For uncooperative patients sent to general anesthesia to complete the clinical examination, study enrollment began at the general anesthesia visit for dental data accuracy as our clinic has an operating room and the waiting list for general anesthesia appointments generally varies from 2-6 weeks.

Data Analysis

Individual patient data and information was extracted from the UW CPD electronic dental record system (axiUm) and organized securely using REDCap (Research Electronic Data Capture) tools (Harris 2009). All data was then analyzed using The R Project (Version 3.4.1) for Statistical Computing.

Descriptive statistics were utilized (N, %, Mean, Standard deviation) to describe both patient and dental treatment data. Fisher's exact tests and two sample t-tests allowing unequal variance were utilized to evaluate differences in the distributions of dental visit types and behavior guidance techniques by demographic variables. Two sample t-tests allowing unequal variance were utilized to evaluate differences between study participant data as compared to NHANES data for the following measures: baseline and last primary and permanent decay and filling scores (dt, DT, ft, Ft); P-values were calculated with a normal approximation to the t-distribution. Logistic regression analysis was applied to evaluate for associations between regions of origin and preferred behavior guidance techniques. Sensitivity analyses were

calculated throughout to evaluate for the presence of bias due to small subsamples. Adjustments for the following hypothesized confounders were completed: age, gender, time to recall, and baseline caries (the sum of dt and DT). For the regression analysis, unadjusted Odds Ratios, adjusted Odds Ratios, and 95% confidence intervals are reported. The significance level was set to $\alpha = 0.05$.

RESULTS

Table 1: Demographic and Dental Visit Type Variables

This sample consisted of 285 participant records with 149 males (52.3%) and 136 females (47.7%). The mean age at baseline presentation was 5.8 years (SD: 2.6) with 167 participants (58.6%) in the 2-5-year age category and 118 patients in the 6-11-year age category (41.4%). Overall, 97.5% of patients had public insurance and the majority of patients were from the following two regions: Asia (40.0%) and Latin America (34.7%). (Table 1)

Overall, 90.1% of the children had dental disease requiring restorative treatment, with 9.8% of the children seen for preventive care only. There was not a statistically significant difference in dental visit type (preventive vs. restorative) by age, gender, language by geographic region, or insurance type. (Table 1)

Tables 2A and 2B: Comparison of Study Participant Dental Variables with Equivalent National Data (NHANES) Data

Baseline Visit Versus NHANES Data

At baseline visit, study children aged 2-5 years and 6-11 years presented with significantly elevated numbers of decayed primary teeth (7.54, 4.12, respectively) compared to NHANES data (0.71, $p<0.001$; 0.58, $p<0.001$; respectively). While for permanent teeth, children aged 6-11 years presented with significantly elevated levels of decayed permanent teeth (1.08 vs 0.12; $p<0.001$).

At baseline visit, among children aged 2-5 years there was not a statistically significant difference in the number of filled primary teeth compared to NHANES data (0.44 vs 0.47, $p=0.41$). Among children aged 6-11 years there were significantly increased numbers of filled primary teeth (1.94 vs 1.26, $p=0.007$), presumed due to a referral effect after baseline dental care was received. While for permanent teeth among children aged 6-11 years there was not a statistically significant difference in the number of filled permanent teeth compared to NHANES data (0.22 vs 0.32, $p=0.08$). (Tables 2A and 2B)

Last visit Versus NHANES Data

At last visit, children aged 2-5 years presented with minimally significant increases in the number of decayed primary teeth compared to NHANES data (1.03 vs 0.71, $p=0.04$). At last visit, children aged 6-11 years presented with minimally significant decreases in the number of decayed primary teeth compared to NHANES data (0.43 vs 0.58, $p=0.047$). While for permanent teeth, among children aged 6-11 years at last visit, there was a significantly increased

number of decayed permanent teeth compared to NHANES data (0.31 vs 0.12, $p<0.002$) presumed due to one of the following reasons: the development of cavities in newly erupted teeth or treatment deferral until eruption status allows for placement of a definitive restoration in a developing patient. At last visit, among children aged 12-19 years in the permanent dentition there was not a statistically significant difference in the number of decayed permanent teeth (0.86 vs 0.47; $p=0.09$).

At last visit, all age groups and dentitions presented with significantly elevated numbers of filled teeth as follows. For primary teeth at last visit for children aged 2-5 years and 6-11 years, there were increased numbers of filled teeth (7.16, 3.28, respectively) compared to NHANES data (0.47, $p<0.001$; 1.26, $p<0.001$, respectively). For permanent teeth at last visit for children aged 6-11 years and 12-19 years, there were increased numbers of filled teeth (0.88, 3.17, respectively) compared to NHANES data (0.32, $p<0.001$; 2.01; $p=0.003$). (Tables 2A and 2B)

Table 3A: Behavioral Guidance Technique by Demographics

Overall, 37.7% in the clinic only, 6.2% under oral sedation, and 56.6% of children were treated under general anesthesia. Of the 97 patients treated in the clinic only setting, 23.7% were in the 2-5-year-old category and 76.3% were in the 6-11-year-old category. Of the 16 patients treated under oral sedation, 68.8% were in the 2-5-year-old category and 31.3 % were in the 6-11-year-old category. Of the 144 patients treated under general anesthesia, 81.3% were in the 2-5-year-old category and 18.8% were in the 6-11-year-old category. Age and language by geographic origin were significantly associated with type of dental visit ($p<0.001$). There was not a statistically significant difference in behavior guidance technique by gender. No

individuals from the African region received treatment under oral sedation and only one individual from the Middle East region received treatment under oral sedation. (Table 3A)

Table 3B: Preferences for Behavior Guidance Technique by Region

As compared to Europeans, children from Asia, Latin America, and Middle East have 2.56 (95% CI = 1.22, 5.37), 1.98 (95% CI = 1.02, 3.82), and 5.45 (95% CI = 1.36, 21.91) statistically significant increased adjusted odds of preferred treatment under general anesthesia. As compared to Europeans, children from the African region present with 1.78 increased adjusted odds (95% CI=0.44, 7.22) of preferred treatment under general anesthesia.

After adjusting for gender, age, time to recall, and baselines caries, there were no statistically significant associations between region of origin and preferences for the following behavior guidance techniques for clinic only and oral sedation. As compared to Europeans, individuals from the following regions: Asia, Latin America, and Middle East have 51% (95% CI=0.21,1.14), 29% (95% CI=0.34,1.50), and 80% (95% CI=0.03,1.49) lower adjusted odds and Africans have 35% higher adjusted odds (95% CI=0.31,5.92) respectively for preferred treatment in clinic setting. As compared to Europeans after adjustment, individuals from Asia and Latin America have 27% (95% CI=0.17,3.19) and 43% (95% CI=0.15,2.19) lower adjusted odds respectively and Middle Easterners have 7% higher adjusted odd (95% CI=0.04,31.13) for preferred treatment under oral sedation (Table 3B).

DISCUSSION

This study described the oral health of immigrant children seeking care at a university pediatric dental clinic, compared their levels of dental disease with equivalent NHANES data,

and assessed preferences for behavior guidance techniques by region of origin. Dental caries remains a highly prevalent pediatric disease with immigrant children representing a growing subset of the US population hypothesized to present with elevated levels of oral disease and behavior guidance preferences that vary by region of origin (Dye et al. 2007; Hernandez et al. 2008; Mendoza 2009; Masejerian et al. 2008). This study provides information on dental disease levels and treatment preferences which could inform more effective care, reduce oral health disparities, and promote future oral health in immigrant children.

Highlighted findings which confirm our hypotheses include very low utilization of preventive only needs, high levels of dental disease at baseline, an increased number of filled teeth with lower levels of decayed teeth at last visit, and increased odds for preferred treatment under general anesthesia for Asians, Latin American, and Middle Easterners compared to Europeans. More specifically, the majority of this study sample consisted of the following two regions: Asia (40%) and Latin America (34.7%). Only 9.8% of immigrant children in this sample had preventive only needs; the vast majority (90.1%) of our sample had treatment needs due to caries. At baseline, all age groups presented with over a 9-fold increase in the number of decayed teeth ($p<0.001$) compared to NHANES. At last visit, all age groups presented with significantly elevated numbers of filled teeth ($p\leq0.003$). While some elevated numbers of decayed teeth are present at last visit, the overall trend in decay scores is towards the equivalent national average (NHANES) with no significant difference among children aged 12 to 19 years ($p=0.09$).

To our knowledge, this is the first study to report parental preferences for behavior guidance techniques in the child immigrant population. Prior studies have evaluated overall parental attitudes and found that the clinic setting, oral sedation, and general anesthesia are

generally well accepted with a trend toward increasing acceptance of pharmacologic techniques to date (Eaton et al. 2005; Patel et al. 2016). As compared to Europeans in this study, there were significantly increased adjusted odds for preferred treatment under GA for the following regions: Asia, Latin America and Middle East, which may be associated with unique cultural experiences.

In immigrant children, this study found elevated baseline dental disease that trends toward the national average with continued dental care in a direction consistent with published literature. Immigrant children were three times as likely to present with dental treatment needs as compared to native-born US children in a San Francisco school-based study (Pollick et al. 1987). In a 2011 study, low income immigrant Chinese-American children presented with over a 2.5-fold increase in dft when compared to the age-equivalent national data; however, DMFT was not elevated (Chinn et al 2011). In the New England Children's Amalgam Trial, immigrant children presented with an adjusted average increase of two carious surfaces in the mixed dentition compared to non-immigrants; however, among immigrants who completed 5-years of follow-up, the effect of caregiver immigrant status on the development of new dental disease lost significance (Masejerian 2008). While the presence of elevated baseline disease that declines with care is consistent with the literature, our study reports more robust elevations in disease status present in both the primary and permanent dentitions. This finding could be due to one or more of the following reasons: acceptance of referrals (1000 annually) from regional clinics due to advanced case complexity in our study, increased accuracy from independent measures of decayed and filled teeth, heterogeneous samples across studies with varying ethnicities represented, and the potential for NHANES data to underestimate disease. NHANES relies on clinical caries detection which may underestimate true disease; our examination completed with availability of dental radiographs provides a more accurate disease measure.

In interpreting this study's results, several strengths and limitations must be considered. This study was conducted at a large pediatric dental university clinic in Seattle, Washington; limitations to the external validity of this study must be conceded as the population and ethnicities represented in this sample are not anticipated to be nationally representative. The following study limitations are associated with the potential to bias the results towards the null hypothesis. Inherent to a retrospective chart review, the collected data was recorded by multiple providers and is subject to inter-provider inconsistencies and contributes a source of non-differential misclassification. Use of interpreter as a proxy for recent immigrant status and grouping participants by regions may combine distinctly different individuals into one group and could reduce reported differences by region of origin. A major strength of the study design is the ability to reach the vulnerable child immigrant population. Due to a lack of English proficiency, this population is often hesitant to participate or excluded from participation in many research studies.

In summary, immigrant children present at baseline with severely elevated levels of dental disease which trend towards the national average with continued dental care. Compared to Europeans, preferences for treatment under general anesthesia vary by region of origin, with the majority of this sample from Asia and Latin America. Immigrant children, a population with high levels of oral disease, will mature to become a significant component of the future US population. Future studies should focus on recruiting larger samples with increased representation from the African and Middle East regions for increased power. Future dental public health policy should aim to increase utilization of preventive services and ensure continued availability of dental care in the child immigrant population.

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Appendix

Table 1: Demographics and Dental Visit Types of Study Participants

	All Study Participants (N=285)	**Preventive Only** n=28 (9.8%)	**All Restorative/ Simple Surgical*** n=257 (90.1%)	**P-value***
Baseline Age in years, Mean (SD)	5.8 (2.6)	5.7 (3.2)	5.8 (2.5)	0.87
Baseline Age, binary N				
2-5 years, N (%)	167 (58.6%)	16 (57.1%)	151 (58.8%)	>0.99
6-11 years, N (%)	118 (41.4%)	12 (42.9%)	106 (41.2%)	
Gender				
Male, N (%)	149 (52.3%)	11 (39.3%)	125 (48.6%)	0.43
Female, N (%)	136 (47.7%)	17 (60.7%)	132 (51.3%)	
Language by Region				
Asia, N (%)	114 (40.0%)	13 (46.4%)	101 (39.2%)	0.58
Latin America, N (%)	99 (34.7%)	8 (28.6%)	91 (35.4%)	
Europe, N (%)	33 (11.6%)	2 (7.1%)	31 (12.1%)	
Africa, N (%)	19 (6.7%)	3 (10.7%)	16 (6.2%)	
Middle East, N (%)	12 (4.2%)	0 (0.0%)	12 (4.7%)	
Unknown, N (%)	8 (2.8%)	2 (7.1%)	6 (2.3%)	
Insurance Type				
Public, N (%)	272 (95.4%)	27(96.4%)	245 (95.3%)	0.75
Public + Private, N (%)	6 (2.1%)	1 (3.6%)	5 (19.5%)	
Private, N (%)	5 (1.8%)	0	5 (1.9%)	
Self-Pay, N (%)	2 (0.7%)	0	2 (0.8)	

***P-value: Preventive vs Restorative/Simple Surgical Distribution**

Table 2A: Comparison of study participant PRIMARY dental caries variables with national data (NHANES)

	Age Group (years)	Participant Decay Mean (SD)	NHANES Decay Mean (SE)	P-value	Participant Filling Mean (SD)	NHANES Filling Mean (SE)	P-value
BASELINE	**2-5**	7.54 (5.98)	0.71 (0.07)	<0.001	0.44 (1.60)	0.47 (0.05)	0.41
	6-11	4.12 (4.76)	0.58 (0.04)	<0.001	1.94 (0.02)	1.26 (0.06)	0.007
LAST	**2-5**	1.03 (2.15)	0.71 (0.07)	0.04	7.16 (4.58)	0.47 (0.05)	<0.001
	6-11	0.43 (0.84)	0.58 (0.04)	0.047	3.28 (0.02)	1.26 (0.06)	<0.001

Table 2B: Comparison of study participant PERMANENT dental caries variables with national data (NHANES)

	Age Group (years)	Participant Decay Mean (SD)	NHANES Decay Mean (SE)	P-value	Participant Filling Mean (SD)	NHANES Filling Mean (SE)	P-value
BASELINE	**6-11**	1.08 (1.66)	0.12 (0.02)	<0.001	0.22 (0.72)	0.32 (0.02)	0.08
LAST	**6-11**	0.31 (0.84)	0.12 (0.02)	<0.002	0.88 (1.39)	0.32 (0.02)	<0.001
	12-19	0.86 (1.85)	0.47 (0.04)	0.09	3.17 (2.70)	2.01 (0.07)	0.003

Table 3A: Behavioral Guidance Techniques by Demographics

	Restorative/Simple Surgical Treatment			
	Clinic Only n=97 (37.7%)	**Sedation*** n=16 (6.2%)	**GA**** n=144 (56.6%)	**P-value**
Baseline Age (years)				
2-5	23 (23.7%)	11 (68.8%)	117 (81.3%)	<0.001
6-11	74 (76.3%)	5 (31.3%)	27 (18.8%)	
Gender				
Male	49 (50.5%)	5 (31.3%)	71 (49.3%)	0.34
Female	48 (49.5%)	11 (68.8%)	73 (50.7%)	
Language by Geographic Region				
Asia	26 (26.8%)	7 (43.8%)	68 (47.2%)	<0.001***
Latin America	40 (41.2%)	5 (31.3%)	46 (31.9%)	
Europe	20 (20.6%)	3 (18.8%)	8 (5.6%)	
Africa	5 (5.2%)	0 (0.0%)	11 (7.6%)	
Middle East	2 (2.1%)	1 (6.3%)	9 (6.3%)	
Unknown	4 (4.2%)	0 (0.0%)	2 (1.4%)	

*** Region: Africa omitted p-value calculation due to empty cell.**

Table 3B: Preferences for Behavior Guidance Technique by Region*

	Behavior Guidance Technique					
	Clinic Only		Sedation		GA	
Region of Origin	**Unadj OR (95% CI)**	**Ad OR* (95% CI)**	**Unadj OR (95% CI)**	**Adj OR* (95% CI)**	**Unadj OR (95% CI)**	**Adj OR* (95% CI)**
Europe	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
Asia	0.19 (0.13, 0.28)	0.49 (0.21, 1.14)	0.70 (0.25, 1.94)	0.73 (0.17, 3.19)	5.92 (3.90, 9.00)	2.56 (1.22, 5.37)
Latin America	0.43 (0.30, 0.62)	0.71 (0.34, 1.50)	0.54 (0.17, 1.69)	0.57 (0.15, 2.19)	2.94 (1.94, 4.46)	1.98 (1.02, 3.82)
Africa	0.25 (0.11, 0.58)	1.35 (0.31, 5.92)	***	***	6.33 (2.57, 15.56)	1.78 (0.44, 7.22)
Middle East	0.11 (0.03, 0.47)	0.20 (0.03, 1.49)	0.85 (0.05, 14.84)	1.07 (0.04, 31.13)	8.63 (2.59, 28.67)	5.45 (1.36, 21.91)

***Adjusted for Continuous Age, Gender, Continuous Time to Recall, and Baseline Caries**

****Unknown language (N=6) were excluded from analysis**

****Africa Omitted due to empty cell.**