# Dental Caries Experience, Tooth Loss, and Factors Associated with Unmet Needs of Haitian Immigrants in New York City

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### Abstract

Objective: The aim of this study was to characterize the dental caries experience, tooth loss, and unmet need of a group of Haitian immigrant residents of New York City. Methods: A purposive sample of 523 adults was obtained through community outreach activities during 1997–98. Clinical examinations were performed by calibrated examiners, according to NIDCR criteria. A comprehensive survey also was administered to all the participants. **Results:** For the whole group, the mean number of missing teeth was 2.64 (SD=4.12), the mean DMFT=6.05 (SD=5.26), the mean DMFS=18.80 (SD=21.04), and the mean DFS=5.58 (SD=6.17). Seventeen percent of the subjects had all their teeth sound, 59 percent had at least one tooth missing, 60 percent had at least one decayed tooth, and only 38 percent had restorations. Multivariate analyses showed that age, sex, education, dental insurance, frequency of dental visits, and dental floss use were predictors of unmet need. Conclusions: Although results showed a relatively low caries experience among this group of Haitian immigrants, the unmet need was very high. Furthermore, the tooth loss experience was relatively high for all age groups, further denoting a lack of access to preventive and restorative services. [J Public Health Dent 2001;61(4):203-9]

Key Words: dental caries, Haitian immigrants, tooth loss, unmet need.

According to the 1990 US Census, there were 280,874 Haitians in the United States, with a large proportion (107,207) residing in New York State (1). New York City (NYC) has the largest concentration of Haitians in the country. Between 1990 and 1994, 15,000 Haitians entered NYC legally, making Haiti the ninth leading source country of immigrants in NYC (2). The Haitian Consulate estimates that, including the undocumented immigrants, over 400,000 Haitians live in NYC (Haitian Consulate, February 2000, personal communication). The large number of undocumented Haitians in the area is partly attributed to the 1965 Immigration and Nationality Act, which made illegal entry more feasible and faster than legal entry into the United States (3). Furthermore, the Immigration Reform and Control Act (IRCA) of 1986 and the Immigration Act of 1990 had a substantially smaller impact than expected on the number of undocumented individuals in NYC because many of these individuals arrived in NYC after 1982, the cutoff date for persons applying for amnesty (2).

To our knowledge, there have been no published studies on the oral health status of the adult Haitian population in the United States or in Haiti. A study conducted in 1983 compared the oral health status of Haitian and Hamburg children aged 12–15 years (4). Results showed that Haitian children had DMFT and DMFS levels that were lower than the Hamburg children (3.65 and 4.80 vs 8.35 and 21.09, respectively). A small study conducted among adolescents and young adults of La Gonâve region found lower rates of dental caries than those reported in the US national studies, but similar rates of decayed teeth to those found in 12–17-year-old African Americans (5).

Most of the oral health studies conducted on low-income developing countries have focused on children (6). These studies have suggested that disadvantaged populations in low-income developing countries tend to have lower levels of caries than those of higher socioeconomic status (7-9). It also has been suggested that this situation tends to disappear the longer immigrants from disadvantage groups in low-income developing countries live in industrialized countries (6,10-13).

There has been a dearth of information about the oral health status of adult and elderly individuals born in developing countries who migrate to the United States. Some studies conducted among adult immigrants to other countries have found less dental caries than their counterparts (14-16). Other studies conducted mainly in northern Europe have found that immigrant adults and children, particularly preschool children, have more dental caries than natives of similar age (17-19).

During the period 1990–94, 563,000 documented immigrants settled in NYC. This represented a 32 percent increase over the previous 10 years (2). Along with the previously established African American and Puerto Rican populations, these groups are changing the complexion of the city and accelerating a demographic shift to a city of minorities. The assessment of the

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determinants of the oral health status of minority groups and immigrants to this country is important to plan effective oral health promotion programs and to eliminate disparities in oral health.

The purpose of this study was to describe and characterize the dental caries experience of a sample of adult Haitian immigrant residents of NYC, and to determine the factors associated with untreated decay and tooth loss in this group of individuals.

#### Methods

A purposive sample of 523 individuals aged 18 years and older was obtained through outreach activities during 1997-98. A targeted nonprobability snowball sampling strategy was employed (20). True probability sampling was deemed to be impossible to obtain for this study due to the atypical households, language barriers, and large numbers of undocumented persons of Haitian origin in the NYC area. Community-based organizations, churches, and other social and political groups were contacted and examinations were conducted in the field by a team of calibrated examiners and trained recorders.

Institutional Review Board (IRB) approval from New York University was obtained prior to the inception of the study. Oral health examinations were conducted utilizing a mirror, a sharp #23 explorer, and artificial light. Teeth were not dried or cleaned prior to the examination and no radiographs were taken. NIDCR diagnostic criteria, used in the Oral Health Survey of US Adults, were utilized (21). Interexaminer reliability was calculated for all the examiners at the toothsurface level. The intraclass correlation coefficient was over .95 for all examiners.

Coronal caries data were collected on all teeth except third molars. Counts of decayed (DS) and filled (FS) surfaces were recorded. Restorations that were determined to have been placed as a sequel to trauma or for purely esthetic reasons were not counted in the F component to avoid overestimation of disease-related findings. Secondary decay was recorded separately, although it was included in the presented scores for analysis purposes. Missing teeth also were recorded separately. DMFT and DMFS scores were calculated for all the participants of the study. DFS, DS, and %DS/DFS were calculated only on dentate individuals to correct for the possible inclusion of teeth that were extracted due to periodontal disease. A questionnaire to assess sociodemographic information as well as knowledge, attitudes, and behavioral practices of the participants was administered. This questionnaire was translated into Haitian Creole and translated back into English according to Brislin's recommendations (22). It was largely self-administered, although trained bilingual interviewers also were used for those participants who were illiterate.

The independent variables used for the multivariate analysis of DS/DFS were: age, sex, education, income, marital status, self perception of general and dental health, dental insurance, regular source of dental care, frequency of dental visits, brushing, flossing, and use of a fluoride toothpaste. These variables were based on components of the Andersen Behavioral Model of Health Services Utilization (23,24). We created most items used in the survey instrument specifically for this study. The items assessing self-perception of general and dental health were taken from questionnaires developed for use by the UCLA Research Center for Minority Oral Health (Atchison KA, 1995, personal communication). The items assessing oral health practices were modified from those used in the International Collaborative Studies (25).

The original instrument as well as the translated version were pilot tested prior to the study. All variables were treated as categorical variables. Age was categorized into four groups: 18-34 years, 35-49 years, 50-64 years, and 65 years and older. Education was categorized as 0-11 years of education, 12 years of education (equivalent to a high school education), and more than 12 years of education. Because this was a relatively poor population, the income variable was categorized into two levels: annual family income below \$10,000, and \$10,000 and above. Possible responses for self-perceived general health and dental health ranged from excellent to poor, but were dichotomized for analysis purposes into excellent/good and fair/poor. The frequency of dental visits was categorized as every two or three years, at least once a year, or only in emergencies. Brushing practices were dichotomized into daily versus not daily, dental floss use into never and daily/sometimes, and the use of a fluoride toothpaste into yes or no. Marital status, having dental insurance, and having a regular source of dental care also were reduced to binary variables.

We used ANOVA to test the hypothesis of equivalence among groups for outcomes of DMFT, DMFS, and DFS scores over age groups, sex, education level, annual household income, and marital status. To compare %DS/DFS between these groups, we used one-way ANOVA, assuming the normality of the ratio of DS over DFS, as a rough approximation. However, because the normality assumption is not a good approximation in this case (since DS/DFS is a ratio bounded between 0 and 1), for multivariate regression modeling we used a more appropriate approach, "# outcomes / # trials" binomial logistic regression. In this approach, for each subject the DS count is the binomial number of outcomes out of a total of DFS "trials." The binomial logistic regression thereby appropriately models the fraction of individuals' total decayed surfaces that are currently untreated. For a more detailed discussion of the method, see Atkin et al. (26). The SAS PROC GENMODE (27) was used to solve for the model. The resulting coefficients have the same log odds ratio interpretation as regular logistic regression. Odds ratios and corresponding 95 percent confidence intervals were computed for each predictor variable.

# Results

The study sample consisted of 220 (42%) males and 303 (58%) females. The mean age was 43 years (range=18-82; SD=14.46) and 65 percent had 12 years or less of education.

Of all participants in this study, only two (.4%) were edentulous. The rest (n=521) had a mean of 25.35 (SD=4.12) remaining teeth. The mean number of missing teeth for the whole group was 2.64 (SD=4.12). An average of 19.71 (SD=7.32) teeth were found to be sound, i.e., no caries or restorations. The mean DMFT was 6.05 (SD=5.26), the mean DMFS was 18.80 (SD=21.04), and the mean DFS was 5.58 (SD=6.17). Seventeen percent of the subjects had all their teeth sound, 59 percent had at

Variable	n	DMFT (SD)	DMES (SD)	DFS (SD)	DS (SD)	%DS/DFS
· · · · ·						
Age (years)						
18–34	156	4.18 (3.98)	8.26 (9.94)	4.70 (5.26)	2.92 (3.66)	70
35-49	179	5.99 (4.60)	17.16 (16.65)	5.91 (6.48)	2.42 (3.29)	54
5064	151	7.46 (5.64)	27.84 (25.04)	6.12 (6.33)	2.36 (3.55)	49
65+	37	8.46 (7.14)	34.30 (30.43)	5.75 (8.04)	2.51 (4.29)	70
Sex						
Male	220	5.96 (5.34)	18.16 (21.60)	5.55 (6.33)	2.80 (3.76)	62
Female	303	6.12 (5.03)	19.27 (20.64)	5.63 (6.17)	2.38 (3.38)	55
Marital status						
Married	254	6.20 (5.11)	19.84 (21.24)	5.58 (6.06)	2.41 (3.33)	56
Not married	269	5.91 (5.21)	17.82 (20.84)	5.60 (6.23)	2.70 (3.75)	60
Education (years)						
0–11	233	6.88 (5.51)	23.80 (23.83)	5.61 (6.04)	2.55 (3.74)	58
12	103	5.89 (4.73)	17.43 (17.78)	5.94 (6.31)	2.71 (3.50)	58
>12	178	5.03 (4.81)	13.08 (17.49)	5.39 (6.51)	2.46 (3.36)	59
Income		. ,	, , ,	· · ·	. ,	
\$0\$9 <i>,</i> 999	264	6.41 (5.48)	20.84 (22.61)	5.59 (6.55)	2.59 (3.56)	61
≥\$10,000	259	5.69 (4.79)	16.72 (19.13)	5.60 (5.90)	2.53 (3.55)	56

 TABLE 1

 DMFT, DMFS, DFS, %D/DFS, and DS Scores by Demographic Variables

\*Differences between the age groups were significant for DMFT, DMFS, and %DS/DFS scores (P<.01).

†Differences between educational levels were significant for DMFT and DMFS scores (P<.01).

Differences between income levels were significant only for DMFS (P<.05).

[One-way ANOVA was used to test for differences in all reported scores.

least one tooth missing, 38 percent had at least one tooth filled, and 60 percent had at least one tooth that was decayed.

Table 1 presents mean DMFT, DMFS, DFS, DS, and %DS/DFS scores, stratified by age, sex, marital status, education level, and income. The DMFT values ranged from 4.18 in the group aged 18-34 years to 8.46 among those aged 65+ years and older. The DMFS values ranged from 8.26 in the youngest age group to 34.30 in the oldest age group. As expected, there was a significant difference (P < .01) in DMFS and DMFT values between age groups. There was also a significant difference between education groups (P<.01) for both DMFT and DMFS values and between income groups (P < .05) for DMFS. Persons with a higher education level had significantly lower DMFS and DMFT scores, whereas only those with lower income had significantly higher DMFS values. When the M portion of the DMFS index was eliminated from the analysis, the DFS values dropped considerably, with values ranging from 4.7 in the 18–34-year-old age group to 6.12 for the 50–64-year-old age group.

In the group aged 65 years and older, the removal of the M portion caused an even greater drop in values, from a DMFS of 34.30 to a DFS of 5.75. There was no significant difference in the DFS index or in the number of decayed surfaces among demographic subgroups. The %D/DFS values, indicating restorative treatment needs as well as access to care, were significantly higher (P<.01) in the youngest and in the oldest groups than among persons aged 35–64 years.

The results of the multivariate analyses of %DS/DFS using binomial logistic regression are presented in Table 2. The significant predictors were: sex (P=.0001), age group (P=.0001), education level (P=.0207), frequency of dental visits (P=.0001), lack of dental insurance (P=.0001), and not using dental floss (P=.0266). Individuals aged 18-34 years with a history of caries were 2.7 times more likely to have an untreated decayed surface than the oldest group. Similarly, females with a history of caries were about 30 percent less likely than males to have a decaved surface, and those with less than 12 years of education were about 30 percent more likely than those with

more than 12 years of education to have a decayed surface. Individuals without dental insurance and with a history of caries had about 80 percent greater chance of having a decayed surface than those with dental insurance. The frequency of dental visits was also a significant predictor for those with caries experience: individuals who reported usually visiting the dentist every year were about 60 percent less likely to have a decayed surface than those who reported visiting the dentist only in an emergency. Persons who reported visiting a dentist every two to three years had a 30 percent less chance of having a decayed surface. Finally, those individuals with a history of caries who reported not using dental floss regularly were 1.22 times more likely than those who used dental floss regularly to have a decayed surface.

Figure 1 shows the mean number of missing teeth stratified by the same demographic variables used in Table 1. The values increased significantly with age (P<.01) from a mean number of missing teeth of .70 in the 18–34-year-old age group to 5.89 in the group aged 65 years and older. Males and

TABLE 2 Multivariate Logistic Regression for DS/DFS (n=324)\*

	, 0		- - <u></u>
	Odds Ratio	95% CI	P-value
Gendert			
Female	.68	.57, .81	
Male	Reference		.0001
Age (years)†			
18-34	2.73	1.89, 3.94	
35-49	1.03	.73, 1.47	
50-64	.87	.62, 1.24	
65+	Reference		.0001
Education (years)†			
0-11	1.31	1.07, 1.59	
12	1.08	.85, 1.37	
>12	Reference		.0207
Income			
\$0-\$9,999	.86	.72, 1.02	
≥\$10,000	Reference		.0851
Marital status			
Married	.91	.76, 1.08	
Not married	Reference		.2909
Dental insurance <sup>†</sup>			
No (0)	1.84	1.50, 2.27	
Yes (1)	Reference		.0001
Frequency of dental visits†			
≤1 year	.39	.31, .49	
2–3 years	.68	.54, .85	
Emergency	Reference		.0001
Self-perceived general health			
Fair/poor	1.16	.95, 1.40	
Good/excellent	Reference		.1372
Self-perceived dental health			
Fair/poor	.92	.74, 1.14	
Good/excellent	Reference		.4389
Regular source of dental care			
No	.82	.65, 1.05	
Yes	Reference		.1145
Frequency of brushing			
Daily	1.13	.87, 1.46	
Not daily	Reference		.3676
Use of toothpaste with fluo- ride			
No	1.23	.99, 1.53	
Yes	Reference	,	.0564
Dental floss use	mercrence		
No (0)	1.22	1.02.1.45	
Yes (1)	Reference		.0266

\*Only those individuals with DFS>0 were included in the model. +Significant variables.

females had similar rates of missing teeth. There was a decreasing trend in missing teeth with increasing education level (P<.01) and increasing income level (P<.05).

# Discussion

To our knowledge, this is the first study conducted on a Haitian adult population in the United States. This study seems to confirm currently held notions that low-income immigrants from developing countries experience low levels of dental caries. The individuals who participated in this study exhibited a lower dental caries experience, as expressed by their DMFT, DMFS, and DFS scores, than those reported in national and local studies conducted among US adults (21,28-30). For the whole group, the mean DMFT was 6.05, the mean DMFS was 18.80, and the mean DFS was 5.58. Furthermore, 17 percent of all the individuals had all of their teeth sound and only 38 percent had teeth restored. In comparison, the mean DMFS for persons examined in the NHANES III study was 53.0 for non-Hispanic whites, 44.2 for non-Hispanic blacks, and 27.6 for Mexican Americans. The overall mean DFS was 21.5. Other studies of immigrants from low-income groups in developing countries have found similar low levels of dental caries (15-16).

As expected, the DMFS and DMFT scores increased significantly with age and decreased with higher education. Interestingly, the DFS scores were not significantly different among any of the demographic subgroups. Moreover, no sex differences were observed for any of the scores at the bivariate level, contrary to the findings from other US studies (21,28).

The relatively low levels of dental caries among Haitian immigrants in this study probably reflect dietary patterns that do not include a large amount of foods high in refined carbohydrates and soft beverages in their country of origin, as well as oral hygiene habits that are unique to this population. In other studies where low levels of dental caries have been found in recent immigrants, it has also been suggested that this condition is probably related to the indigenous disease levels in the country of origin, as well as dietary habits of the individuals (8,9,15,16,31). Previous studies have documented an increase in caries prevalence and severity when native people from underdeveloped countries or regions have shifted to Western dietary habits (32-34). The effect of acculturation and length of stay on the oral health of these individuals will be explored in detail in a future study. Furthermore, in Haiti the use of a twig from the "lamandier" bush as an alternative method of brushing is very popular (35). More research is needed

FIGURE 1 Bivariate Analysis for Mean Number of Missing Teeth by Demographic Variables



as to the possible bactericidal properties of this plant.

Although this group of individuals exhibited a relatively low caries experience, the unmet need was very high: 60 percent of all individuals had one or more decayed teeth. The %DS/DFS was higher in all age groups of this study than those reported in similar age groups and in all racial and ethnic groups in the most recent US national study (28). This problem is common in developed countries in Europe and North America, where immigrant groups usually carry an excessive burden of oral disease (36).

The multivariate analysis performed using DS (of DFS) as the dependent variable showed that the significant predictors were age, sex, presence of dental insurance, frequency of dental visits, and use of dental floss. Most of these predictors, except for sex and use of dental floss, suggest a serious lack of access to dental care among these individuals. This is not surprising, since 81 percent of these individuals reported not having a usual source of dental care in NYC. These results are similar to those of other studies. In a recent study conducted among several racial/ethnic groups in the United States, the most important predictors of unmet needs included race/ethnicity, educational attainment, and oral health practices (29). In another study of older adults conducted in Canada, frequency of dental visits was a predictor of untreated decay (37). Sex differences in untreated decay were similar to those found in most recent US national survey data: males usually have more untreated decayed teeth than females (10).

The prevalence of tooth loss was relatively high: 59 percent of participants in this study had at least one tooth missing due to disease, although it was almost impossible to distinguish those teeth that were lost due to periodontal disease from those lost to caries. However, the actual mean number of missing teeth was 2.64, reflecting a lower number of missing teeth than those reported for other racial/ethnic minorities in the United States (29,38,39).

The relatively high rates of missing teeth compared to the filled and decayed portion of the DMFS index may reflect cultural attitudes and lack of access to care both in this country and in Haiti. In a study on the oral health knowledge and attitudes conducted in a rural Haitian population, the majority of the individuals reported traditional beliefs such as that one should visit the dentists only when in pain (35). Extraction of the affected tooth was the preferred treatment. This situation is exacerbated by the lack of dental professionals in Haiti. According to the World Health Organization (WHO), during 1990–95 there were only 135 oral health professionals (2 per 100,000 population) in Haiti (40). The cost of extracting teeth versus restoring them, in addition to the cultural and personal attitudes toward tooth loss, also may play a role in the high rate of missing teeth in this population.

During the last decade, the number of immigrants to the United States and NYC has increased (2). These immigrants increasingly have been from diverse nationalities and sociocultural backgrounds. The oral health needs of immigrants vary according to their income level, education, and country of origin (41). Haiti is the poorest country of the Western Hemisphere and most of the individuals in this study reported very low levels of annual household income.

The notion that certain races are naturally resistant to dental caries is no longer accepted; it has become clear that the differences are mainly due to behavior, diet, and access to dental care (10). It also has been suggested that the majority of ethnic differences in general health require a lifestyle explanation (42). To improve the oral health and the access to care of these individuals, it is important that their cultural background, language, social conditions, and environmental conditions be considered. Oral health promotions that take into consideration the unique cultural characteristics of Haitian immigrants should be developed to improve their access to care, to reinforce those behaviors that have resulted in their low dental caries experience, and to acquire effective preventive measures currently available to others in the United States.

The cross-sectional design of this study limits its conclusions because only associations between independent variables and the dental caries experience and tooth loss of these individuals can be inferred. Furthermore, other factors associated with dental caries such as salivary flow, the buffering capacity of saliva, and oral microbiology were not measured.

Possibly, this group of individuals presented a high prevalence of periodontal diseases causing the need for these teeth to be extracted, especially in the older groups. Since it was not possible to obtain accurate histories with respect to the reason for extraction, caution must be exercised when interpreting the DMF values, which may overestimate caries experience particularly in a group of individuals with low DF values (16).

The results of this study may not be representative of the larger population of Haitian immigrants in NYC due to its sampling methodology. Nevertheless, this study provides important information on a group of individuals with particular sociocultural characteristics and strikingly different caries experience from those reported for other residents of the United States.

#### Acknowledgments

We are indebted to the leaders of the Haitian community-based organizations that partnered with us and were instrumental in the collection of data for this study. We also would like to thank all of the examiners, recorders, and interviewers that made this study possible. Finally, we thank Dr. Roy Shore for reviewing the manuscript.

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