The Association of Immigration and Acculturation Attributes With Oral Health Among Immigrants in New York City

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From 1990 to 2000, there was a dramatic increase in the number of immigrants to the United States.[1] The consequent racial/ethnic diversification of the US population has been driven largely by immigrants from Latin America, the Caribbean, and Asia. In New York City, the foreign-born population increased from 2.1 million in 1990 to 2.7 million in 2000. Today, more than 56% of the New York City population are foreign-born or are the children of foreign-born parents.[2]

Despite the dramatic increase in the numbers of immigrants from diverse backgrounds in large US cities, very little is known about immigrants' oral health. Previous studies of the oral health of adult immigrants in other industrialized countries have generated contradictory findings. Some studies have found fewer lifetime dental caries among adult immigrants than among their counterparts in their host country.[3–5] Other studies have found that both immigrant adults and immigrant children have more dental caries than natives of similar age, particularly preschool children.[6–8] A recent study conducted in New York City among Haitian immigrants showed relatively low rates of lifetime dental caries when compared with the US national average, but the number of teeth in need of restoration was much higher among the immigrant population.[9]

Studies of periodontal disease among immigrants have shown similarly contradictory results. Some studies have shown that immigrants from developing countries exhibit higher prevalence of periodontal disease than their native counterparts,[7,10,11] whereas other studies have found lower prevalence of periodontal disease among immigrants.[12,13]

Most studies conducted in developing countries have focused on children,[14] and results suggest that disadvantaged populations in developing countries tend to have lower levels of caries than do populations with higher socioeconomic status.[15–17] It has been suggested that for people who immigrate from developing countries to industrialized nations, the positive association between the number of caries and socioeconomic status tends to disappear the longer these immigrants live in industrialized countries.[14,18–21]

Acculturation has been shown to serve as a proxy for changes in immigrants' cultural norms and behaviors that may influence their care-seeking and preventive behaviors, which ultimately may affect their health outcomes.[22–24] Studies on the association of acculturation with the general health of immigrants to the United States have suggested that acculturation can be beneficial to some health behaviors and outcomes and detrimental to others.[25] Studies on the association of acculturation with oral health have been limited, but they have yielded similarly contradictory results.[26–29] A recent study conducted among Haitian immigrants showed that acculturation levels were negatively associated with measures of decayed teeth, periodontal disease, and missing teeth, suggesting a positive impact of acculturation.[9]

To our knowledge, there were no published studies comparing the association of immigration and acculturation with oral heath among diverse groups of immigrants, so we examined the association of immigration and acculturation attributes (country of birth, age at immigration, length of stay, preferred language) with multiple clinical indicators of oral health (dental caries and periodontal disease) among immigrants living in New York City. We then compared these associations across the top 7 immigrant groups in New York City (Chinese, Asian Indians, Haitians, Dominicans, Puerto Ricans, other Hispanics, and other Black Caribbeans). We sought to answer the following questions: (1) Does oral disease differ among immigrants according to their country of origin? (2) How does immigrants' length of stay and language preference affect their oral health? (3) Is age at immigration independently associated with immigrants' oral health?

METHODS

We used targeted nonprobability snowball sampling[30] to recruit individuals aged 18 to 65 years who were born outside the United States.

Objectives. We examined associations between immigration and acculturation attributes and oral disease among immigrants.

Methods. We conducted a large cross-sectional study of 1318 immigrants in New York City. We performed comprehensive interviews and oral examinations of the participants and used linear regression models to assess differences in oral disease levels among immigrant subgroups. We also constructed proportional odds models to evaluate the association of oral disease level with length of stay in the United States, age at immigration, and language preference.

Results. After we controlled for most known risk factors, country of birth and age at immigration were associated with variations in oral disease prevalence and need for oral health care. Length of stay was inversely associated with need for treatment of dental caries but not with any other indicator of oral disease. Language preference was not associated with any indicator of oral disease.

Conclusions. Immigrants' country of birth, length of stay in the United States, and age at immigration played important roles in their oral disease prevalence, independently of most known risk factors for oral diseases. Our findings emphasize the need for more studies to elucidate the complex relationships of ethnicity, socioeconomic status, and culturally influenced factors that impact immigrants' oral health. (*Am J Public Health.* 2009;99:S474–S480. doi:10.2105/AJPH.2008.149799)

This type of network sampling allowed us to work within a framework of previously identified community-based organizations that provided access to members of their respective communities. Recruitment was conducted through community-based organizations, churches, and other social and political groups from specific neighborhoods in New York City that were predominantly populated by the immigrant groups we wished to study.

We distributed a self-administered questionnaire that collected information on sociodemographics, access to dental care, utilization of dental care services, oral health practices, self-perceived oral health, self-perceived need for oral health care, immigration status, knowledge regarding oral health, and attitudes regarding oral health. Most items used in the survey instrument were developed specifically for this study. The items assessing oral health practices were modified from those used in the International Collaborative Studies.[31] The survey instrument was translated into Spanish and Haitian Creole and back-translated into English according to standard methodology.[32]

Because of the multiple regional variations of the Chinese language, trained interviewers who were proficient in English and either Cantonese or Mandarin interviewed the Chinese participants. All Asian Indian participants spoke English. Trained bilingual interviewers collected questionnaire data from the few participants who were illiterate (less than 2% of the sample). The original instruments and the translated versions were pilot-tested and validated.

Oral Health Examinations

The recruited community-based organizations (churches, schools, and so on) sponsored on-site health fairs, and a team of trained and calibrated examiners conducted oral health examinations of immigrants during these events. The examiners used a plane glass mirror, a sharp #23 dental explorer, a standard 10 mm periodontal probe, and an artificial light. Calibration exercises were held prior to the onset of the study and on an ongoing basis, with an experienced examiner serving as the "gold standard." Interexaminer reliability was calculated for all the examiners at the tooth-surface level. The intraclass correlation coefficient[33] was more than 0.95 for all examiners for

the dental caries scores. For the periodontal measurements the intraclass correlation coefficients were 0.88 and 0.91 for attachment loss and pocket depth, respectively.

Teeth were not dried or cleaned before examination, and no radiographs were taken. Examiners used National Institute of Dental and Craniofacial Research examination criteria.[34] Caries data were collected on all teeth except third molars to avoid misclassifications if extracted for reasons other than dental caries. Missing teeth were recorded separately. Restorations determined to have been placed as a result of trauma or for aesthetic purposes were not counted as filled. Secondary caries were recorded separately.

For each participant, 2 quadrants (1 maxillary and 1 mandibular) were randomly selected for periodontal examination. To improve estimates of severity, the disto-lingual site was added to the 2 sites included in the National Institute of Dental and Craniofacial Research examination (mesio-buccal and buccal). Pocket depth and attachment level (distance from the cementoenamel junction to the free gingiva level) were recorded at each site, and attachment loss was calculated as pocket depth minus attachment level.

The main outcome variables included 2 sets of clinical indices: 1 set for caries experience, which included decayed, missing, and filled surfaces (DMFS), missing tooth surfaces (MS), and ratio of decayed surfaces to decayed and filled surfaces (DS:DFS); and 1 set for periodontal disease, which included the percentage of sites with periodontal pockets deeper than 4 mm and the percentage of sites with attachment loss of more than 4 mm.

A total of 1669 participants were recruited. Data on caries experience were available for all participants. Periodontal examinations were not conducted for participants who reported certain conditions, according to standard-of-care guidelines. Individuals with missing values for any of the covariate variables of interest were excluded. Consequently, we only included 1318 participants for periodontal experience and 1202 participants for caries experience in all analyses. In addition, a total of 190 participants with a missing value for decayed and filled surfaces were excluded from analyses related to DS:DFS. There were no differences in periodontal and caries experience between

those excluded from the analysis and those included in the analysis.

Statistical Analysis

Descriptive analysis included all 1318 participants with data on caries experienced, allowing us to compare differences in risk factors for oral disease across the 7 subgroups. The main independent variables were country of birth, age at immigration, length of stay, and preferred language.

We used linear regression to evaluate whether there were differences in oral health indices among participants with different countries of birth. We also computed least squares means of oral health indices by country of birth, adjusted for different sets of risk factors. We first adjusted for age and gender, and we constructed a separate model to additionally adjust for established risk factors for oral health, including markers of socioeconomic status (educational attainment, income level), access to dental care (dental insurance), smoking status, diabetic status, oral health practices (frequency of brushing teeth, flossing, and visiting a dentist), knowledge about oral health, and attitudes about oral health. We also adjusted for other attributes of immigration and acculturation (age at immigration, length of stay, and preferred language). These variables have been found to be risk factors for oral diseases, and their distribution may vary among racial/ethnic groups.[35–41]

All independent variables were treated as ordered variables or categorical variables according to the original scale in the questionnaire. The knowledge score was constructed on the basis of answers to 4 questions related to causes and consequences of caries and gum disease. The attitude score was constructed on the basis of answers to 3 questions related to the perceived importance of oral health (Appendix 1, available as a supplement to the online version of the article at http://www.ajph.org).

To evaluate the associations of oral health indices with age at immigration, length of stay, and preferred language, we used a cumulative logistic model to estimate cumulative odds ratios (ORs) for having a higher level of a given dental index versus having a lower level[42] in relation to the independent variables of interest, adjusting for country of birth, age, gender, and all the conventional risk factors in the model in

the previous paragraph. The distributions of the dental indices were skewed, so a simple dichotomization would have lost much of the information about the wide range of scores, which in effect would have introduced measurement error.[43] Thus, to capture more of the dispersion of scores, for each dependent variable we created 3 levels with a similar sample size in each level, on the basis of the distribution of the dependent variable in the overall study population (Appendix 2, available as a supplement to the online version of the article at http://www.ajph.org).

We used the Spearman correlation coefficient to evaluate the potential for collinearity between age and age at immigration and between age and length of stay in the United States. Overall, these covariates were not highly correlated. There was no correlation between years in the United States and age at immigration (Spearman correlation = −0.05). The Spearman correlation between current age and each of the dummy variables that were used to express years in the United States and age at immigration in logistic regression models ranged from −0.16 to 0.55, with 2 correlation estimates greater than 0.40. Score test results indicated that the assumption of proportional odds was not violated for any of the variables examined.

We also tested for trend with length of stay, age at immigration, and preferred language as continuous variables in the model. To test whether the associations of oral health with length of stay, age at immigration, and preferred language differed by country of birth, we performed a likelihood ratio test comparing deviance between nested models with and without the interaction terms representing the cross-product of country of birth and the independent variables of interest. We used SAS version 9.1 (SAS Institute Inc, Cary, NC) to conduct statistical analyses.

RESULTS

The study population included the following subgroups: Chinese (n = 166), Dominicans (n = 164), Haitians (n = 337), Asian Indians (n = 196), Puerto Ricans (n = 173), other Hispanics (n = 121), and other Black Caribbeans (n = 161). Study participants were mostly middle-aged (range: 18–65 years) and of low socioeconomic status as measured by level of income and educational attainment (Table 1). As expected, several demographic

TABLE 1—Demographic Characteristics and Conventional Oral-Health Risk Factors, by Race/Ethnicity: Immigrants Residing in New York City, 1996–2001

	Chinese	Dominican	Haitian	Asian Indian	Other Hispanic[a]	Puerto Rican	Other Black Caribbean[b]
No.	166	164	337	196	173	121	161
Age, y, mean (SD)	44.0 (12.8)	36.2 (11.6)	41.7 (13.2)	41.1 (12.4)	39.0 (12.1)	44.9 (12.9)	40.2 (11.8)
Men, %	62.1	70.7	59.9	51.5	66.5	43.0	64.6
Educational attainment, %							
<12 y	38.6	42.1	46.3	26.5	50.9	46.3	23.0
12 y	21.7	25.6	19.9	17.4	22.5	25.6	16.8
>12 y	39.8	32.3	33.8	56.1	26.6	28.1	60.2
Income level, US $, %							
<20 000	70.5	84.8	81.6	62.2	85.6	81.0	52.2
20 000–39 999	23.5	14.0	13.4	22.5	14.5	18.2	31.1
>39 999	6.0	1.2	5.0	15.3	0.0	0.8	16.8
Current smoking status, % yes	8.4	9.8	5.3	4.1	8.7	35.5	9.3
Self-reported diabetes, % yes	4.2	3.1	7.4	7.1	2.9	5.8	4.4
Dental insurance, % no	89.8	68.9	76.0	84.7	93.6	50.4	65.2
Frequency of visiting a dentist, %							
Once a year	15.7	51.2	21.1	27.0	30.6	40.5	39.8
Every 2 to 3 years or only in emergency	75.3	47.6	56.7	53.6	63.6	57.9	57.8
Never	9.0	1.2	22.3	19.4	5.8	1.7	2.5
Frequency of flossing, %							
Don't floss	65.7	37.8	62.0	64.8	43.9	43.8	34.2
Infrequent	18.1	32.3	17.8	18.4	30.6	26.5	47.2
Daily	16.3	29.9	20.2	16.8	25.4	29.8	18.6
Frequency of brushing teeth, %							
Daily	95.2	96.9	90.5	95.9	91.9	93.4	96.9
Years in the United States, %							
<5 y	32.5	25.0	19.3	47.5	31.8	6.6	16.8
5–9 y	24.1	25.6	25.5	13.3	25.4	4.1	18.6
10–14 y	18.1	13.4	23.7	22.5	21.4	9.9	17.4
>14 y	25.3	36.0	31.5	16.8	21.4	79.3	47.0
Age at immigration, %							
<25 y	21.7	43.6	28.8	27.6	33.5	30.6	37.9
25–34 y	22.9	31.1	30.3	27.0	30.6	26.5	32.3
35–44 y	30.1	18.3	22.6	24.0	25.4	24.8	18.6
>44 y	25.3	6.7	18.4	21.4	10.4	18.2	11.2
Preferred language, %							
Non-English	80.7	74.4	62.6	44.4	80.4	39.7	1.9
Both English and non-English	15.7	13.4	13.1	20.9	12.7	33.1	1.2
English	3.6	12.2	24.3	34.7	6.9	27.3	96.9
Oral-health knowledge score							
Low	15.1	7.3	16.0	18.9	7.5	12.4	9.3
Medium	27.1	26.2	35.6	22.5	34.1	35.5	28.0
High	57.8	66.5	48.4	58.7	58.4	52.1	62.7
Oral-health attitude score							
Low	7.8	5.5	8.3	10.2	5.8	13.2	2.5
Medium	13.9	15.2	19.3	10.7	15.6	16.5	19.9
High	78.3	79.3	72.4	79.1	78.6	70.3	77.6

[a]Other Hispanics were mostly from Central America.
[b]Other Black Caribbeans were mostly from Jamaica and Barbados.

characteristics varied widely across all immigrant groups, such as health insurance coverage, oral hygiene behaviors, acculturation-related factors, and smoking habits.

Age- and gender-adjusted dental-caries status differed by country of birth. Puerto Ricans and other Hispanics exhibited the highest levels of overall dental caries experience (decayed, missing, and filled surfaces),

and Haitians and Asian Indians showed the highest levels of unmet need for oral health care (DS:DFS; Table 2). With regard to periodontal disease, Haitians, Asian Indians, and Puerto Rican participants had higher average levels of mean pocket depth and percentage of pockets with depth greater than 4 mm, and Dominicans exhibited the lowest levels for both indices.

After we adjusted for all the conventional oral-health risk factors measured in this study, significant differences remained in dental caries experience and periodontal pocket depth among all immigrant groups ($P<.05$), but there was no significant difference in average percentage of sites with attachment loss greater than 4 mm. Additional adjustment of acculturation-related variables and immigration attributes did not change the results.

There was a significant ($P<.01$) inverse relationship between length of stay in the United States and DS:DFS (Table 3). The odds of having a higher level of tooth decay were 66% lower for participants who had been in the United States for more than 14 years than it was for those who had been in the United States for fewer than 5 years.

Age at immigration was positively and significantly associated ($P<.05$) with having a high level of dental caries experienced (decayed, missing, and filled surfaces and missing tooth surfaces) and unmet need for dental care (DS:DFS; Table 3). The odds of having a higher level of dental caries, missing teeth, and decayed surfaces was 2.08 to 3.60 times greater for participants who were older than 44 years at immigration than it was for those who were younger than 25 years at immigration.

Age at immigration was positively and significantly associated with a higher severity on the periodontal indices; the trends of ORs were all apparent ($P<.05$; Table 4). There was no association between preferred language spoken with any caries or periodontal indices (Tables 3 and 4).

The associations of length of stay and age at immigration with all the dental caries and periodontal indices did not differ by country of origin (P for interaction >0.05), indicating that the influences of these factors are similar among the subgroups.

DISCUSSION

Our results provide previously unavailable information on the association of immigration and acculturation attributes with the oral health status of the top 7 immigrant groups in New York City. Our findings show the crucial role that immigrants' country of birth plays in their oral health experience.

Comparisons across the 7 subgroups of immigrants showed significant variations in

TABLE 2—Adjusted Means of Oral Health Indexes, by Race/Ethnicity: Immigrants Residing in New York City, 1996–2001

| | | Dental Caries Status | | | | Periodontal Status | |
| | | | | | | % of Pockets | |
	No.	DMFS, Mean	MS, Mean	DS:DFS,[a] Mean	No.	With Depth >4 mm, Mean	% of Sites With Attachment Loss >4 mm, Mean
Overall means	1318	25.9	15.5	0.33	1202	8.20	15.20
Adjusted for age and gender							
Chinese	166	23.41	13.48	0.34	149	9.28	21.14
Dominican	164	39.59	24.84	0.20	148	8.80	17.85
Haitian	337	23.87	17.64	0.58	303	12.86	20.57
Indian	196	23.21	15.97	0.45	182	11.01	19.52
Other Hispanic	173	43.59	26.67	0.23	161	8.80	18.79
Puerto Rican	121	43.97	29.51	0.16	110	10.94	24.18
Black Caribbean	161	36.91	25.48	0.32	149	10.20	18.10
P for group difference		<.01	<.01	<.01		<.01	.10
Adjusted for age, gender, and risk factors[b]							
Chinese	166	24.23	13.06	0.28	149	8.26	19.88
Dominican	164	39.00	24.11	0.20	148	8.39	17.64
Haitian	337	24.94	17.04	0.48	303	11.77	19.00
Indian	196	24.32	16.41	0.41	182	10.58	19.07
Other Hispanic	173	43.84	25.67	0.17	161	7.69	17.58
Puerto Rican	121	42.53	27.57	0.16	110	10.18	22.41
Black Caribbean	161	36.76	25.96	0.35	149	10.51	18.65
P for group difference		<.01	<.01	<.01		.01	.47
Adjusted for age, gender, risk factors, and acculturation factors[c]							
Chinese	166	19.01	8.68	0.31	149	6.98	17.14
Dominican	164	34.45	20.63	0.24	148	7.34	15.39
Haitian	337	19.40	12.99	0.54	303	10.92	16.83
Indian	196	17.80	11.12	0.44	182	9.47	16.15
Other Hispanic	173	38.40	21.29	0.20	161	6.45	14.88
Puerto Rican	121	36.27	23.63	0.27	110	9.47	20.42
Black Caribbean	161	30.25	21.86	0.46	149	10.42	17.21
P for group difference		<.01	<.01	<.01		<.01	.39

Note. DMFS = decayed, missing, and filled surfaces; MS = missing surfaces; DS/DFS = ratio of decayed surfaces to decayed and filled surfaces.
[a]A total of 190 participants with zero degrees of freedom were excluded from analysis related to DS:DFS.
[b]*P* for group differences and means of oral health indices were adjusted for age, gender, educational attainment, income level, status of dental insurance, smoking status, diabetic status, frequency of brushing teeth, frequency of flossing, and frequency of visiting a dentist.
[c]Additional controls for length of stay, age at immigration, and preferred language.

TABLE 3—Association of Dental Caries Status With Acculturation Factors: Immigrants Residing in New York City, 1996–2001

	No.	DMFS, OR (95% CI)	P for Trend	P for Interaction[a]	MS, OR (95% CI)	P for Trend	P for Interaction[a]	DS:DFS,[b] OR (95% CI)	P for Trend	P for Interaction[a]
Years in the United States			.21	.30		.65	.60		<.01	.50
<5 y (Ref)	343	1.00			1.00			1.00		
5–9 y	273	0.93 (0.67, 1.28)			0.92 (0.67, 1.27)			0.64 (0.45, 0.90)		
10–14 y	253	0.90 (0.65, 1.25)			0.93 (0.67, 1.30)			0.66 (0.47, 0.95)		
>14 y	449	1.23 (0.90, 1.68)			0.92 (0.67, 1.27)			0.34 (0.24, 0.48)		
Age at immigration			<.01	.12		<.01	.16		.02	.92
<25 y (Ref)	415	1.00			1.00			1.00		
25–34 y	381	2.15 (1.56, 2.98)			2.71 (1.95, 3.76)			1.29 (0.91, 1.84)		
35–44 y	307	1.96 (1.21, 3.15)			2.96 (1.83, 4.78)			1.80 (1.06, 3.06)		
>44 y	215	2.08 (1.14, 4.79)			3.60 (1.97, 6.59)			2.64 (1.35, 5.13)		
Language most often spoken			.99	.72		.59	.55		.18	.38
Non-English (Ref)	744	1.00			1.00			1.00		
Non-English and English	197	1.06 (0.76, 1.48)			1.06 (0.76, 1.48)			0.61 (0.43, 0.88)		
English	377	0.99 (0.72, 1.36)			0.90 (0.65, 1.24)			0.85 (0.60, 1.21)		

Note. OR = odds ratio; CI = confidence interval; DMFS = decayed, missing, and filled surfaces; MS = missing surfaces; DS:DFS = ratio of decayed surfaces to decayed and filled surfaces. Odds ratios for increasing levels of oral health indices were adjusted for age, gender, educational attainment, income level, status of dental insurance, smoking status, diabetic status, frequency of brushing teeth, frequency of flossing, frequency of visiting a dentist, country of birth, knowledge about oral health, and attitudes about oral health.
[a]For interaction with country of birth. P values were based on the likelihood ratio χ^2 test comparing nested models.
[b]A total of 190 participants with zero degrees of freedom were excluded from analysis related to DS:DFS (32 Chinese, 6 Dominican, 70 Haitian, 53 Indian, 11 other Hispanic, 9 Puerto Rican, and 9 Black).

disease levels and oral health care need by country of origin, even after control for socioeconomic indicators, such as income and education levels, and for a wide variety of known risk factors, including self-reported smoking status and oral health–related systemic conditions such as diabetes.

Interestingly, all Hispanic subgroups and other Black Caribbeans exhibited the highest levels of dental caries experienced (decayed, missing, and filled surfaces) and missing tooth surfaces, whereas the Asian subgroups and Haitians showed the lowest levels of these indices; but the inverse seemed to be the case with regard to treatment need (DS:DFS). In terms of periodontal disease, there was no commonality across the subgroups.

The current discourse on the putative determinants of oral health disparities among racial/ethnic groups and other minority groups in the United States, including immigrants, has generally focused on differences in socioeconomic characteristics such as education and income levels. The results of this study show that in the case of immigrants, acculturation and immigration attributes play an independent—and perhaps even more

important—role in their oral disease experience.

Country of birth largely determines an immigrant's cultural background. Culture has been defined as "the totality of socially transmitted behavior patterns, arts, belief, institutions, and all other products of human work and thought."[44 (p442)] Thus, immigrants bring with them particular behaviors, dietary practices, values, and attitudes that, in conjunction with their exposure to environmental and sociopolitical factors, may influence their oral health. For example, some subgroups may be less prone to oral diseases partly because they come from a culture with a traditional diet high in fiber and low in refined carbohydrates; for other groups, their oral hygiene habits, available dental products, and environmental fluoride may serve as preventive measures. At the societal level, dental caries experience may also be an indication of the overall impact of oral health care systems in the country of origin.[31] In addition, differences in biological characteristics among diverse populations, such as the morphology of teeth and oral microflora, could also account for variations in susceptibility to oral disease among immigrants.

Length of stay in the United States was positively associated with better oral health status as reflected by lower rates of decayed surfaces, possibly indicating that the longer immigrants were in this country, the better they were able to overcome barriers to access to the oral health care system. This effect was similar for all subgroups.

Oral diseases tend to be chronic, lifetime diseases. Dentate individuals are susceptible to dental caries throughout their lifetime, and periodontal diseases are more prevalent and severe in older individuals, probably because of a cumulative progression of lesions.[45] In this study, age at immigration was inversely associated with oral health; the older the participants were when they immigrated to the United States, the worse their oral health experience was, independent of calendar age. Because most of the study participants were immigrants from developing countries, this finding may indicate that the older the participants were at immigration, the less opportunity they had to benefit from preventive strategies or access to oral health care not available in their country of origin.

Surprisingly, one of the most commonly used indicators of acculturation, language

TABLE 4—Association of Periodontal Status With Acculturation Factors: Immigrants Residing in New York City, 1996–2001

	No.	% of Sites With Pocket Depth >4mm, OR (95% CI)	P for Trend	P for Interaction[a]	% of Sites With Attachment Loss >4mm, OR (95% CI)	P for Trend	P for Interaction[a]
Years in the United States			.21	.74		.49	.48
<5 y (Ref)	322	1.00			1.00		
5–9 y	250	0.89 (0.64, 1.22)			0.92 (0.67, 1.28)		
10–14 y	233	0.86 (0.62, 1.19)			0.92 (0.66, 1.28)		
>14 y	397	0.81 (0.59, 1.12)			0.89 (0.64, 1.23)		
Age at immigration			<.01	.29		<.01	.65
<25 y (Ref)	390	1.00			1.00		
25–34 y	353	1.43 (1.03, 1.97)			1.76 (1.27, 2.42)		
35–44 y	273	1.27 (0.79, 2.06)			1.40 (0.86, 2.26)		
>44 y	186	1.78 (1.04, 3.26)			2.08 (1.12, 3.85)		
Language most often spoken			.17	.74		.15	.45
Non-English (Ref)	670	1.00			1.00		
Non-English and English	182	0.90 (0.65, 1.24)			0.97 (0.70, 1.35)		
English	350	0.80 (0.58, 1.11)			0.78 (0.56, 1.08)		

Note. OR = odds ratio; CI = confidence interval. Odds ratios for increasing levels of oral health indices were adjusted for age, gender, educational attainment, income level, status of dental insurance, smoking status, diabetic status, frequency of brushing teeth, frequency of flossing, frequency of visiting a dentist, country of birth, knowledge about oral health, and attitudes about oral health.

[a]For interaction with country of birth. P values were based on the likelihood ratio χ^2 test comparing nested models.

preference, was not associated with any of the oral disease variables measured in our study, including the need for oral health care (DS:DFS). It is possible that for immigrants living in a multicultural environment such as that found in New York City, language barriers constitute less of an obstacle to oral health information and care than culturally influenced behaviors or past environmental and health system experience in their country of birth.

It is important to note that when discussing the association between length of stay and oral health status, the term "better oral health" as used in this context reflects a lower level of treatment need (decayed teeth), not a lower level of dental caries experience or periodontal disease experience. There was no statistically significant difference in dental caries experience (decayed, missing, and filled surfaces and missing tooth surfaces) or periodontal disease associated with length of stay in the United States. In addition, neither dental caries experience (decayed, missing, and filled surfaces and missing tooth surfaces) nor periodontal disease showed a statistically significant association with length of stay in the United States. A previous study conducted among Haitian immigrants in New York City showed similar findings.[46]

Paradoxically, a recent report from the New York City Department of Health found that increased length of stay in the United States seemed to be associated with poorer overall general health status for immigrants.[47] Thus, our findings suggest that for immigrants to the United States, the relationship between length of stay and oral health is somewhat different from the relationship between length of stay and general health.

Our results show that among the top 7 immigrant groups in New York City, country of birth, immigration attributes, and acculturation attributes are more relevant to oral health experience, including need for oral health care, than are most known risk factors for oral disease, including socioeconomic status. An accurate assessment of the determinants of the oral health of immigrants in the United States is crucial to plan effective oral health promotion programs and to eliminate existing disparities in oral health; therefore, our findings could inform the development of oral health policy for immigrants in the United States.

Our study had several limitations. Our sampling methodology prevented us from making definitive generalizations based on our results. The participants were members of community-based organizations that provide services to immigrants, regardless of their immigration or socioeconomic status, so our study population does not reflect the socioeconomic characteristics of immigrants as measured by the US Census Bureau. Furthermore, because the surveys collected self-reported information, the possibility of recall bias exists. It is also possible that the use of interviewers for some participants may have influenced those participants' answers.

Nevertheless, our findings present previously unavailable data on the oral health of a diverse group of immigrants to the United States. Our findings also emphasize the need for more studies (quantitative and qualitative) to elucidate the complex relationships among ethnicity, income, education, biology, and culturally influenced behaviors that influence immigrants' oral health. These studies could shed light on some of the main conundrums we unearthed: When immigrants of similar socioeconomic status hail from various countries of origin, why do they present such a diverse oral disease profile? Do the process of acculturation and its effect on health vary by country of origin? What specific culturally influenced factors are beneficial or detrimental to the oral health of individuals born in diverse countries? ∎

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