

Dental Caries Experience in Northern Manhattan Adolescents

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Abstract

Objective: The study sought to document dental caries among adolescents residing in northern Manhattan, New York, by race, sex, and community. **Methods:** Clinical and demographic data were collected from children aged 12–17 years at five school-based dental clinics in northern Manhattan. Data on dental caries were collected by calibrated examiners using the National Institute of Dental and Craniofacial Research criteria for oral examinations. **Results:** A total of 566 children participated in the study. They were predominantly Hispanic (64%) or African American (28%). Compared to data from the National Health and Nutrition Examination Survey III, mean DMFT (3.36 vs 2.53; $P < .01$) and the prevalence of untreated disease (36% vs 16%; $P < .01$) were significantly higher for northern Manhattan adolescents. Of the adolescents evaluated, 13 percent had at least one severely carious tooth with pulpal involvement that required either extraction or endodontic therapy. **Conclusions:** Adolescents in northern Manhattan have higher caries prevalence and higher levels of untreated caries than their national counterparts. Carious lesions progress to pulpal involvement in a high percentage of northern Manhattan children and require extraction or root canal therapy as treatment. There is an urgent need for affordable and available dental primary care services targeted to economically disadvantaged communities. [*J Public Health Dent* 2003;63(3):189-94]

Key Words: oral health, dental caries, adolescents, school-based dentistry.

Although dental caries is preventable and treatable, it remains a significant public health problem among economically and socially disadvantaged communities in the United States (1,2). In these communities, access to primary care dental services is either unavailable or limited by inadequate insurance covering dental services (3). Across all age and racial or ethnic groups, the poor are more likely to have at least one untreated decayed tooth than nonpoor (1).

Adolescents have the lowest health care utilization of all ages and the greatest risk of inadequate dental care (1). African-American and Hispanic youths are disproportionately affected by decayed and missing teeth, and

bear a greater burden of overall dental disease compared to their white counterparts (4). They are also less likely to have their diseased tooth surfaces treated than white adolescents (1).

National data on adolescent dental caries may not fully capture ethnic and community-related differences because they use samples in which Hispanics tend to be largely Mexican American. Thus, these samples may not be representative for many other Hispanic groups, such as Dominicans or Puerto Ricans, which are more common in the northeast of the United States. We therefore undertook this study to further understand the problem of adolescent dental caries in two different minority communities in

New York City (NYC).

The northern Manhattan communities of Washington Heights/Inwood and Harlem, located north of 110th Street, have different racial/ethnic compositions. Washington Heights/Inwood is predominantly Hispanic (74%), among whom 72 percent are of Dominican origin. Because of the restricted access to health insurance among recent immigrants, it was expected that there would be lower levels of dental care and higher dental caries rates in Washington Heights/Inwood than in Harlem, with its largely African-American population (77%) that is primarily native-born. This study documents the variation in dental caries by ethnicity, sex, and community, and then compares these rates to the national and race-specific rates observed in the Third National Health and Nutrition Examination Survey (NHANES III) to underscore the importance of considering ethnic and community differences in assessing dental service needs.

Methods

Study Setting. Northern Manhattan in NYC with its two distinct communities, Harlem and Washington Heights/Inwood, has an overall population of 427,000, 84 percent of whom are African American or Hispanic. Median income in these communities is among the lowest in NYC, with 32 percent receiving income support (5). Both communities are designated as dental health professional shortage areas by the Department of Health and Human Services' Bureau of Primary Care.

Beginning in 1994, the Columbia

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University School of Dental and Oral Surgery (CUSDOS) and its affiliate, the Harlem Hospital Center Department of Dentistry (HHCDD), collaborated with Columbia University's Mailman School of Public Health (CUSPH), the public schools in northern Manhattan, as well as local school and community boards and other community-based organizations to form the Community DentCare Network, as described by Walter et al. (6) and Formicola et al. (7). After a pilot period in two schools, full dental prevention sites were established in 1997 at five public schools with completely staffed school-based health clinics: Intermediate School (IS) 52, IS 143, and IS 164 in Washington Heights/Inwood, and IS 136 and the School for Pregnant and Parenting Teens (SPPT) in Central Harlem. SPPT serves students predominantly from Harlem; however, some students from Washington Heights/Inwood also attend the school. The IS schools represent grades 6 through 9. Each school was equipped with a fully functional standard dental operator chair and lighting.

Subjects. At the beginning of the 1997-98 school year, all parents/guardians of children were invited to sign consent forms allowing their children to receive services (including dental) at these school-based clinics. Consent forms were received for over 90 percent of all students. Only 12-17-year-olds were eligible, to be comparable with the 12-17-year-old NHANES III sample. We recruited first-time users of dental services dur-

ing the school year 1997-98 ($n=566$). Most children (393) were seen at Washington Heights/Inwood schools, and the balance (178) at schools in central Harlem.

This convenience sample had power of 80 percent to detect a 10 percent difference in caries rates between Washington Heights/Inwood and Harlem, with 95 percent confidence level.

Procedures. Dental services were provided by fully licensed dentists, postdoctoral primary care dental fellows, and dental hygienists (7). Data on dental caries were collected by five calibrated examiners trained by one of the coinvestigators (KPA) using the National Institute of Dental and Craniofacial Research criteria for oral examinations (8). Dental clinical examination procedures were identical to the NHANES III procedures, to allow comparability (9). Interexaminer agreement was 0.7 ($\kappa=0.89$).

Subjects received oral examinations and were offered prophylaxis, fluoride treatment, scaling, placement of pit and fissure sealants, instruction in oral hygiene, and referral for treatment (7). Radiographs were not available. Adolescents requiring immediate referral for treatment received comprehensive clinical examinations and preventive services after their acute conditions had been treated at either a CUSDOS affiliated treatment site, or by the child's own dentist, if he or she had one. Data on race, sex, and age also were recorded. The study received approval from the Columbia-Presbyterian Medical Center Institu-

tional Review Board.

Data Analysis. We analyze tooth-level data to highlight the prevalence of untreated dental disease in this community. We used three caries measures: diseased teeth, proportion of total disease, and caries-free children. The tooth-level assessments of disease were mean number of decayed (DT), filled (FT), and missing (MT) teeth, as well as an overall measure of dental caries (DMFT). We calculated relative distributions of DT, FT, and MT as a proportion of DMFT. Finally, we calculated proportion of caries-free adolescents and proportion of adolescents with seriously carious teeth requiring either extraction or endodontic therapy, defined by visual oral examination as severe caries extending to the pulp or a nonrestorable tooth. We tested for significant differences in the absolute and relative levels of disease by community and sex using two-sample *t*-tests.

We then compared data for northern Manhattan to the national data. National data were obtained from the raw data files of the NHANES III, including dental examination data and demographic data. Sample weights were used in all calculations.

Two-tailed hypothesis tests were conducted and $P < .05$ were considered statistically significant. Z-scores for normal distributed samples were computed for the mean DMFTs, DTs, FTs, and MTs and compared to NHANES III counterparts. Z-scores for binomial distributions were computed for the proportion of decay, missing, and filled and compared to NHANES III

TABLE 1
Study Population by Community DentCare Sites* (Adolescents Aged 12-17 Years, 1997-98)

	Washington Heights/Inwood			Central Harlem		Total N
	IS 143	IS 52	IS 164	IS 136	SPPT	
Number of children	24	196	173	145	33	571
Sex (%)†						
Male	42	49	47	41	0	241
Female	58	51	53	59	100	317
Race (%)†						
Hispanic	87	85	78	28	61	336
African American	4	6	12	69	36	148

*Chi-square test to assess differences in sex and race across schools. Categories may not sum to total due to missing data.

† $P < .01$.

IS=Intermediate school; SPPT=School for Pregnant and Parenting Teens.

data. Z-scores also were used to assess significant differences in disease severity by sex between northern Manhattan and the United States. Data were entered using Microsoft Access (Microsoft Corp., Redmond, WA) and analyzed with SPSS 7.0 software (SPSS Inc., Chicago, IL).

Results

Population Distribution. Students from the three Washington Heights/Inwood schools were predominantly Hispanic (83.3%), whereas those at IS 136 in central Harlem were mostly African-American (76.7%) (Table 1). The School for Pregnant and Parenting Teens (SPPT) in Central Harlem was 61 percent African-American and 36 percent Hispanic.

DMFT Distribution. Disease patterns were analyzed by sex for each district in northern Manhattan (Table 2). The proportion of diseased and missing teeth differed significantly by sex, with different patterns for Washington Heights/Inwood than in Harlem. Male adolescents had significantly more missing teeth, while female adolescents had significantly more diseased teeth. In central Harlem, the female adolescents had significantly more diseased and filled teeth. The mean DMFT differed by sex for Central Harlem, with the female adolescents significantly higher than their male counterparts (4.14 vs 2.76; $P<.05$); but in Washington Heights/Inwood there was a smaller nonsigni-

TABLE 2
Caries Experience by Sex and Community for Northern Manhattan Adolescents Aged 12–17 Years, 1997–98

	Central Harlem		Washington Heights/Inwood	
	Male (N=59)	Female (N=118)	Male (N=181)	Female (N=195)
DMFT	2.76	4.14	3.32	3.19
DT	1.27	1.58†	0.83	0.93†
MT	0.14	0.39	1.25	0.80‡
FT	1.34	2.17†	1.24	1.46
DT/DMFT	0.46	0.42	0.25	0.29*
MT/DMFT	0.05	0.10	0.38	0.25‡
FT/DMFT	0.49	0.52	0.37	0.46

* $P<.05$.

† $P<.10$.

‡ $P<.01$.

ficant difference, with males higher than females.

Table 3 presents the caries prevalence for northern Manhattan and the national population by race/ethnicity. The mean DT, FT, MT, and DMFT for northern Manhattan were significantly higher than comparable NHANES III values. The mean DMFT for African-American children in northern Manhattan was 3.39, compared to 2.36 for the national sample of African Americans ($P<.01$); for Hispanics, it was 3.47 for northern Manhattan adolescents, compared to 2.74 for Hispanics nationally ($P<.01$). Northern Manhattan children had more decayed teeth, more missing teeth, and less treatment (filled teeth)

than each comparable US group. These disparities were even more striking when compared to NHANES III data for white youths aged 12 to 17 years.

Children in northern Manhattan also had lower proportions of treated disease (Table 3). After controlling for race/ethnicity, the northern Manhattan children had FT/DMFT proportions significantly below those found for the comparable national cohort. The FT/DMFT proportion was below 0.50 for both northern Manhattan groups, while it was 0.60 and above for both national groups. Northern Manhattan adolescents also had very high proportions of DMFT comprised of missing teeth (0.11 for African Ameri-

TABLE 3
Caries Experience of Northern Manhattan versus US Adolescents Ages 12 to 17 Years, 1997–98

	All		African American		Hispanic		White NHANES III (N=735)
	NHANES III (N=2,448)	N. Manhattan (N=566)	NHANES III (N=867)	N. Manhattan (N=148)	NHANES III (N=829)	N. Manhattan (N=336)	
DMFT	2.53	3.36*	2.36	3.39*	2.74	3.47*	2.60
DT	0.32	1.08*	0.73	1.45*	0.75	0.96*	0.43
FT	2.16	1.51*	1.52	1.51	1.93	1.54*	2.11
MT	0.05	0.78*	0.11	0.42*	0.06	0.97*	0.06
DT/DMFT	0.16	0.36*	0.31	0.46*	0.27	0.32*	0.13
FT/DMFT	0.85	0.43*	0.64	0.44*	0.70	0.44*	0.81
MT/DMFT	0.02	0.21*	0.05	0.11*	0.03	0.25*	0.03

* $P<.01$.

Because there are no white adolescents in our northern Manhattan study, we present the NHANES III data for whites without comparison to our study population. Unweighted sample sizes are reported for the distribution of NHANES III cases by race/ethnicity. However, weights were used in the calculation of disease values.

TABLE 4
Caries Experience Extremes by Sex, Race, and Community for Northern Manhattan vs US Adolescents, 1997-98

	Caries Free (%)		Northern Manhattan	
	Northern Manhattan	NHANES III	At Least 1 Severely Carious Tooth (%)	Mean Number of Severely Carious Teeth
All	38.0*†	32.7	13.0	1.56
Sex				
Male	45.0*†	33.2	11.0	1.59
Female	31.0	32.2	14.5	1.56
Race				
Hispanic	40.0*	29.8	12.0	1.71
African American	29.0	41.4	18.0*	1.52
Community				
Central Harlem	24.0	NA	19.0*	1.68
Washington Heights*	46.0*	NA	10.0	1.45

* $P < .01$. Row-wise *t*-statistics used to test significance.

† $P < .01$. Column-wise *Z* scores used to assess differences in distributions, northern Manhattan vs NHANES.

Note: Severely carious teeth defined by visual examination as severe caries that extends to the pulp or is nonrestorable and requires extraction or endodontic therapy for treatment.

cans and 0.25 for Hispanics), significantly above comparable national ratios.

In Table 4, the analysis focuses on the two extremes of disease in this population: caries-free adolescents and those with at least one severely carious tooth. The overall proportion of caries-free adolescents in northern Manhattan was 38.0 percent compared to the national estimate of 32.7 percent. Within northern Manhattan, males (45.0%) were more likely than females (31.0%) to be caries free ($P < .01$). More adolescent females than males (14.5% vs 11.0%) had at least one severely carious tooth requiring extraction or endodontic therapy by visual clinical examination. Severely carious teeth were also more likely among African Americans and those living in central Harlem.

Discussion

Untreated dental disease is a serious problem among northern Manhattan adolescents. The mean DMFT for African-American children in northern Manhattan was 3.39, compared to 2.36 for African Americans nationally, while for Hispanics it was 3.47 for northern Manhattan adolescents, compared to 2.74 for the Hispanics nationally. Northern Manhattan adolescents also had more untreated caries, with an FT/DMFT proportion of 0.43, half that found in the national popula-

tion. Thirteen percent of adolescents, including 19 percent of African Americans, had caries so serious that they had pulpal involvement and required extraction or endodontic therapy. This serious burden is evidence of chronic delays in dental care experienced by northern Manhattan adolescent children.

We also demonstrated sex differentials in untreated disease between the two northern Manhattan communities. The African-American females of central Harlem had higher disease levels; however, compared to their male counterparts, they were more likely to have filled teeth. No such differential was observed among the largely Hispanic adolescents of Washington Heights/Inwood. High levels of missing teeth, particularly for males, were a significant problem for Hispanic adolescents in Washington Heights/Inwood. We do not have enough background information on these adolescents to determine the reasons for these sex differentials, but they may be due to sex differences in what children eat and drink, as well as in their home and professional dental care practices. In follow-up studies, we are examining those factors so we can make sex-specific dental care recommendations. At this time, we underscore the importance of tailoring dental services and recommendations for to each community, race, and sex.

The high prevalence of missing teeth and untreated caries suggests that these children had previously experienced markedly inadequate access to recommended oral health promotion or disease-prevention services (10-12). The high levels of untreated disease at such early ages are a matter of great concern. A "severity index" should be developed to capture the extent of untreated disease that has progressed to pulpal involvement similar to the "extent and severity index" developed in periodontics (13). Clearly, such an index would require epidemiologic validation and might be based on the prevalence of untreated carious teeth that require endodontic therapy or extraction through visual clinical examination.

Interestingly, while there was a high level of dental caries in this group of adolescents, there also was a significant number who were caries free. Consistent with dental caries distribution findings in other low-income communities, the high caries levels observed in northern Manhattan adolescents (especially in the Hispanic children in Washington Heights/Inwood) were concentrated in a small proportion of the children.

A major limitation of this study was the absence of more complete health and background information for the subjects, so we cannot fully explain the observed community or sex differen-

tials in oral disease. The selected schools may not equally represent their communities. The schools selected in Washington Heights/Inwood represent three of the five public I.S. schools in that community, and findings are highly representative of all comparable-aged public school adolescents in that community; however, the small number of schools selected in central Harlem and the special nature of the SPPT may make them less representative of that area. Specifically, the pregnant teens at SPPT may not be representative of all young women in the community and the elevated caries levels experienced may be associated with multiple high-risk behaviors. In addition, our study excludes the 17 percent of children 12–17 years of age attending private schools in this community.

The oral health burden of adolescent children of color in urban areas represents an important health care problem warranting exploration of new approaches to the delivery of oral health care services in these communities. We believe that the CUSDOS Community DentCare Network program is a practical approach to addressing the oral health promotion/disease prevention needs of adolescent and other school-aged children in northern Manhattan and in other underserved communities. To achieve the Healthy People 2010 objectives (18) among youths in northern Manhattan and nationally, the findings point to a need for additional school-based oral health promotion/disease prevention programs that emphasize preventive oral health care services to the youngest and neediest individuals. Such programs need to include not only regular oral examinations, but also oral hygiene home care instructions for children, the placement of pit and fissure sealants on teeth, and the application of topical fluorides and fluoride varnishes when indicated. These programs also must provide or make referral arrangements for restorative services for the children, as it is obvious from this study that many of the children will require immediate treatment for their dental needs.

Innovative approaches such as the Community DentCare model are essential to counter the effects of 20 years of policy changes that have reduced our capacity to deliver oral health services outside the traditional, pri-

vate-practice, fee-for-service setting (5). The closing of dental schools reduced the number of clinics offering low-cost care to residents of nearby urban communities and, concomitantly, a significant reduction in the number of dental school graduates who might have been able to establish affordable private practices serving low-income communities. This problem is compounded by reduced overall dental expenditures for dental care by the Maternal Child Health Block grants and a loss of priority for dental programs under federal mandates from legislation passed in the 1960s (14). Inadequate or nonexistent Medicaid reimbursement rates for dental services and primary prevention is also a major problem. Further, these trends are alarming in relation to the recently described findings that oral infection may be a risk factor for certain systemic diseases, such as diabetes, cardiovascular diseases, and preterm, low birthweight babies (15–17). Together with the debilitating effect of acute dental disease in adolescents documented in our study, such long-term sequelae give urgency to the call for resources for adolescent dental care in our most impoverished communities.

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