



Dental caries among disadvantaged 3- to 4-year-old children in northern Manhattan

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Abstract

Purpose: The study was conducted to determine the prevalence of early childhood caries (ECC), untreated caries, and the ratio of posterior to anterior caries in a disadvantaged predominantly Hispanic or African-American urban population. Data are compared to NHANES III to assess the caries burden in our cohort. Comparisons are made to the aggregate and to minorities within the national database.

Methods: A retrospective chart review was conducted for children enrolled in a Head Start or day care program in the communities of Washington-Heights and Central and East Harlem and seen on the community organization's mobile dental van between 1995 and 1997. The study included only children 3 to 4 years of age at the initial examination (n=1605). A single examiner provided all the examinations. The mean number of decayed and filled surfaces (dfs), decayed surfaces (ds) and filled surfaces (fs), the percentage of decayed of total decayed and filled surfaces (%d/dfs), decayed and filled teeth (dft), decayed teeth (dt) and filled teeth (ft), and the percentage of decayed of total decayed and filled teeth (%d/dft) were calculated. Posterior vs anterior d, f, dft, dfs and d-anterior/total d, and d-posterior/total d were tabulated. Northern Manhattan data was tabulated and compared to NHANES III (1988-1994) in the aggregate and for subpopulations categorized by gender and ethnicity. All results are also reported for children with at least one decayed or filled tooth. T-tests were used to assess for significant differences.

Results: There was even representation of males (50%) and females (50%). Mean dft was 1.08 overall, and 3.14 for children with dft>0. The level of untreated decay, %d/dft, was 91%, significantly higher than the US national population which is 76% overall, and 76% for African Americans and Mexican Americans within the US national population.

Conclusions: The children in this population have higher caries prevalence and a higher level of untreated caries than the national means as reported in NHANES III. The high level of untreated decay found in this particularly disadvantaged community suggests that enhanced dental services targeting the very young are needed in these communities. (*Pediatr Dent* 24:229-233, 2002)

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National surveys¹⁻⁴ have established a decline in dental caries of primary teeth of preschoolers above the poverty level. Between 1971 and 1991, the National Health and Nutrition Examination Survey (NHANES) demonstrated a decrease in untreated caries for primary teeth across all age, sex and racial/ethnic groups. The only exception to this trend was children at or below the federal poverty level (FPL), for whom the level of untreated

caries in primary teeth has not changed significantly since 1971.⁵

There are a limited number of studies on the prevalence of preschool dental caries. These studies have found an increased caries prevalence in low-income and/or minority preschool children. Trubman studied 3- to 6-year-old children in Mississippi and found that the mean dfs ranged from 2.33 to 9.99 in his sample.⁶ O'Sullivan reported a high

caries prevalence in Navajo preschool children.⁷ Louie described 3- to 5-year-old Head Start children in fluoridated and non-fluoridated communities in California, Hawaii and Micronesia with dfs scores ranging from 4.8 to 12.17.⁸ Tang reported high caries levels, with much of the decay untreated, in Arizona preschool children.⁹ Watson studied children 2- to 5-year-old children of Central American ethnicity and reported that only 53% of these children were caries free by age 5.¹⁰

To date, there have been few studies that examine the problem of untreated caries among low-income urban populations. In such communities, both poverty, with its impact on ability to afford care, and limited access to dental services are likely to lead to high levels of untreated dental disease among very young children. A study of caries prevalence was therefore conducted among very young children (3 to 4 years of age) in the communities surrounding the Columbia University School of Dental and Oral Surgery (CUSDOS) and serviced by the Children's Aid Society (CAS) and CUSDOS.

Dental caries continues to affect a significant proportion of the pediatric population.¹¹ National surveys demonstrate that 80% of the pediatric population is affected by dental caries by age 17.³ Dental caries is of particular concern for disadvantaged preschool children, particularly children from minority groups and low-income households. The Washington-Heights/Inwood and Harlem communities are identified as Dental Health Manpower Shortage Areas by the Bureau of Shortage Designation of the Health Resources Services Administration (HRSA) of the Department of Health and Human Services.

This article presents caries data in northern Manhattan for children living at less than 100% of FPL in Head Start as specified in the Head Start performance standard for admission into a program. Because of the scarcity of Head Start programs, children who meet the federal eligibility criteria for Head Start programs are placed in day care programs within the community. FPL for a family of four in the 48 contiguous states and the District of Columbia was set at \$16,700 in 1999.¹²

Of particular concern in this study is Early Childhood Caries (ECC). It was hypothesized that children in this community would be at risk for "baby bottle decay," recently redefined as ECC. The definition of ECC was examined at a workshop sponsored by National Institute of Dental and Craniofacial Research (NIDCR), HRSA and Health Care Financing Administration (HCFA) in 1999. The new definition of ECC is the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth present in 3- to 4-year-old children.^{13,14} Caries reported within this study is therefore classified as ECC. A posterior-anterior ratio was calculated to test the hypothesis that anterior teeth would have higher caries rates than posterior teeth, which is consistent with the improper use of the nursing bottle.

Study population

The study was conducted in Northern Manhattan, a community with an estimated population of 500,000 in the year 2000, of whom almost 40,000 were under age 5 (US Census Bureau, 2000). Northern Manhattan has a lower average income than New York City, with an estimated 34% of the population living at or below the federal poverty level as of 1990. Median household income in 1990 was recorded as \$21,800 in Washington Heights and \$16,000 in Central and West Harlem. Half of the population (49%) is Hispanic, 44% is African-American, and the balance represents other ethnic/racial groups (US Census Bureau, 1990). The Washington-Heights/Inwood and Harlem communities were identified as Dental Health Manpower Shortage Areas by the Bureau of Shortage Designation of the Health Resources Services Administration of the Department of Health and Human Services. The CUSDOS and CAS operate a mobile dental van which provides dental exams and treatment directly to 26 Head Start and childcare centers in this community. Children included in the study were enrolled in one of these centers and received free dental services as part of their participation at the center. Because the programs serviced utilize a means test, virtually all of the children are in families at or below the FPL.

Methods

Procedure

The data were collected in a retrospective chart review of examinations completed by a single dentist over an 18-month period from 1995-1997. One research assistant performed the chart reviews to abstract the relevant items. The coronal caries assessments were conducted in the dental operatory of the mobile dental van. The child was examined in a dental chair and their mouth was illuminated by a high-intensity fiber optic lamp (Aseptico). The coronal examination was made with a sharp #23 sickle-shaped explorer and non-magnifying front surface mirror. Compressed air was used to dry the tooth surfaces before examination of each quadrant. One dental assistant collected all data.

Radiographs were used by the dental examiner as an aide in caries diagnosis and utilized for 7% of the children. Only the charts for 3- to 4-year olds were included in this study (n=1605). Data collected included: age, sex, ethnicity, Head Start/day care site, chart number, date of initial visit, number of visits, and decayed, missing or filled surfaces (dmfs) per primary tooth. The reason for the missing primary tooth could not be accurately ascertained and was not utilized in the analysis. For primary teeth, 5 surfaces were examined and recorded as decayed, missing or filled surfaces. Age was calculated as age at first presentation to the mobile van. Race/ethnicity was not collected in a standardized way, so dental health is not reported by race/ethnicity. All children had been 3 to 4 years of age at their initial examination on the

Table 1. Decay Status and Treatment of Teeth* in Northern Manhattan 3- to 4-Year-Old Children by Gender

Gender	% caries free	dt	ft	dft	%d/dft [†]	dt [‡]	ft [‡]	dft [‡]	%d/dft [‡]
Female	68	0.91	0.09	0.99	92%	2.84	0.27	3.11	90%
Male	63 ^{**}	1.08	0.09	1.17	92%	2.92	0.25	3.17	91%
Total	66	0.99	0.09	1.08	92%	2.88	0.26	3.14	91%

*Mean decayed teeth (dt), filled teeth (ft) and decayed and filled teeth (dft)

** $P=0.032$ (significant between gender)

[†]Children with dft >0 only (none of these are significantly different by gender; F statistic used as test for difference in means)

Table 2. Decay Status and Treatment of Surfaces* in Northern Manhattan 3- to 4-Year-Old Children by Gender

Gender	ds	Fs	dfs	%d/dfs	ds ^{**}	Fs ^{**}	dfs ^{**}	%d/dfs ^{**}
Female	1.86	0.17	2.03	92%	5.83	0.55	6.37	90%
Male	2.19	0.18	2.37	92%	5.92	0.49	6.41	91%
Total	2.02	0.18	2.20	92%	5.88	0.52	6.39	91%

*Mean decayed surfaces (ds), filled surfaces (fs) and decayed and filled surfaces (dfs)

**Children with dfs >0 only (none of these are significantly different by gender; F statistic used as test for difference in means)

Table 3. Decay Status and Treatment of Teeth* of 3- to 4-Year-Old Children in Northern Manhattan Compared to US (Total and Minorities[‡])

Tooth status	Northern Manhattan	US-total Value	(t-test)	US-minority Value	(t-test)
dt	0.99	0.71	5.74	1.03	-0.68
ft	0.09	0.23	-11.05	0.32	-17.9
dft	1.08	0.94	2.78	1.35	-5.09
% d/dft	91%	76%	13.23	76%	12.53

Note: $t \geq 1.96$ is significant .05 level or better

*Mean decayed teeth (dt), filled teeth (ft) and decayed and filled teeth (dft)

[‡]U.S. minority represents African Americans and Mexican Americans surveyed in NHANES III (The Third National Health and Nutrition Examination Survey, 1988-1994)

mobile dental van. Children were seen in the van when their caregivers provided permission for their children to receive a dental examination and treatment.

Northern Manhattan data was analyzed and then compared to the third National Health and Nutrition Examination Survey (NHANES III) findings for dental caries in this age group. The comparable national data were obtained from National Center for Health Statistics.¹⁵ This included NHANES III (3- to 4-year olds) in the aggregate, those at or less than 100% of FPL, and for a minority composite that included African Americans and Mexicans. This nationally representative survey uses a multi-stage, stratified probability sample of clusters of people in geographic areas. NHANES III was conducted from October 1988 to October 1994. NHANES III over-sampled children from two months to 5 years of age, African-American and Mexican children, as well as children at or below poverty.¹⁶

Posterior vs anterior decayed teeth, filled teeth, and decayed and filled teeth were calculated in addition to the ratio of d-anterior to total d, and the ratio of d-posterior to total d. Statistical differences between groups in dfs and dft scores were evaluated with the t-test. Differences at the $P < 0.05$ level were considered significant.

Results

Sixty-six percent of children in the study were caries free. Significantly more females were caries free than males (68% vs 63%, $t=2.15$, $P=0.032$; Table 1). There were no significant differences in the numbers of decayed (dt) or filled teeth (ft) by gender, nor in the aggregate measures of decay (dft and %d/dft; Table 1). On average, the study children had 1.08 decayed or filled teeth, while children with dft >0 had 3.14 decayed or filled teeth. Only 1 in 10 diseased teeth were filled. There were no significant differences in surface decay status (ds or fs) by gender. The dfs scores in northern Manhattan were, on average, 2.2 for both genders and 5.88 for children with dfs >0, while the mean %d/dft was 92% (Table 2).

The children of northern Manhattan had significantly more decayed teeth (dt) and fewer filled teeth (ft) than the U.S. total population (Table 3); dft was significantly higher than the dft for the United States total population of 3- to 4-year olds. When compared to the most current national data, the children in northern Manhattan displayed caries rates comparable to the national sub-population of minorities (African-American and Mexican-American). However, compared to these minority children, the northern Manhattan children were significantly less likely to have treated decay (ft), which also contributed to a lower dft. This very low treatment level contributed to the very high percentage of decayed teeth of the total decayed and filled teeth (%d/dft), which was 91%, vs 76% among US minority and 76% among the total US population.

Anterior vs posterior caries

In northern Manhattan, children had significantly more decayed surfaces in their anterior teeth (1.16) compared to their posterior surfaces (0.86) This is also true for 3- to 4-year olds with any decayed or filled teeth, 3.36 compared to 2.17 (Table 4). Filled surfaces were low for anterior (0.33) and posterior surfaces (0.15). A significantly higher amount of filled surfaces are present in the anterior compared to the posterior dentition, while 3- to 4-year olds with any decayed or filled teeth had significantly more posterior filled surfaces than anterior surfaces (0.42 compared to 0.10).

Table 4. Posterior vs. Anterior Decay Status and Treatment of Surfaces* in Northern Manhattan 3- to 4-Year Olds

Surface status	Anterior	Posterior	t-test	Anterior**	Posterior**	t-test**
ds	1.16	0.86	3.94	3.36	2.51	3.97
fs	0.33	0.15	3.77	0.10	0.42	-3.80
dfs	1.19	1.07	2.17	3.46	2.96	2.17

Note: t ≥ 1.96 is significant .05 level or better

*Mean decayed surfaces (ds), filled surfaces (fs) and decayed and filled surfaces (dfs)

**Children with dfs >0 only

Anterior to posterior caries ratios for teeth were compared, contrasting northern Manhattan children with the national group (NHANES III) of children 3 to 4 years old, both all US children and those living in poverty (Table 5). When teeth are the unit of analysis, the Northern Manhattan children have more posterior than anterior teeth with any decayed surfaces. Northern Manhattan 3- to 4-year olds have significantly more decayed and less filled teeth than the comparable national population for all anterior and posterior teeth. The dft scores are significantly lower for northern Manhattan than for the total US group. The northern Manhattan posterior dft is identical to the US posterior dft, but is comprised of more decay and less treated (filled) teeth.

Discussion

The growth in the preschool population, particularly in urban areas, requires a better understanding of dental caries prevalence in these populations.¹⁷ High levels of dental caries in preschool populations are concomitantly associated with low levels of treatment.¹⁸ This study was conducted to provide more information for the planning and implementation of community programs in the inner city communities of northern Manhattan by the Children's Aid Society and the Columbia University DentCare program.¹⁹ Because the Hispanic population of Northern Manhattan is predominantly Dominican, who have been shown to have very different cultural and health behavior patterns than Mexican Americans and are often of mixed African-Dominican ethnicity, it would be inappropriate to contrast the Northern Manhattan group by ethnicity.

Therefore, all contrasts with the US minority population use the combined African-American and Hispanic ethnic groups surveyed in NHANES III. The untreated disease burden is substantially higher in our study population than in the comparable US population of 3- and

4-year-old children. Although the dt for northern Manhattan, and US minority sub-cohort do not differ, the US minority ft value is significantly higher. This highlights the need for care in the northern Manhattan population.²³

The higher level of dt and lower ft in northern Manhattan may be due to the lack of access⁴ to dental health services in this community, which is a designated dental health manpower shortage area. Further, pediatricians are the primary contact for these children and should have a role in diagnosis of dental caries and referral for treatment. A lack of understanding by the medical profession of the caries process may be in part due to the unwillingness of general dental practitioners to treat the preschool age group.

The higher proportion of posterior caries within the dft (0.65/0.43) compared to the dfs (1.07/1.19), indicates that the decay process involves more surfaces on the anterior teeth than the posterior teeth. AAPD guidelines call for bitewing radiographs to be taken when posterior contacts don't allow interproximal visualization. More involved posterior surfaces may have been observed with additional radiographs. Although radiographs were available on the van, they were used only when the examiner requested them as an adjunctive aid (7% of children). The use of an alternative diagnostic tool for this age group would aid in the identification and treatment of caries. Utilizing a diagnostic aid such as digital fiber optic transillumination as a standard for anterior and posterior caries examination could improve posterior primary tooth caries detection.²⁰ The digital fiber optic transillumination system can also be useful in diagnosing incipient lesions before cavitation occurs.

There may be multiple factors involved in the differences observed in caries prevalence between the population of children in northern Manhattan and all children in the US. Possible factors that account for the differences seen between this population and the nation as a whole include: economic factors, education about dental health, cultural views on primary teeth, baby bottle use, and diet as well as attitudes

Table 5. Posterior vs. Anterior Decay Status and Treatment of Teeth* of 3- to 4-Year Old Children in Northern Manhattan Compared to United States (Total and <100% of FPL)**

Tooth status	Northern Manhattan		US population (recorded in NHANES III)					
				Total US		US<100% FPL		
	Anterior	Posterior	t-test	Anterior (t-test)	Posterior (t-test)	Anterior (t-test)	Posterior (t-test)	
dt	0.42	0.57	-5.19	0.33(5.58)	0.45(3.75)	0.47(-1.79)	0.61(-1.11)	
ft	0.01	0.08	-6.09	0.27(-11.63)	0.20(-10.4)	0.06(-18.1)	0.24(-14.1)	
dft	0.43	0.65	-6.98	0.60(-3.84)	0.65(0.06)	0.55(-4.32)	0.84(-5.76)	
%d anterior/dt	43%	—	—	38%(1.05)	—	44%(2.19)	—	

Note: t ≥ 1.96 is significant .05 level or better

*Mean decayed teeth (dt), filled teeth (ft) and decayed and filled teeth (dft)

**FPL (Federal Poverty Level)

toward seeking dental treatment. More information must be gathered about this population to establish what factors play a role in caries prevalence. Caries in the primary dentition increases with increasing age; high caries prevalence at an early age can lead to a lifetime of dental disease and morbidity associated with chronic dental caries.^{21,22} The Healthy People 2010 (Objectives 21-1 and 21-2) call for decreasing the caries experience in the primary teeth and for reducing the proportion of children with untreated caries.

Conclusions

The northern Manhattan survey shows that preschool children are at high risk for dental caries. They exhibit higher levels of untreated caries compared to national averages for the same age group. The high proportion of posterior vs. anterior caries in the northern Manhattan and US population warrants further observation to develop a clearer understanding of ECC. Preventive dentistry and access to care for disadvantaged urban preschool children is critical to thwart a preventable disease process.

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