

## Intergenerational Caries among Mother-Child Pairs following Migration

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### Abstract

**Objectives:** Dental caries experience among immigrants upon migrations often lower than the comparative US-population, but this advantage is quickly reversed. One strong predictor of child caries experience is maternal oral health, a relationship not confirmed among immigrants. This study explored the association between caries experience of immigrant mothers and their children, and caries experience between mothers and children grouped by preferred maternal language.

**Methods:** The study was conducted at a Midwestern urban clinic and compared caries experience of 286 child-mother pairs grouped by preferred maternal language. Data were abstracted from dental and administrative records.

**Results:** No correlation was found between mother-child caries experience. Statistically significant differences were found between Southeast Asian mothers and all other groups (English, Somali, and Spanish), but no differences were found between child groups.

**Conclusions:** Clinicians should note that mother's oral health status may not predict their child's oral health in foreign-born populations.

**Keywords:** Intergenerational caries; Migration; Immigrant; Refugee health

### Introduction

It is well established that dental caries is the single most reported disease among children in the US [1,2]. Caries experience of immigrant children upon migration shows substantial variation to the US average when considering country of origin or parental preferred language [3,4]. Yet within several years post-migration, a common finding is that caries, particularly untreated caries, has increased to surpass the US average by age group(1). Factors associated with this increase include, but are not limited to, adapting a Western diet, lower socioeconomic status (SES), and limited access to care. Several studies also link poor oral status of immigrant mothers to high caries experience in their children [1,5-7]. Indeed, compelling evidence links the caries experience of mothers and their children residing in the same geographic areas [8-11]. While these studies describe the genetic and familial relationships attributed to oral disease, there is a paucity of data available to demonstrate the strength of intergenerational caries relationships when lifestyle and environmental factors are dramatically altered as is often the case with migration due to resettlement. Of available studies comparing the oral health outcomes of immigrant mothers and their children, no studies, to our knowledge, use the same measures of oral health for both mothers and children. Maternal oral health often uses self-reported oral health status or edentulism and child oral health is directly assessed through clinical measures.

The purpose of this study was to use the same clinical measures for both mothers and their children. We sought to answer three questions: 1) What is the correlation of maternal-child caries experience post-migration, 2) What is the difference in caries experience between immigrant mothers post-migration, and 3) What is the difference in caries experience of immigrant children by preferred maternal language? The study was conducted as part of a needs assessment to determine if a targeted intervention was indicated to address children's oral health for specific immigrant and refugee patient groups in an urban health care clinic.

### Methods

The study was conducted at an urban Federally Qualified Health Center (FQHC) with a large immigrant and refugee patient base affiliated with the University of Minnesota-Minneapolis. We used the clinic's electronic dental records to identify children with a dental visit for any reason between the study period of July 1, 2012 and June 30, 2013. Children eligible for study inclusion were less than 18 years of age at the index visit and had a diagnostic dental record for the full dentition. We then checked administrative records to determine if the child's mother was also a clinic patient. If the mother was not a dental patient or if her dental record did not include enough information to determine caries experience, the pair was excluded from the study. Families with more than one child qualifying for study inclusion included only the oldest child following the methods established in previous intergenerational caries studies [8,10].

We identified 1,244 children with dental visits within the one-year study period. Cases were excluded for the following reasons: 927 children had mothered with no a dental record, 17 children had an older sibling were already identified for study inclusion, seven were aged 18 or older, and seven had mothers with incomplete dental records. Two hundred eighty-six mother-child pairs were available for analysis.

Approval to conduct the study was granted by the University of Minnesota Institutional Review Board.

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## Study variables

The dependent variable was dental caries experience recorded by dental staff during clinical visits and abstracted from participants' electronic dental and administrative records. Data were used to calculate the defs (decayed, extracted due to decay, filled surfaces) index for primary teeth, and the DMFS (decayed, missing, filled surfaces) index for permanent teeth following standard methods [12]. We calculated "total caries" for children with mixed dentitions by adding their defs and DMFS scores. Our primary independent variable was mother's caries experience by her primary language. We used mother's primary language as a proxy for foreign birth, i.e. whether mothers were immigrants or refugees. While not ideal, primary language was shown by Maserjian et al. [3] to be more predictive of caries prevalence than country of origin. We abstracted mothers' self-identified preferred language from administrative records. Languages included English, Spanish, Vietnamese, Khmer (Cambodian), Laotian, Hmong, and Somali. An "other" category was created following data abstraction as an aggregate group for languages occurring fewer than five times. Vietnamese, Hmong, Laotian and Khmer (Cambodian) were collapsed into the category described as "Southeast Asian" (SE) due to the small number in each category.

Additional variables were date of the "most recent dental visit" for both mother and child, and number of "years as a patient" calculated by subtracting the date of most recent visit from the date of first dental visit. Were corded "reason for first dental visit" (emergency, regular check-up, other, not recorded), "annual recalls" within each of the last three years including the baseline appointment (yes, no), "dental insurance" at the most recent appointment (yes, no), "sealants" on any of the child's permanent teeth (yes/no/not noted), and any "fluoride treatment" for the child (yes/no/not noted). Additional demographic variables recorded were "age" in years for both the child and mother, "gender" (M/F), and "race" (Black, White, Asian, Pacific Islander, American Indian, Alaskan Native, more than one race, refused to report), and "ethnicity" (Hispanic, non-Hispanic).

A code book was created to guide data abstraction. Three graduate students with varying levels of dental experience were calibrated using 21 records. Seven discrepancies in abstraction were found between abstractors, differences were clarified through discussion, and the code book was modified accordingly to assure clarity. Records were randomly selected throughout the study to assure calibration with an acceptable level of agreement between the abstractor and the principle investigator [13].

## Statistical analysis

Descriptive statistics (means and standard deviations for continuous variables; counts and percentages for categorical variables) were used to describe the study sample. A Pearson's correlation coefficient was calculated to assess the relationship of total caries within the child-mother pairs. Multiple linear regressions was used to see how this relationship changed while controlling for maternal language group, child's age, gender, dental insurance status, fluoride use, sealant presence, and years as a patient. In addition mother's age, dental insurance status, and years as a patient were included. Analysis of variance (ANOVA) and chi-square tests were used to compare child variables between maternal language groups. ANOVA and multiple linear regression models were used to compare caries outcomes between maternal language groups and child age groups. If the overall ANOVA test was significant, pair wise comparisons were made with a

Tukey-Kramer multiple comparison adjustment. The level of statistical significance was set at  $P < 0.05$ . SAS<sup>®</sup>9.3 (SAS Institute, Inc., Cary, NC) was used for the statistical analysis.

## Results

We included 286 children aged 0 through 17 years of age paired with their mothers. Table 1 reports descriptions of children and their mothers in the sample. The majority of mothers indicated that English (45.5%) was their primary language followed by Spanish (29.0%), a Southeast Asian language (16.3%), and Somali (10.1%). Statistically significant differences were found between mother-child pairs as children were more likely to have dental insurance ( $p = .0208$ ), an annual dental visit ( $p = .0017$ ), and a non-emergency first visit ( $p < .0001$ ) compared to their mother. As a group, slightly over half of all children (54.7%) had sealants on at least one permanent tooth and almost all (91.3%) had received a fluoride treatment.

## Correlation between mother and child caries

Pearson's correlation coefficient ( $r$ ) for maternal caries compared to total child caries was  $-0.025$  ( $p = 0.6699$ ) indicating almost no correlation between the two variables. A perfect correlation would be reflected by a correlation coefficient of 1, whereas 0 indicates no correlation [14]. In the multiple linear regression model, the association between mother's caries and child caries (dependent variable) was not significant ( $\beta = 0.001$ ;  $SE = 0.03$ ;  $p = 0.96$ ).

## Mother caries results

Results of ANOVA found statistically significant differences between SE Asian mothers mean caries experience and all other maternal groups. Mean DMFS (SD) by maternal language group was SE Asian=44.1 (31.9), English=22.7 (22.8), Spanish=24.8 (24.0), and Somali (20.3 (14.8)). When adjusting for age, insurance, and years as a patient in a multiple regression model, differences between primary language remained statistically significant ( $P = 0.04$ ), and age was significant ( $P < 0.0001$ ). Southeast Asian language group mothers were older with a mean age (SD) of 42.5 (10.1) compared to Somali (34.6, 9.2), English (34.6, 8.5), and Spanish groups (33.8, 5.5).

## Child caries results

For the overall sample, mean caries experience (SD) for primary teeth (defs) was 6.2 (10.2), for permanent teeth (DMFS) was 2.8 (5.7), and total caries experience (defs + DMFS) was 6.92 (10.0). To determine if there were differences in child age by maternal language that would influence caries experience comparisons between groups, we conducted an analysis of variance (ANOVA) and found no statistically significant differences.

Table 2 presents child caries experience (defs, DMFS, and total caries) and additional variables of interest by maternal language. Only one statistically significant difference was found between groups with children of Spanish-speaking mothers least likely to have dental insurance compared to all others ( $P = 0.001$ ).

## Discussion

Perhaps our most compelling finding was that almost no correlation existed between maternal-child caries experience. Our results differ from several studies reporting a strong relationship between maternal and child dental caries in non-migratory populations [8-11,15,16]. However, comparisons are difficult as there is a paucity

Characteristics	Mothers n=286	Children n=286
Sex, No. (%)		
Female	286 (100.0)	134 (46.9)
Male	---	152 (53.1)
Primary language - Mother, No. (%)		
English	156 (54.5)	---
SE Asian*	18 (6.3)	---
Somali	29 (10.1)	---
Spanish	83 (29.0)	---
Race, No. (%)		
Black	94 (32.9)	99 (34.6)
Asian	35 (12.2)	33 (11.5)
American Indian	19 (6.6)	15 (5.2)
Pacific Islander	3 (1.0)	4 (1.4)
White	119 (41.6)	118 (41.3)
Other	4 (1.4)	1 (0.3)
Refused	12 (4.2)	16 (5.6)
Ethnicity – Hispanic	91 (31.8)	91 (31.8)
Years as a patient, mean (SD)	4.3 ( 5.1)	3.5 (3.3)
Current dental insurance, No. (%)	180 (62.9)	244 (85.3)
Annual appointments, No. (%)	79 (27.6)	133 (46.5)
Reason for 1 <sup>st</sup> appointment, No. (%)		
Emergency	129 (45.1)	40 (14.0)
Regular check-up	141 (49.3)	240 (83.9)
Other	15 (5.2)	5 (1.7)
Not recorded	1 (0.3)	1 (0.3)
Sealants on permanent teeth†, No. (%)	---	151 (54.7)
Fluoride treatment, No. (%)	---	261 (91.3)

\*Hmong, Vietnamese, Laotian, Khmer

†n=276

Table 1: Characteristics of the sample

	Mother's primary language				p-value†
	English	SE Asian	Somali	Spanish	
Child caries experience, mean (SD)					
defs	4.8 (8.3)	8.4 (10.8)	9.1 (13.8)	7.1 (11.2)	p=0.152
DMFS	3.2 (6.9)	2.5 (2.6)	1.6 (2.1)	2.6 (4.2)	p=0.653
Total caries	6.0 (8.9)	7.7 (9.7)	9.6 (13.6)	7.6 (10.5)	p=0.277
Years as patient, mean (SD)	3.4 (3.4)	5.2 (4.1)	3.3 (3.6)	3.4 (2.7)	p=0.165
Insured child,%	89.7	94.4	93.1	72.3	p=0.001
Sealants on 1 + permanent teeth,%	52.3	50.0	75.0	54.2	p=0.212
Topical fluoride,%	88.5	94.4	100.0	92.8	p=0.189
Annual recalls,%	46.2	55.6	44.8	45.8	p=0.885

†From one-way ANOVAs for continuous variables; Chi-square tests for categorical variables.

Table 2: Child variables by mother's primary language

of intergenerational studies on oral health in migratory populations. Those reports available used different measures to assess maternal oral health and that of their children. Previous studies measuring maternal oral health have used self-report through surveys and clinical assessments employing DMF, caries experience, number of missing teeth, and periodontal health [5-7,16]. In addition, maternal risk factors associated with oral health have included oral health behaviors such as brushing and flossing, attitudes, smoking, dental anxiety, and routine dental visits. Child oral health measures are often direct clinical

assessments of caries experience and untreated caries. Therefore, using caries experience for both mothers and their children provide a more accurate comparison compared to previous studies of mother-child oral health among immigrant populations.

Our finding of caries experience between maternal groups was that there was a statistically significant different between mothers indicating a SE Asian language as their preferred language and all other mother groups. No statistically significant differences were found between mothers indicating Somali, English, or Spanish as their preferred language.

Consistency between our results and other published reports of similar immigrant groups are mixed. Similar to our results, mothers indicating Somali as their preferred language had the lowest caries experience. In a large study conducted in Massachusetts, Somali adults migrating to the US within the past 10 years had lower caries experience compared to the US national average [17]. Inconsistent with our findings was a study by Cruz et al. [18] comparing seven New York City immigrant groups. Asian adults had the lowest and Hispanics had the highest caries rates. These results are the reverse of our findings where mothers preferring a SE Asian language had the highest and Spanish-speaking (directly correlated with Hispanic ethnicity in our study) had moderate comparative caries experience. Further, Cruz et al., found no differences between immigrant groups by language preference. Again, we are cautious when comparing our results to other studies as the study designs, sample sizes, immigrant groups compared, time lived in the US, cultural differences and other factors varied or were not considered, and could account for differences in the results.

When comparing child groups by their mother's preferred language, we found no statistically significant differences in caries experience. Consistency between our results and other studies are mixed. Consistent with US reports [1], we found that children of mothers who preferred a language other than English had higher caries rates than children with English-speaking mothers. More difficult to find comparable results are our results with other published reports of specific immigrant groups of children. We found that Somali children had the highest caries rate. Of available studies on caries experience of Somali children, one small Danish study found that 3-year-old Somali children had a higher DMFS compared to Danish children (1.8 vs. 0.3), but 15-year-old Somali children had lower DMFS rate compared to Danes (1.7 vs. 3.3) [19]. While we did not analyze caries experience by age, we found a much higher DMFS among Somali children in our study (9.1), but a comparable DMFS (1.6) compared to Somali children in the Danish study. In contrast, children grouped by SE Asian languages in our study had the lowest caries rate of non-English speaking mother groups. This is inconsistent with a recent study of Thai children reporting that 80.6% of five to six year-old children had caries experience— a proportion nearly double that of US white children [20]. Likewise, Do [21] found that Vietnamese immigrant children had higher caries prevalence compared to Australian children of the same age.

Of clinical relevance and of interest for our needs assessment, we found that despite the high caries experience, Somali children had a greater proportion of sealants and fluoride applications, but fewer annual visits and the highest total caries compared to all other groups. Age, often associated with increasing caries experience, did not appear to be an explanatory factor as Somali children with the highest total caries experience were the youngest group (mean age=7.7, SD 3.7) and Asian children with the lowest caries experience were the oldest (mean age=10.3, SD 5.3). However, all children in our study with mothers preferring a language other than English had children with much higher caries experience in their primary teeth compared to permanent teeth. Because we conducted our study in a clinical setting, these observations could reflect a reduction in caries among children with an established dental home and associated preventive benefits. However, further inquiry is warranted to confirm the associations between these factors.

While our study was small and did not explore causation, one explanation in the disruption of the strong maternal-child oral health relationship could be attributed, at least in part, to migration. One recent study found that among immigrants to Austria, migration

was shown to be more predictive of children's caries experience than parental education, family income or former dental treatment [22]. However, this study looked at children caries only and no associations could be made with their parents' caries experience.

The factors associated with migration are related to social determinants of health shown to be substantial contributors to multiple health outcomes, and have shown to be stronger variables than individual characteristics such as age, sex or race [23]. Acculturation post migration has been shown to effect oral health outcomes and is associated with additional variables such as level of education, income, and health literacy [24-26]. Cruz et al. [18] found a positive effect of acculturation on Haitian immigrants as increasing acculturation levels were negatively associated with dental decay and missing teeth [18]. Geltman et al. [17] found that Somali refugees in Massachusetts had low levels of dental decay upon entering the US but untreated caries increased within five years of immigration for those with low health literacy [17]. We were not able to determine acculturation or years lived in the US for our sample, yet Somali refugees are more recent migrants to the US compared to those from Southeast Asia. Therefore, the effects of acculturation may be more pronounced among SE Asian mothers and may account, in part, for our results.

Our results provide previously unavailable data on intergenerational caries for maternal-child pairs by maternal preferred language. We suggest the importance of social determinants of health on caries development in addition to previously reported hereditary and familial factors. While biological and disease transmission factors are known to predict caries in families, we add to the literature by finding that the factors associated with migration may be stronger predictors of caries than hereditary and familial factors.

Our results served a practical purpose to inform our needs assessment to identify patient sub-groups that may benefit from a targeted clinical or educational intervention. Efforts prioritizing parental education of children with high caries experience employing a dental therapist to provide both education and treatment are in process at our clinic.

## Limitations

This study describes the dental caries experience of mother-child pairs using the mother's preferred language. As the number in some groups was small, we collapsed those mothers indicating Hmong, Vietnamese, Laotian and Cambodian (Khmer) into one group although we acknowledge that cultural differences affecting health outcomes may exist between these groups. While we included clinical topical fluoride application as a factor in our study, we did not assess fluoridated water intake as compared to bottled water, and no information was available on use of fluoride-containing products such as toothpaste or mouth rinse.

Only mothers and their children receiving care at the study clinic were included in the study, and not representative of other potential participants not receiving dental care. Our sample size was small rendering lower statistical power for language subgroups. A larger prospective study would be beneficial to correct for these limitations. We are cautious when making assumptions about comparisons of our study results to other studies conducted in substantially different settings and with heterogeneous variables.

## Conclusion

This is the first study comparing intergenerational caries

experience between immigrant and refugee mothers and children post-migration in the US. Our results are significant in that the previously strong relationship between caries of mothers and children is absent in this study sample. Dental providers should be aware that mother's dental disease experience are generally predictive of their child's dental disease but may not be accurate in migratory populations. A prospective cohort study is needed to further examine the relationship between maternal-child caries and the interplay of factors associated with migration, acculturation and oral health literacy.

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