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Maternal-Child Nutrition and Oral Health in Vietnam: A Longitudinal Study

by
Michelle Ta

THESIS

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of the

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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Abstract

Maternal-Child Nutrition and Oral Health in Vietnam: A Longitudinal Study

Michelle Ta

Objective: This study evaluates the impact of an oral health and nutrition intervention in children aged 2 to 6 years old in Central and South Vietnam. Associations between early childhood caries, child nutritional status, and level of oral health and nutrition education of parents were evaluated longitudinally.

Methods: A total of 593 parent-child pairs were recruited from 5 primary schools in Ho Chi Minh City and Da Nang, Vietnam in 2011. Children ages 2, 3 and 4 from the baseline year in 2011 were used as the comparison group and followed for two consecutive years from 2011 to 2013. The intervention was comprised of oral health and nutrition education, fluoride varnish application, and dental screenings. Parents completed surveys about children's dietary habits, oral health practices, and dental history. Children received annual anthropometric assessment and dental examinations.

Results: There was a high prevalence of dental caries (58.5% – 84.8%) and untreated decay (89.9% – 97.5%) in this population. The number of treated teeth and reported children who own their own toothbrushes and toothpaste increased during the course of the study. The proportion of parents giving their children soda, juice, and chips increased each year. In addition, the prevalence of overweight/obese children increased each study year.

Conclusion: This study showed that preschool-aged children in urban/suburban Vietnam experienced a high prevalence of early childhood caries and overweight status. As children grew older, they consumed higher amounts of sugar sweetened beverages and junk food. The

high proportion of 2-year-olds with tooth decay conveys the need for pre-natal and infant oral health and nutritional education to begin before age 2. Physical exercise should also be promoted in conjunction with a healthier lifestyle. These programs should place emphasis on less consumption of unhealthy foods and accessible dental care for children in order to prevent early childhood caries.

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List of Abbreviations

BAZ = body mass index-for-age z-score

dmfs = decayed, missing, filled surfaces

dmft = decayed, missing, filled teeth

ECC = early childhood caries

HAZ = height-for age z-score

VTP = Vietnam Tooth Project

WAZ = weight-for-age z-score

WHO = World Health Organization

Introduction

Every country in the world is affected by one or more forms of malnutrition¹. Childhood malnutrition is a serious global epidemic and accounts for almost half of the number of deaths among children under 5 years old². These deaths mostly occur in low to middle-income countries². In childhood, growth is considered the most important indicator of health, with malnutrition resulting in stunting, wasting, and undernutrition. Child malnutrition affects children's cognitive and physical development and influences child mortality and morbidity³. The prevalence of overweight and obesity is rising in children five years of age and younger globally. Overweight status is a major contributor to diabetes and other chronic diseases in adulthood². Malnutrition is foreseen to be one of the biggest contributors to the global burden of disease⁴. By focusing on the health and nutritional status of young children, this worldwide concern can be battled in an early and preventive manner.

Vietnam is a developing Southeast Asian country undergoing rapid westernization and economic growth. Since the opening of its markets to foreign investments in the late 1980s, both positive and negative health changes have emerged. Increased food production and dietary intake was seen due to new economic, agriculture, and nutrition strategies⁵. While the traditional Vietnamese diet included abundant fresh fruits and vegetables, the introduction of "modern diets," "fast foods" and carbohydrate-dense snack foods and beverages has substantially changed the Vietnamese diet and practices for feeding their children⁵. Anecdotal reports describe a shift from traditional breastfeeding to bottle-feeding, from agriculture-based foods to processed foods, and from family meals to snacking. These changes in early childhood feeding practices pose a threat to children's oral health and nutrition, as there are confirmed

links between the frequency of consumption of carbohydrate-dense foods and drinks and tooth decay, as well as obesity⁶. Vietnam continues to be ranked among Asian countries as having one of the highest child malnutrition rates⁷. Among children 5 years and younger in Vietnam, iron deficiency anemia and vitamin A deficiency have been observed in 29% and 14% respectively in the mountainous, underserved regions of Vietnam⁸. The changes in Vietnamese children's lifestyles have been seen in recent years in parallel with refined sugar being more readily available⁹.

The energy-dense foods of limited nutritional value including soft drinks and sugary snacks have possible adverse health effects that propagate the problems of undernutrition in children of developing countries⁶. The nutritional deficiencies from recent industrialization have clinically manifested as both underweight and overweight statuses of children. The increase in obesity seen worldwide is mainly driven by changes in the global food system, which is producing more processed, affordable, and effectively marketed food³. According to UNICEF, the number of overweight children under 5 in Asia has increased by 40% since the year 2000. In Vietnam, the number of overweight-, obesity-, and nutritionally-related chronic diseases has increased rapidly. Before the year 1995, there were no reports of this community health problem¹⁰. Vietnam now faces a double-burden of malnutrition with documented undernutrition in rural regions and increasing overweight or obesity in urban areas^{10,11}. Modifiable lifestyle factors and urbanization are independent factors associated with these malnutrition statuses¹¹. Unlike tobacco use and infectious diseases, there are no exemplar populations in which the obesity epidemic has been reversed by public health measures³. This

increases the need and urgency to develop evidence-based policymaking with an emphasis on reducing the driving force on the supply side.

Child undernutrition and infant and young child feeding are multifaceted public health issues that involve many legal policies in Vietnam. It is important to initiate appropriate policy on nutrition and health to improve the diet and lifestyle of the Vietnamese population to prevent and control the country's double-burden of malnutrition¹⁰. In 2010, an amendment was made to the Law on Advertising that bans advertisements for breast milk substitutes¹². Although studies and child nutrition initiatives have been implemented globally to start the battle to fight the international disparity, there has been limited exploration of the role of tooth decay—which is the most prevalent chronic disease worldwide, currently affecting 50-95% of young children in developing countries¹³.

Early childhood caries (ECC) is highly prevalent on a global scale, yet is infrequently treated¹⁴. ECC is defined as the presence of one or more decayed, missing, or filled tooth surface in any primary teeth in a child less than six years old¹⁵. In addition to increasing the risk of new decay on primary and permanent teeth, consequences of ECC include increased number of hospitalizations and emergency department visits, high treatment costs, more absent days from school, decreased ability to learn and focus in school, and lower oral health-related quality of life^{15,16}. The societal costs and impact on the quality of life on pre-school children are tremendously high. Severe untreated dental caries is common in pre-school aged children. Following the treatment of ECC, rapid weight gain and growth velocity is seen in the treated children. This results in a significant change in the psychological and social aspects of the child's life¹⁷.

The latest National Oral Health Survey of Vietnam conducted in 1999 found that 71% of children aged 6-11 years had dental caries with an average number of 8 decayed teeth per child¹⁸. Earlier studies on risk factors for childhood caries in Vietnam found that only 7% of the population was exposed to adequate fluoride levels from drinking water to obtain dental benefit and 91% of children did not know how to brush their teeth properly¹⁸. The persistence of high rates of early childhood caries over the past decade demonstrates that Vietnam faces a very challenging disease that would require substantial behavior change in both nutrition and oral hygiene for children and families and innovative strategies to address it.

Developing countries do not have sufficient financial resources to treat dental decay with traditional restorative dentistry¹⁹. Vietnam as a nation has limited dental resources that cannot meet the needs of its population⁹. The latest National Oral Health Survey of Vietnam reported that only 40% of children under 5 years old had started to brush their teeth and only 30% of this population used toothpaste. The survey showed the proportion of untreated decayed teeth over number of diseased teeth was almost 90% in the Vietnamese pediatric population¹⁸. This indicates the limited treatment available for dental care in the developing country.

The rapid westernization and development seen in Vietnam predisposes the country's younger generations to unhealthy dietary and oral health practices. These trends have been documented as paralleling an increased availability of processed foods that strays far from traditional diets and strains the country's limited dental resources²⁰. Literature shows that higher numbers of dmft are significantly associated with urban residency and geographical location. The primary caries status was significantly higher living in a rural location with lower

levels of fluoride in drinking water. The highest dmfs was seen among children living in the Mekong River Delta²¹. In another study, the Central Highlands located in southern Vietnam was shown to be one of the rural areas where the poverty rate has remained around 52%²². Dental care for the poor and ethnic minorities in this area is not easily accessed because Vietnam's dental care is mainly available in urban areas and is cure-oriented, instead of prevention based²². Less effort is made towards preventative or restorative dental services due to lack of dental professionals and limited capacity of equipment and supplies. Children aged 6 years in Vietnam had four times the dmfs primary teeth score as compared with the United Kingdom or Australia⁹.

The World Health Organization has established the Global Oral Goals by 2020 that work to increase the oral health capacity in lower income countries. Currently, only 10% of funding for research in global health is used to support health problems that afflict 90% of the world's population²³. Studies conducted in Ecuador, Nepal, and Vietnam have begun to explore the link between global nutrition trends and oral health in developing countries²⁴⁻²⁸. Using a three-year oral health and nutrition intervention, these studies have included oral health education, dental screenings, and fluoride varnish application for children. In addition to oral health education, parents also were involved in nutritional health workshops to include breastfeeding and food consumption sessions. Community health workers and local teachers were recruited in order to facilitate with the oral health and nutrition intervention and to provide the children and parents with continued support. In order to make further changes in public health policy, additional research needs to be completed in order to prove that the changes in the cultural practices of feeding children in Vietnam—shifts from traditional breastfeeding to bottle-

feeding, from agriculture-based foods to processed foods, and from family meals to snacking—are associated with increasing rates of early childhood caries and nutritional problems, including malnutrition and obesity.

Several mechanisms exist by which tooth decay and malnutrition may be connected. What children eat—particularly, sugary snacks and soda—can lead to both tooth decay and nutrition problems. In the developed world, snacks and soda typically provide extra calories in addition to the child’s usual nutrition, leading to obesity²⁹. In developing countries, snacks and soda can depress children’s appetite and replace nutritious food, which could lead to malnutrition. Once a child has tooth decay, it could lead to malnutrition by loss of tooth structures leading to inability to chew food and eat. Malnutrition could also be caused by mouth pain leading to decreased appetite, oral inflammation, abscessed teeth, chronic infection, and generalized failure to thrive. By studying the epidemiological connections between early childhood caries and nutritional status, public health outcomes can potentially benefit millions of children globally.

This project expanded upon the previous baseline analysis completed on a three-year oral health and nutrition intervention in urban and sub-urban sites in Vietnam from 2011 to 2013²⁶⁻²⁸. The aim of this study was to evaluate the impact of the intervention based on child and parent dental caries experience, oral health nutrition knowledge and practices, and child nutritional outcomes of the study population over the three-year (baseline and two-year follow-up) observational period.

Methods

Study design

This study was a quasi-experimental evaluation of a three-year oral health and nutrition intervention, named the Vietnam Tooth Project (VTP), in Ho Chi Minh City and Da Nang, Vietnam from years 2011 – 2013. The VTP intervention was adapted from a family of studies conducted in five countries throughout Latin America and Asia. Qualitative and quantitative evaluation of changes over time of parent-child pairs participating in the intervention was conducted from baseline year (2011) with two-year (2012, 2013) longitudinal follow-up.

Study protocol and instruments approvals were obtained from the institutional review board of University of California, Berkeley Committee for Protection of Human Subjects (#2011-04-3176) with reliance on this IRB by the Vietnam partner organizations. After receiving parental consent, identification numbers were assigned to participating parent-child pairs at baseline and used to track the longitudinal cohort for follow-up over next two years.

Study population

Partnerships with University of Medicine and Pharmacy, Ho Chi Minh City and the East Meets West Foundation, a non-governmental organization in Da Nang, allowed for patient recruitment from five urban/suburban preschools. Three schools were located in Ho Chi Minh City (southern Vietnam) and two schools were located in Da Nang (central Vietnam). Data were collected on a convenience sample of children ages 6 months to 6 years of age. Each family could only enroll 1 child to form a parent-child pair, thus siblings were excluded. However, all children who attended were given the intervention, despite enrollment status into the study.

Figure 1 illustrates that 593 children enrolled at baseline in 2011, 333 children in 2012, and 151 children in 2013. A historical control was used from baseline year (2011) to include children 2, 3, and 4-years-old for comparison. The 1-year follow-up (2012) included the enrolled children from baseline year now ages 3, 4, and 5. The 2-year follow-up (2013) continued to follow the enrolled children from baseline year now ages 4, 5, and 6. The longitudinal sub-sample included 385 children at baseline in 2011, 320 children in 2012, and 139 children in 2013. Based on longitudinal sub-sample between baseline year and 1-year follow-up, 65 children were either lost to follow-up, graduated from the pre-school, or grew out of specified age groups. Between year 2012 and 2013, 181 children were lost to follow-up or graduated from age group (Figure 1).

Intervention

Each year during the summer, the pre-school children received oral health and nutrition education through interactive activities carried out by school and health personnel, college students, and other volunteers. They were also given toothbrushes and toothpaste for the family as well as tooth brushing instructions. Fluoride varnish application, dental screenings by dentists, and referrals for treatment were completed twice annually. Each summer, parents participated in nutritional health workshops including breastfeeding and food consumption sessions. School teachers and health personnel also participated in oral health and nutritional workshops conducted by community health workers and the Vietnam Tooth Project USA team. All educational activities and workshops were conducted in Vietnamese.

Data collection

Baseline and annual follow-up data included a parental written survey, child dental screening examination, and child anthropometric measurement after parent's written consent and child assent was obtained.

The parental written survey (Appendix 1) was a 50-question survey comprised of multiple choice and open-ended questions given to the primary caregiver (predominantly mothers). The questions covered family/child demographics and nutrition/oral health knowledge, practices, and experiences. This included questions on breastfeeding, bottle-feeding, medical/dental care utilization, and parent's perception on child's dental and overall health. The survey was adapted from the WHO Oral Health Survey for cultural/language appropriateness and low-literacy populations. The instrument of all survey questions was not validated but the mouth pain questions were similar to items on validated scales³⁰. A packet consisting of the survey and informed consent document was given prior to the intervention by onsite coordinators (mainly school principals) who explained the study to parents. The materials were translated from English to Vietnamese, and back translated to Vietnamese for accuracy. The packet was collected on the day of the intervention and only children from families that supplied the packet were included in the data collection portion of the study.

Child dental screening examinations were completed by licensed Vietnamese and US dental professionals. Dental examiners were calibrated by local university dental trainers according to WHO standards³¹. Visual inspection was completed with the use of dental mirror with headlight or natural lighting. The dental exam included the status of each primary or permanent tooth to include healthy, unerupted, and decayed, missing, and filled teeth

according to WHO standards³². Children who required treatment were referred to local dentists by the dental examiner.

The child height and weight measurements were conducted by trained teachers and volunteers using a stadiometer (Seca, Chino, CA) and professional grade scale. These measurements were recorded to the nearest 1 centimeter and 0.1 kilogram, respectively. All measurements were taken without shoes while child wore lightweight clothing. These values were later coded by WHO software to z-scores outlined by WHO criteria to assess child nutritional status.

Data analysis

Data were entered into an Excel spreadsheet (Microsoft, Redmond, WA) with three annual datasets from years 2011, 2012, and 2013. A family ID was used to link parent-child pairs between years and yield a longitudinal cohort data set that was imported into SPSS Statistics (IBM, Armonk, New York).

For nutritional and growth status data, child's height, weight, gender, and age were used to calculate standardized anthropometric z-scores according to WHO standards using WHO Anthro and WHO AnthroPlus software for children under 5 years and older than 5 years respectively³¹. Z-scores < -2 for height-for age (HAZ) and weight-for-age (WAZ) indicated stunting and underweight status respectively. Z-scores > 2 for body mass index-for-age (BAZ) indicated overweight status.

For evaluation of children's dental caries experience, caries increment scores were used in addition to dmft scores. "Caries increment" is defined as the number of new carious lesions

per year and categorized into tertiles of low (0 – 2 dmft/year), medium (3 – 5 dmft/year) and high (≥ 6 dmft/year) caries increment²⁴.

Data analysis was completed using Microsoft Excel and SPSS for descriptive statistics and statistical associations. Descriptive statistics, including frequency, mean, and standard deviation, were run for each category when appropriate to determine proportions for the selected group per year. Statistical procedures were run as indicated by numerical or categorical data to evaluate bivariate relationships (e.g., chi-square test, paired or unpaired t-test, 2-sample proportion test) between comparisons of baseline year with either year 1 follow-up or year 2 follow-up. Results from individual comparisons with p-value less than 0.05 were considered to be statistically significant.

Results

Child and Parent demographics

The study sample includes 385 parent-child pairs in baseline year (year 1), 320 in first year follow-up (year 2) and 139 in second year follow-up (year 3). The children in year 1 served as the comparison group for the study and were followed for two years. In the baseline year, the prevalence of 2-year-olds, 3-year-olds, and 4-year-olds were 16.9%, 52.3%, and 30.7% respectively. In year 1 follow-up, the prevalence of 3-year-olds, 4-year-olds, and 5-year-olds were 22.2%, 53.1% and 24.7% respectively. In year 2 follow-up, the prevalence of 4-year-olds, 5-year-olds, and 6-year-olds were 24.8%, 52.6%, and 22.6% respectively.

The average age of the parent answering the survey was 32.5, 34.5, and 36.0 years old throughout the 3-year course of study. The average number of years of formal education

ranged from 13.2 – 14.0 years. The majority of parents responding in survey were mothers, with prevalence decreasing each year from 95.2%, 70.9%, and 68.2%. The average number of children in families was 1.7 across all years (Table 1).

Dental caries experience

The percentage of children having any tooth with decay during baseline year was 58.5%, 64.7% and 78.0% and average dmft was 2.7, 4.5, and 6.4 for 2-year-olds, 3-year-olds, and 4-year-olds respectively. In year 2, the percentage of children having any tooth with decay was 71.8%, 81.8%, and 84.8% and average dmft was 5.2, 6.9, and 6.6 for 3-year-olds, 4-year-olds, and 5-year-olds respectively. In year 3, the percentage of children having any tooth with decay was 70.6%, 72.2%, and 64.5% and average dmft was 4.6, 5.8, and 5.2 for 4-year-olds, 5-year-olds, and 6-year-olds respectively. The average number of decayed teeth per year was 4.7, 6.2, and 4.8 from 2011 to 2013. The number of untreated teeth was calculated by the proportion of decayed teeth in the dmft index. The prevalence of untreated teeth decreased each year from 97.8%, 96.0%, to 89.9%. The number of treated teeth was calculated as the proportion of missing and filled teeth in the dmft index. The prevalence of treated teeth increased each year from 2.2%, 4.0%, to 10.1%. Both changes in prevalence of untreated and treated teeth were statistically significant with p value < 0.05 (Table 2).

Caries increment is a measurement used to evaluate the level of caries each year and is divided into three categories of low, medium, and high. Table 3 followed the same set of children grouped by age from baseline year to year two follow-up. For example, children aged 2 in baseline year were age 4 at end of study. In this group, 55.6%, 29.6%, and 14.8% were the

prevalence of low, medium, and high caries increment respectively. For children who enrolled at age 3, the low, medium, and high caries increment was 77.0%, 11.5%, and 11.5% respectively after 2 years. For children who enrolled at age 4, the low, medium, and high caries increment was 76.7%, 10.0%, and 13.3% respectively after 2 years (Table 3).

Childhood caries experience (having any number of tooth decay) could be visualized by age to see number of children having any decay in a cross-sectional view. In year 1, prevalence of tooth decay increased with age group from 58%, 65% to 78% in 2, 3, and 4-year-olds respectively. In year 2, percentage of having any tooth decay also increased from 72%, 82%, to 85% in 3, 4, and 5-year-olds respectively. There was a decrease in prevalence of decay in year 3 from 71%, 72%, to 65% in 4, 5, and 6-year-olds respectively (Figure 2).

Parents' perception of their child's mouth pain changed over the 3-year study. Frequency of child complaining about tooth or mouth pain decreased in "never" responses from 60.5%, 49.0%, to 35.6%, while "occasionally" responses increased from 36.0%, 49.7% to 61.4% from 2011 to 2013 respectively. Similarly, frequency of child having problems eating and problems sleeping due to mouth pain had decreased "never" responses (66.9%, 58.6%, to 38.6% and 83.9%, 76.6%, to 60.3% respectively), and increased "occasionally" responses (30.0%, 39.4%, to 56.8% and 15.0%, 23.1%, to 38.9% respectively) (Table 4).

Parent's oral health experience was summarized in Table 5. The time in months elapsed since last dental visit decreased over each year from 8.6, 5.2, to 4.7 months. Tooth pain, bleeding gums, extraction of teeth, and going to dentist with child were all responses that saw increasing frequency each year, with bleeding gums and going to dentist with child as statistically significant differences between baseline and second year follow-up. Decayed tooth

and for check-up responses decreased each year of study, with decayed tooth showing statistically significant differences between baseline year and both follow-up years. Parent's answers in response to having any teeth, gums, or mouth problems showed consistent percentages across all years, with pain/sensitivity and mouth inflammation as the two highest responses (Table 5).

Nutrition and Oral Health Knowledge and Practices

An overall increase in children's weekly consumption of soda and sweets was seen during the study period (27.1%, 44.0%, to 45.9% for soda and 42.5%, 54.7%, to 51.5% for sweets consumption) and was statistically significant with p value < 0.05 . Children's daily consumption of junk food also increased during the study from 12.2% to 29.6% (Table 6).

The majority of families (72% – 83%) were able to walk to the nearest convenience store in 5 minutes or less. Convenience stores were specified in the survey as the nearest location to purchase junk food items including chips, candy, and soda. The percentage ranged from 15% – 27% of families being able to walk to the nearest convenience store in 6 to 20 minutes. Only 1-2% of families had to walk more than 20 minutes to purchase chips, candy, or soda from a local store (Figure 3).

Almost all children enrolled in the study were breastfed (92.0% – 96.3%) and averaged between 12.8 – 14.2 months in duration. The majority of children (71.3% – 85.9%) received milk through the baby bottle. The average number of months which children were bottle-fed milk decreased from 26.5 to 18.7 months. There was a slight increase from 16.0%, 20.1%, to 29.0% in children "occasionally" falling asleep with a baby bottle while "never" responses increased

from year 1 to year 2 and dropped again during final year (59.5%, 75.4%, to 60.7%). Formula remained the highest reported liquid that mothers put in the bottle and saw a small decrease each year from 52.9%, 46.8%, to 44.7%, while water continued to be the second most popular liquid and increased each year from 23.4%, 24.0%, to 32.7% (Table 7).

Giving their child sweets and not brushing their teeth were the most reported answers to the open-ended question asking what causes childhood decay, with frequencies of 33.8% – 43.4% and 34.9% – 41.1% respectively. Virtually all parents believed that cavities cause problems for children. Parents were also asked to elaborate in a second open-ended question of why cavities cause problems for children. The highest responses included problems eating, harming child’s overall health, and pain. These responses ranged from 17.5% to 25.8% prevalence and remained consistent throughout the study (Table 8).

The most common response for how parents took care of their child’s teeth was to brush their teeth with an average of 75% response rate. During the baseline year of the intervention, 5 children did not own their toothbrush and 19 children did not have toothpaste at home. The next follow-up year, 100% of children had their own toothbrush and had toothpaste in the house. Study results showed that there was a slight decline in parents “frequently” (64.5%, 61.7%, to 52.6%) and “almost always” (19.0%, 16.0%, to 9.0%) helping their child brush their teeth, as their child grew older each year (Table 9).

The number of children who were reported to have visited the dentist increased significantly from 39.0%, 52.2%, to 75.4% from years 2011 – 2013 respectively. The number of visits also increased from averages of 1.8, 3.2, to 3.7 and was statistically significant compared

to baseline year. “Check up” had the highest response rate (33.5% – 42.6%) for reason of dental visit (Table 10).

Child Nutritional Status

The third aim of the study was to evaluate the impact of the intervention on nutritional outcomes, specifically stunting, underweight, and overweight. The prevalence of stunting stayed low and decreased every year from 7.7%, 3.5%, to 1.4% in 3 year olds who had enrolled in 2011. The percentage of underweight children was also low with the highest frequency seen in 3 year-olds during baseline year (4.1%) and the same set of children in 2011 at 5 year-olds (2.8%). The highest percentage of malnutrition statuses was seen in overweight children. In year 1 of the study, the prevalence of overweight children ranged from 13.8% to 26.3%. In year 3 of the study, the percentage of overweight children ranged from 22.6% to 32.4%. Overall, the prevalence of overweight children increased in each age group throughout the duration of the study (Table 11).

Analyzing only the subset of children with malnutrition statuses (stunted, underweight, or overweight), all statuses each year had over 60% of children having any tooth decay, with the exception of one group. The group that did not was stunted children in year 3, as only one child was reported as “stunted”. The average dmft was higher for stunted and underweight children (ranging from 7.1 to 11.5) as compared to overweight children (6.4 – 6.5) for each year (Table 12).

Parents were asked about their perceptions of their child’s oral health and overall health. From baseline year to second follow-up year, the percentages across all categories

stayed relatively consistent from 34.3% – 35.1% for “excellent”, 50.0% – 53.7% for “fair”, and 11.9% – 15.1% for “poor” oral health rating. When asked about their child’s overall health, an increased prevalence was seen in “excellent” responses from 48.0% to 57.5% that caused “fair” responses to drop from 50.4% to 42.5% from Year 1 to Year 3 respectively (Table 13).

Discussion

Dental caries experience

This population of urban/suburban children from Central and South Vietnam experienced a high prevalence of tooth decay from Year 1 through Year 3 of the study. The prevalence of having any dental caries increased for all ages from baseline year to first year follow-up. Between Year 2 and Year 3 of the study, prevalence of tooth decay dropped. Similarly, the mean dmft initially increased and then decreased between the follow-up years. This trend and high caries prevalence were also seen in other studies conducted on Vietnamese school-aged children³³. Caries prevalence and mean dmft increases were higher at a younger age and gradually developed in older pre-school children. In addition, the “low” category of caries increment (having 0 to 2 new cavities a year) was higher for 3 and 4-year-olds compared to 2-year-olds, which saw higher “medium” caries increment scores (3 to 5 cavities). These data suggest that younger toddlers may develop cavities more rapidly than kindergarten-age children and reinforces the need for pre-natal and infant oral health care and education to begin before age 2. The drop in mean dmft during follow-up years could also indicate the protective factors of biannual fluoride varnish applications and increased oral health education and tooth brushing conducted at the pre-school for children as seen in previous studies³⁴.

Nutrition and Oral Health Knowledge and Practices

Although nutrition and oral health workshops were conducted with parents annually, the study's results did not show that parent's knowledge and practices improved due to the intervention. Most parents were knowledgeable that not brushing their children's teeth and eating sweets led to cavities. However, less than 4% of parents answered each year that juice and soda consumption as well as prolonged bottle feeding can cause dental caries. The frequency of parents giving their children soda, candy, and junk food all increased throughout duration of the intervention. Although not specified in the child surveys, the workshops conducted with mothers showed that purchasing sugar-added milk or soymilk and adding sugar to milk are common daily practices in Vietnam. This study saw that the majority of children were bottle-fed and the number of months ranged from 18.7 to 26.5. The American Academy of Pediatric Dentistry recommends that baby bottle use stop after 12-18 months and states that frequent nighttime bottle-feeding with milk is associated with early childhood caries¹⁵. The prolonged duration of bottle-feeding and likelihood of putting sweetened milk in the bottles are all risk factors for early childhood caries in this population. Studies have shown that there has been a sharp incline of sugar-sweetened beverages consumed by children in recent years in developing Asian countries like Vietnam and that the increased marketing of processed junk food is targeted to children³⁵. The accessibility and low costs of sugar-sweetened beverages and junk food are possible factors of the trends in consumption seen during the intervention. More than 60 countries globally have placed restrictions on marketing junk food to children and have regulations on the food and beverage advertising to children³⁶. Additional policies that limit marketing of unhealthy food items and beverages to children and further research to

evaluate impact of policies on children’s health need to be conducted to encourage better feeding practices worldwide.

The percent of children reported to have their own toothbrush and toothpaste increased to virtually 100% during the course of the intervention. The number of dental visits also increased each year and the proportion of visits being for check-ups remained high. Although a majority of tooth decay remained untreated, statistically significant increases in the number of decayed teeth that were treated were seen in parallel with significant decreases in the number of untreated teeth for children enrolled in the study. Most parents reported they help their children brush their teeth, but the proportion of parents helping “frequently” or “almost always” decreased by year. This decline could have resulted from parents assuming that the children were being supervised during their brushing at school and taught proper techniques at school. Future school-based interventions should emphasize the importance of parent-facilitated tooth brushing and referring active caries to local dentists. The World Health Organization published an implementation manual in 2019 outlining the framework for integrating early childhood caries prevention and control in public health initiatives³⁷. The manual recommends targeting pregnant women, new mothers, and primary care teams for oral health programs to educate about breastfeeding and added sugars to children’s diet. In addition, the manual advocates for population-directed and individual fluoride administration for prevention and control of early childhood caries.

Child Nutritional Status

This population of Vietnamese children saw low prevalence of underweight (4.1% to 2.8%) and stunting (7.7% to 1.4%) that continued to decrease over the intervention, showing similar results to other studies in Vietnam³⁸. Children who were stunted or underweight had higher prevalence and dmft compared to overweight children. These data suggest that these malnourished children experienced decreased appetite or inability to eat likely due to dental caries. The proportion of children who were overweight or obese continued to increase each year with frequencies of 22.6% to 32.4% in Year 3. This prevalence matched other studies that saw an increasing number of overweight and obese children as they were followed for longer periods and higher numbers in urban areas^{38,39}. Mothers were about 8-times more likely to rate their child's oral health as "poor" compared to their child's overall health. This finding underscores the fact that early childhood caries and mouth pain are among the greatest causes of poor health and quality life for Vietnamese children.

The percentage of mothers completing the survey each year also decreased, which could be explained by more Vietnamese mothers joining the workforce. This made it more difficult to have consistent contact with same caregiver over extended periods of time. A recent study conducted in Vietnam that evaluated women's employment and the health effects on children under 5 years saw that maternal full-time employment was positively associated with overweight children. This study suggested an association between working mothers and children's higher consumption of unhealthy foods in addition to increased sedentary behavior⁴⁰. Future school-based interventions should take additional measures to involve all family caregivers and children within the family. Additional emphasis should be placed on

frequency and amount of sugar-sweetened drinks and junk food. A healthier lifestyle should be promoted in conjunction with physical exercise.

Strengths and limitations

A limitation of the study was that the convenience sample of urban/sub-urban children from Central and South Vietnam may not be representative of children from other regions and in rural areas. The intervention included a written survey to be completed by parents, so results of the study may not be adaptable to families with less access to resources and education. Questions regarding children's food consumption may not have been accurately reported, as children could receive junk food from other family members or eat outside of the house. Many children that were lost to follow-up during Year 3 may have graduated from the pre-school.

Strengths of the study included strong local partnerships to facilitate a school-based model for oral health intervention that could be run by local health and education institutions. This study builds upon previous literature that evaluates maternal-child nutrition and practice with children's oral health.

Conclusion

This study showed that preschool-aged children in urban/suburban Vietnam experienced a high prevalence of early childhood caries and overweight status. As children in the sample grew older, they consumed higher amounts of sugar sweetened beverages and junk food. The high proportion of 2-year-olds with tooth decay conveys the need for pre-natal and

infant oral health and nutritional education to begin before age 2. Further studies evaluating school-based interventions should be completed to develop and incorporate oral health and nutrition into early childhood education programs. These programs should place emphasis on less consumption of unhealthy foods and accessible dental care for children in order to prevent early childhood caries.

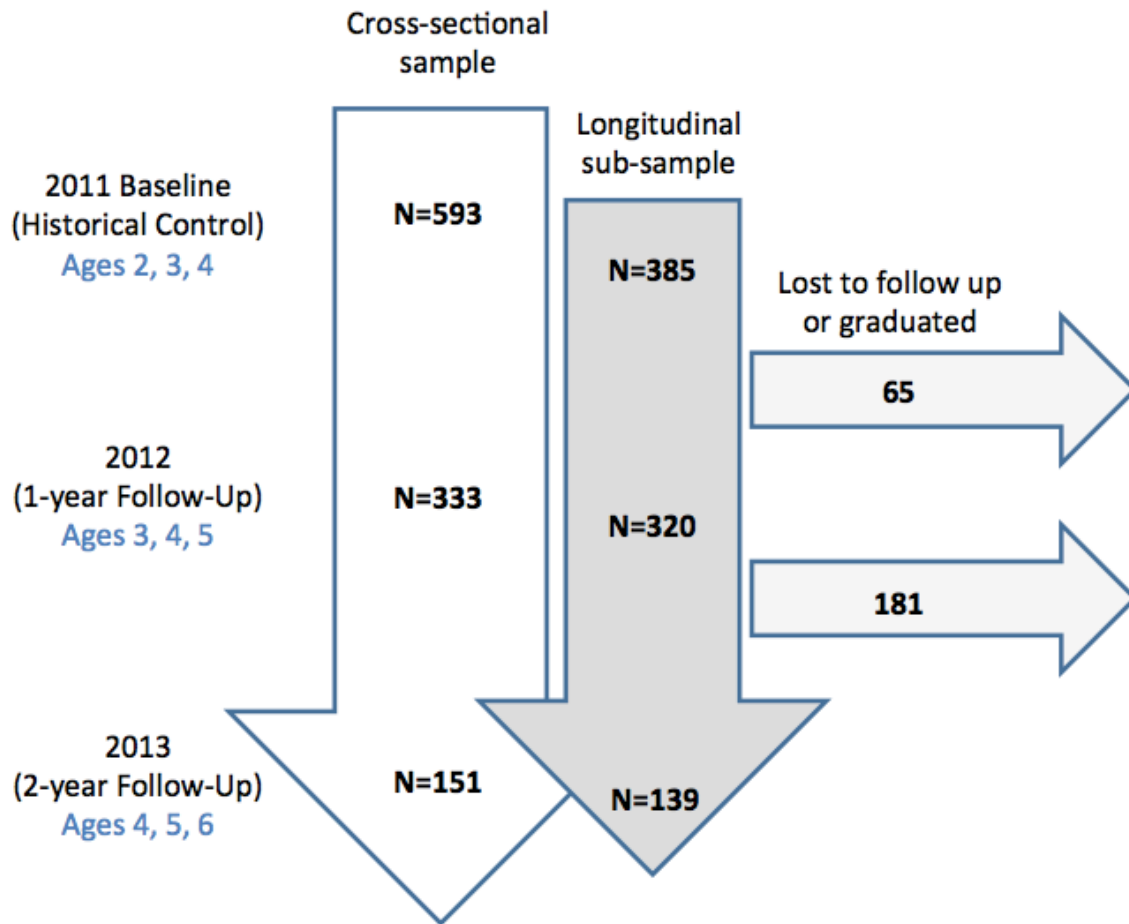


Fig. 1 – Numbers of Children Examined Across the Study Years

A flow chart depicting child participation including longitudinal sub-sample comprised of historical control, 1-year follow-up, and 2-year follow-up.

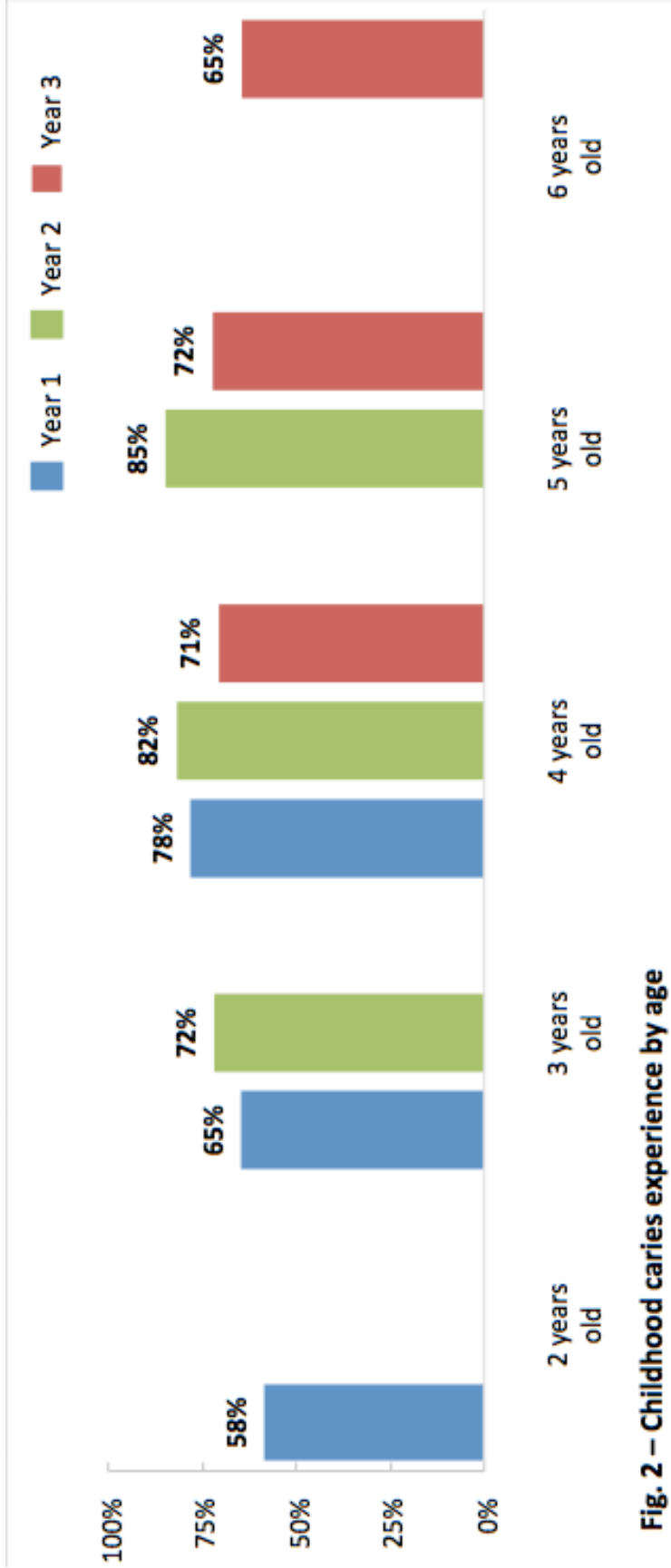


Fig. 2 – Childhood caries experience by age

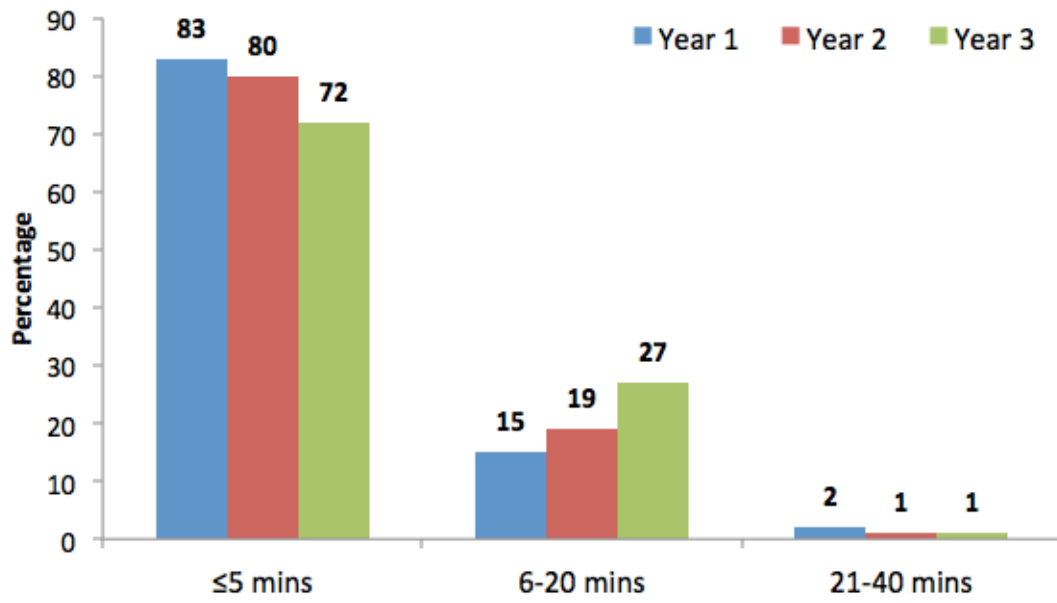


Fig. 3 – Time to walk to nearest convenience store

Table 1 – Child and Parent Demographics						
Category	Baseline (Year 1)		First Follow-Up (Year 2)		Second Follow-Up (Year 3)	
	Frequency or mean	% or SD	Frequency or mean	% or SD	Frequency or mean	% or SD
Children Demographics						
Parent-child pairs						
Gender						
Male	189	49.4%	156	49.2%	58	42.0%
Female	193	50.5%	161	50.8%	80	58.0%
Age						
2 years old	65	16.9%	/	/	/	/
3 years old	201	52.3%	71	22.2%	/	/
4 years old	118	30.7%	170	53.1%	34	24.8%
5 years old	/	/	79	24.7%	72	52.6%
6 years old	/	/	/	/	31	22.6%
Parent Demographics						
Age	32.5	±4.70	34.5	±4.99	36.0	±4.66
Years of formal education	13.2	±3.52	14.0	±3.70	13.4	±3.03
Survey respondent is mother	364	95.2%	212	70.9%	88	68.2%
Number of children in the family	1.6	±0.62	1.7	±0.88	1.7	±0.62

Category	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)			
	Frequency or mean	% or SD	Sample	Frequency or mean	% or SD	Sample	Frequency or mean	% or SD	Sample	P-value
Has any tooth decay										
2 years old	38	58.5%	65	/	/	/	/	/	/	
3 years old	130	64.7%	201	51	71.8%	71	/	/	/	
4 years old	92	78.0%	118	139	81.8%	170	24	70.6%	34	
5 years old	/	/	/	67	84.8%	79	52	72.2%	72	
6 years old	/	/	/	/	/	/	20	64.5%	31	
dmft average										
2 years old	2.7	±3.41	65	/	/	/	/	/	/	
3 years old	4.5	±4.95	201	5.2	±5.1	71	/	/	/	
4 years old	6.4	±5.44	118	6.9	±5.73	170	4.6	±4.89	34	
5 years old	/	/	/	6.6	±5.21	79	5.8	±5.57	72	
6 years old	/	/	/	/	/	/	5.2	±5.79	31	
Average number of decayed teeth	4.7	±4.95	385	6.2	±5.37	320	4.8	±5.04	138	
Untreated teeth	1801	97.8%	1841	1975	96.0%	2058	662	89.9%	736	*
Treated teeth	40	2.2%	1841	83	4.0%	2058	74	10.1%	736	*

* indicates a p-value < 0.05

Table 3 – Caries Increment by Age		
	Frequency	Percent
Age 2 --> Age 4		
Low (0-2)	15	55.6%
Med (3-5)	8	29.6%
High (>6)	4	14.8%
Total	27	
Age 3 --> Age 5		
Low (0-2)	47	77.0%
Med (3-5)	7	11.5%
High (>6)	7	11.5%
Total	61	
Age 4 --> Age 6		
Low (0-2)	23	76.7%
Med (3-5)	3	10.0%
High (>6)	4	13.3%
Total	30	

Table 4 – Parent's Perception of Child Mouth Pain											
Question prompt	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)				
	Frequency	Percent	Sample	Frequency	Percent	Sample	Frequency	Percent	Sample		
How often does your child complain of tooth or mouth pain?			372			296			132		
Never	225	60.5%		145	49.0%		47	35.6%			
Occasionally	134	36.0%		147	49.7%		81	61.4%			
Frequently	10	2.7%		3	1.0%		4	3.0%			
Almost always	3	0.8%		1	0.3%		0	0.0%			
How often does your child have problems eating because of mouth pain?			363			297			132		
Never	243	66.9%		174	58.6%		51	38.6%			
Occasionally	109	30.0%		117	39.4%		75	56.8%			
Frequently	10	2.8%		5	1.7%		6	4.5%			
Almost always	1	0.3%		1	0.3%		0	0.0%			
How often does your child have problems sleeping because of mouth pain?			366			295			131		
Never	307	83.9%		226	76.6%		79	60.3%			
Occasionally	55	15.0%		68	23.1%		51	38.9%			
Frequently	3	0.8%		0	0.0%		1	0.8%			
Almost always	1	0.3%		1	0.3%		0	0.0%			

Table 5 – Parent Oral Health Experience

Question prompt	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)			
	Frequency or mean	Percent or SD	Sample	Frequency or mean	Percent or SD	Sample	Frequency or mean	Percent or SD	Sample	P-value
How long ago was the last time you went to the dentist (in months)	8.6	±14.6	261	5.2	±8.4	113	4.7	±6.7	113	*
Why did you go to the dentist the last time?	296			234			94			
Tooth pain	82	27.7%		78	33.3%		32	34.0%		0.88
Bleeding gums	7	2.4%		11	4.7%		7	7.4%		*
Decayed tooth	58	19.6%		20	8.5%		9	9.6%		*
Extraction of teeth	11	3.7%		15	6.4%		15	16.0%		*
Check up	64	21.6%		37	15.8%		11	11.7%		*
Went with child	35	11.8%		29	12.4%		14	14.9%		0.78
Other	39	13.2%		44	18.8%		6	6.4%		*
In the past 3 months, have you had any problems with your teeth, gums, or mouth?	270			228			90			
Pain or sensitivity	92	34.1%		80	35%		35	39%		0.80
Bleeding gums	35	13.0%		30	13%		13	14%		0.64
Decayed or loose teeth	36	13.3%		31	14%		13	14%		0.60
Mouth inflammation	65	24.1%		42	18%		20	22%		0.36
Other	42	15.6%		45	20%		9	10%		0.10

* indicates a p-value < 0.05

Table 6 – Changes in Soda, Sugary Food, and Junk Food Consumption											
Category	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)				
	Frequency	Percent	Sample	Frequency	Percent	Sample	Frequency	Percent	Sample	P-value	
Soda consumption			295			302			135		
Never/Rarely	215	72.9%		158	52.3%		60	44.4%		*	
Weekly	80	27.1%		133	44.0%		62	45.9%		*	
Daily	14	47.0%		11	36.0%		13	9.6%		*	
Sweets/candy consumption			327			300			136		
Never/Rarely	142	43.4%		103	34.3%		50	36.8%		0.09	
Weekly	139	42.5%		164	54.7%		70	51.5%		*	
Daily	46	14.1%		33	11.0%		16	11.8%		0.25	
Junk food consumption			335			300			135		
Never/Rarely	143	42.7%		73	24.3%		31	23.0%		*	
Weekly	151	45.1%		127	42.3%		64	47.4%		0.68	
Daily	41	12.2%		100	33.3%		40	29.6%		*	

* indicates a p-value < 0.05

Question prompt	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)		
	Frequency or mean	Percent or SD	Sample	Frequency or mean	Percent or SD	Sample	Frequency or mean	Percent or SD	Sample
Was this child breastfed?									
Yes responses	354	95.4%	371	275	92.0%	299	130	96.3%	135
To what age (in months) did child breastfeed?									
Did this child receive milk through a baby bottle?	14.2	±8.1	341	14.0	±7.7	273	12.8	±8.5	123
Up to what age (in months) did child receive milk through a baby bottle?	310	85.9%	361	211	71.3%	296	103	76.3%	135
How often does he/she fall asleep with the baby bottle in his/her mouth?									
Never bottlefed	26.5	±13.4	273	23.1	±16.5	211	18.7	±13.2	100
Never	51	14.0%	363	0	0.0%	244	0	0.0%	107
Occasionally	216	59.5%		184	75.4%		65	60.7%	
Frequently	58	16.0%		49	20.1%		31	29.0%	
Almost always	32	8.8%		10	4.1%		6	5.6%	
What does he/she drink in the baby bottle? (mark all that apply)	6	1.7%		1	0.4%		5	4.7%	
Water	68	23.4%	291	74	24.0%	308	52	32.7%	159
Milk	54	18.6%		54	17.5%		24	15.1%	
Formula	154	52.9%		144	46.8%		71	44.7%	
Lemonade	6	2.1%		9	2.9%		0	0.0%	
Natural juice	7	2.4%		16	5.2%		10	6.3%	
Artificial juice	1	0.3%		0	0.0%		0	0.0%	
Rice water	0	0.0%		4	1.3%		0	0.0%	
Soda	0	0.0%		2	0.6%		2	1.3%	
Sugar water	1	0.3%		1	0.3%		0	0.0%	
Other	0	0.0%		4	1.3%		0	0.0%	

Table 8 – Parents' Knowledge of Caries

Question prompt	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)		
	Frequency	Percent	Sample	Frequency	Percent	Sample	Frequency	Percent	Sample
What do you think causes cavities in baby teeth? (open ended)			516			594			219
Sweets	224	43.4%		201	33.8%		82	37.4%	
Gum problems	1	0.2%		95	16.0%		0	0.0%	
Juice/soda	14	2.7%		21	3.5%		8	3.7%	
Not brushing	180	34.9%		227	38.2%		90	41.1%	
Baby bottle feeding	9	1.7%		18	3.0%		4	1.8%	
Other	88	16.7%		32	5.4%		35	16.0%	
Do you think that cavities cause problems for children?									
Yes responses	370	99.5%	372	304	100%	304	132	100%	132
If yes, why do you think cavities cause problems for children? (open ended)			566			515			225
Pain	99	17.5%		100	19.4%		40	17.8%	
Problems eating	145	25.6%		127	24.7%		58	25.8%	
Problems sleeping	22	3.9%		32	6.2%		9	4.0%	
Decayed teeth	11	1.9%		7	1.4%		4	1.8%	
Harm one's health	121	21.4%		123	23.9%		54	24.0%	
Esthetics issue	0	0.0%		30	5.8%		0	0.0%	
Other	168	29.5%		96	18.4%		60	26.7%	

Table 9 – Child Oral Health Regimen											
Question prompt	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)				
	Frequency	Percent	Sample	Frequency	Percent	Sample	Frequency	Percent	Sample		
What do you (parent) do to take care of your child's teeth?			436			361				169	
Brush teeth	325	74.5%		276	76.5%		124	73.4%			
Avoid giving candy	25	5.7%		20	5.5%		6	3.6%			
Nothing	1	0.2%		0	0.0%		0	0.0%			
Dental exams	0	0.0%		11	3.0%		0	0.0%			
Use mouthwash	0	0.0%		48	13.3%		0	0.0%			
Other	85	19.5%		6	1.7%		39	23.1%			
Does your child have his/her own toothbrush at home?											
Yes responses	363	98.6%	368	301	100%	301	131	100%	131	131	
Does your child have toothpaste at home?											
Yes responses	351	94.9%	370	300	100%	300	134	99.3%	135	135	
How often do you help your child brush his/her teeth?											
Never	4	1.1%	369	3	1.0%	300	9	6.8%	133	133	
Occasionally	57	15.4%		64	21.3%		42	31.6%			
Frequently	238	64.5%		185	61.7%		70	52.6%			
Almost always	70	19.0%		48	16.0%		12	9.0%			

Table 10 – Child Dental History											
Question prompt	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)			P-value	
	Frequency	Percent or SD	Sample	Frequency	Percent or SD	Sample	Frequency	Percent or SD	Sample		
Has your child been to the dentist?											
Yes responses	119	39.0%	305	151	52.2%	289	101	75.4%	134	*	
If yes, how many times has your child been to the dentist?											
	1.8	1.9	152	3.2	2.7	161	3.7	2.0	82	*	
Why did your child go to the dentist?											
			146			185			108		
Check up	61	41.8%		62	33.5%		46	42.6%		0.55	
Cavities	41	28.1%		58	31.4%		24	22.2%		0.15	
Pain	28	19.2%		41	22.2%		24	22.2%		0.72	
Other	16	11.0%		24	13.0%		14	13.0%		0.69	

* indicates a p-value < 0.05

	Baseline (Year 1)						First Follow-Up (Year 2)			Second Follow-Up (Year 3)		
	Age 2	Age 3	Age 4	Age 3	Age 4	Age 5	Age 3	Age 4	Age 5	Age 4	Age 5	Age 6
Sample	65	194	65	71	170	79	71	170	79	34	71	31
HAZ Stunted												
Frequency	2	15	0	1	6	1	1	6	1	0	1	0
Percent	3.1%	7.7%	0.0%	1.4%	3.5%	1.3%	1.4%	3.5%	1.3%	0.0%	1.4%	0.0%
P-value				0.55	0.09	1.00	0.55	0.09	1.00	0.54	0.06	1.00
WAZ Underweight												
Frequency	0	8	0	0	3	1	0	3	1	0	2	0
Percent	0.0%	4.1%	0.0%	0.0%	1.8%	1.3%	0.0%	1.8%	1.3%	0.0%	2.8%	0.0%
P-value				1.00	0.19	1.00	1.00	0.19	1.00	1.00	0.62	1.00
BAZ Overweight												
Frequency	9	51	12	19	56	22	19	56	22	11	21	7
Percent	13.8%	26.3%	18.5%	26.8%	32.9%	27.8%	26.8%	32.9%	27.8%	32.4%	29.6%	22.6%
P-value				0.06	0.17	0.19	0.06	0.17	0.19	0.29	0.59	0.64

Table 12 – Malnutrition versus Caries

	Baseline (Year1)		First Follow-up (Year 2)		Second Follow-up (Year 3)				
	Stunted	Underweight	Overweight	Stunted	Underweight	Overweight	Stunted	Underweight	Overweight
Frequency with caries	14	6	42	8	4	73	1	2	25
Sample of malnutrition status	17	8	73	8	4	97	1	2	39
Any tooth decay (%)	82.4%	75.0%	57.5%	100.0%	100.0%	75.3%	0.0%	100.0%	64.1%
Average dmft (if any decay)	7.1	10.5	6.5	9.3	11.5	6.5	N/A	8.0	6.4

Table 13 – Parent’s Perception of Child Oral Health and Overall Health

Question prompt	Baseline (Year 1)			First Follow-Up (Year 2)			Second Follow-Up (Year 3)		
	Frequency	Percent	Sample	Frequency	Percent	Sample	Frequency	Percent	Sample
How would you rate your child's teeth overall?			370			298			134
Excellent	130	35.1%		104	34.9%		46	34.3%	
Fair	193	52.2%		149	50.0%		72	53.7%	
Poor	47	12.7%		45	15.1%		16	11.9%	
How would you rate your child's health overall?									
			367			300			134
Excellent	176	48.0%		156	52.0%		77	57.5%	
Fair	185	50.4%		138	46.0%		57	42.5%	
Poor	6	1.6%		6	2.0%		0	0.0%	

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Appendix 1

Mother and child survey instrument (4 pages total)

MOTHER'S INTERVIEW

Vietnam Tooth Project 1

Today's Date (dd /mm /year): ___/___/____ ID #: _____

NAME OF PARENT (who answered questionnaire): _____

CHILD'S NAME : _____

RELATION WITH CHILD: _____ TOWN / CITY: _____

1. Your age: _____

2. Your level of education (NOTE: record in YEARS of education NOT AGE when left school) :

3. How many children do you have? _____

4. How many are less than 7 years old? _____

Names and ages of children less than 7 years old :

1. _____ Age: _____

2. _____ Age: _____

3. _____ Age: _____

5. How many people live in your house? _____

6. Does your house have electricity?

Yes No

7. Does your house have clean drinking water?

Yes No

8. Do you cook with wood, gas or electronic stove?

Wood stove Gas stove
 Wood and gas stoves Electronic stove

9. How long does it take you to walk to a store where you can buy junk food (e.g., chips, candy, soda)?

< 5 minutes 41 to 60 minutes
 6 to 20 minutes more than 60 minutes
 21 to 40 minutes

10. When do you go to the doctor?

Only when I'm sick
 For check-ups
 Both
 Never go to the doctor

11. When do you go to the dentist?

Only when I'm sick
 For check-ups
 Both
 Never go to the doctor

12. How often do you drink milk?

Never 2-3 times / week
 Every 2 -4 weeks Once a day
 Every week 2-3 times / day

13. How often do you drink soda?

Never 2-3 times / week
 Every 2 -4 weeks Once a day
 Every week 2-3 times / day

14. How often do you eat chips?

Never 2-3 times / week
 Every 2 -4 weeks Once a day
 Every week 2-3 times / day

MOTHER'S INTERVIEW

15. In your life, how many teeth have you had fallen out or extracted? (not including baby teeth)

16. Right now in your home, do you have your own tooth brush?

- Yes No

17. How long ago was the last time you went to the dentist? (in months)

(If never gone, answer 00 and skip to Q. #19)

18. Why did you go the dentist the last time?

- Pain in tooth/molar Extraction of teeth
 Bleeding gum Check-up
 Decayed tooth/molar I went with my child
 Other reasons: _____

19. In the past 3 months, have you had any problem with your teeth, molars, gums, or mouth (check all that apply)?

- Pain or sensitivity
 Decayed or loose teeth/ molars
 Bleeding gum
 Inflammation of the mouth
 Other problems: _____

20. What do you think causes cavities in baby teeth?

21. Do you think that cavities cause problems for children?

- Yes No

22. If yes, why do you think that cavities cause problems for children?

CHILD'S INFORMATION

CHILD'S NAME : _____ ID #: _____

CHILD'S DATE OF BIRTH (DD/ MM/ YEAR) : __ __ / __ __ / ____

CHILD'S GENDER: MALE FEMALE

25. Did you receive prenatal care when you were pregnant with this child?

- Yes (1) No (2)

26. If yes, how many prenatal visits? _____

27. Are this child's vaccines up-to-date?

- Yes (1) No (0) I don't know (888)

28a. Was this child breastfed?

- Yes (1) No (2)

(If no, skip to Q. #29)

28b. If yes then to what age (in months) was the child breastfed? _____

28c. Is he/she still breastfeeding?

- Yes (1) No (0)

29. Did this child receive milk through a baby bottle?

- Yes (1) No (0)

(If no, skip to question #33)

30a. If yes, up to what age (in months) did the child receive milk through a baby bottle? _____

30b. Is he/she still drinking from a baby bottle?

- Yes (1) No (0)

31. How often does he/she fall asleep with the baby bottle in his/her mouth?

- Never (1) Frequently (3)
 Occasionally (2) Almost always (4)

32. What does he/she drink in the baby bottle? (mark all that apply)

- Water Fruit juice
 Milk Soda
 Formula Sugar water
 Lemonade Rice water (porridge)
 Other drink: _____

33. How often did your child drink **milk**?

- Never (1) Once every 2-4 weeks (4)
 Once a week (2) 2-3 times/week (5)
 Once a day (3) 2-3 times/day (6)

34. How often did your child drink **soda**?

- Never (1) Once every 2-4 weeks (4)
 Once a week (2) 2-3 times/week (5)
 Once a day (3) 2-3 times/day (6)

35. How often did your child eat **candy**?

- Never (1) Once every 2-4 weeks (4)
 Once a week (2) 2-3 times/week (5)
 Once a day (3) 2-3 times/day (6)

36. How often did your child eat **junk food/snacks**?

- Never (1) Once every 2-4 weeks (4)
 Once a week (2) 2-3 times/week (5)
 Once a day (3) 2-3 times/day (6)

CHILD'S INFORMATION

37. When your child cries during the day or night, what do you do to calm him/her?

38. What do you do to take care of your child's teeth?

39. Right now in your home, does your child have his/her own toothbrush?

Yes (1) No (0)

40. Does he/she have toothpaste?

Yes (1) No (0)

41. How often do you help your child brush his/her teeth?

Never (1) Frequently (3)
 Occasionally (2) Almost always (4)

42. Has your child been to the dentist?

Yes (1) No (0)

(If no, skip to question # 45)

43. If he/she has been to dentist, how many times? _____

44. Reason why he/she went to the dentist:

- Check-ups (1)
- Dental caries (2)
- Pain (3)
- Other reasons: _____

45. How often does your child complain of pain in the mouth or teeth?

Never (1) Frequently (3)
 Occasionally (2) Almost always (4)

46. How often does your child have problems eating because of mouth pain?

Never (1) Frequently (3)
 Occasionally (2) Almost always (4)

47. How often does your child have problem sleeping because of mouth pain?

Never (1) Frequently (3)
 Occasionally (2) Almost always (4)

48. In your opinion, how are your child's teeth overall?

Excellent (1) Okay (2) Bad (3)

49. In your opinion, how is your child's health overall?

Excellent (1) Okay (2) Bad (3)

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