HIV Impact on Oral Health-Related Quality of Life in Kenya

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Abstract

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Purpose: This longitudinal study investigates the impact of HIV status on oral health-related quality of life (OHRQoL) in children living in West Kenya.

Methods: The 360 children aged 3-4 years from Kisumu County were enrolled from 31 clinics/hospitals and followed up for 12 months. This longitudinal study analyzed scores from Early Childhood Oral Health Impact Scale (ECOHIS) questionnaires given to parent-caregivers at 0, 6, and 12 months after enrollment. The three groupings of 120 were recruited by HIV status: HIV+, HIV-exposed but uninfected (HEU), and unexposed and uninfected (HUU). Caregivers evaluated OHRQoL across four domains: symptoms, function, psychological well-being, and self-image/social interaction. Higher ECOHIS scores indicated a greater perceived negative impact. Data from dental exams by a calibrated examiner at each point of the study included dental caries, plaque, gingival bleeding, abnormal findings, fluorosis, erosion, and salivary gland swelling. The data were analyzed using descriptive statistics, t-test, and regression analysis ($P<.05$).

Results: Mean age was 3.4 years, with the majority as female (51%), attending private school (47%), and living in a rural area (49%). At 0 and 6 months, the HIV group reported the lowest ECOHIS score (8%, 8%) compared to the HEU (12%, 12%) and the HUU (22%, 20%) in "Difficulty of drinking cold and hot beverages" (P=.006, .04 respectively). No statistically significant differences were found for other domains.

Conclusion: The data does not validate the hypothesis that positive HIV status negatively impacts OHRQoL in 3–4-year-old children living in Kisumu, Kenya.

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I. BACKGROUND

By the end of 2024, an estimated 40.8 million people worldwide were living with HIV/AIDS, with 1.4 million of these individuals being children under the age of 15[22]. In the same year, an estimated 1.3 million new infections occurred, and 630,000 individuals died from HIV related causes[22]. Africa accounts for over half of these infections, acquisitions, and deaths at 26.3 million, 650,000, and 380,000, respectively[22]. While new infections and deaths have been on a steady decline, peaking at almost 3.5 million new infections and over 2 millions deaths annually in the mid 1990s, HIV/AIDS remains a major global health crisis.

Kenya is among the countries most affected by HIV/AIDS, with 1.3 million people infected including 62,000 children[22]. HIV is the leading cause of death among women and third leading cause of death among men in Kenya[24]. At an estimated 15.5% prevalence of HIV, Kisumu County, Kenya, is one of 4 counties in Kenya where HIV is considered a generalized epidemic, defined as an HIV prevalence above 10%[2]. For this reason, Kisumu is one of the 13 counties designated as a high-priority area by Kenya's AIDS Strategic Framework[23].

Antiretroviral Therapy (ART) has evolved rapidly since the introduction of the first ART drug in 1987 and has contributed greatly to the reductions in deaths seen since the mid 1990s[17]. While ART has helped provide huge advancements in managing viral load in children with HIV, an estimated 26% of children under the age of 15 utilizing ART treatment continued to have uncontrolled viral loads of over 1000 copies per mL[25]. Further, the WHO estimates that only 76% of children in Kenya receive ART[4].

HIV's impact on oral health in children and adolescents has been an ongoing topic of research throughout the years. While some studies report no significant difference in caries rate between HIV infected and uninfected children, other studies indicate that children with HIV have lower salivary pH, decreased salivary flow, and higher incidence of oral candidiasis, angular cheilitis, and caries[1,3,10,12,15]. While the association between HIV and adverse oral health outcomes has been documented, there is less literature regarding how these adverse oral health outcomes affect the quality of life for children infected with HIV and their families. Additionally, there is little literature exploring if the effect on quality of life is different between HIV infected (HIV+), HIV-exposed uninfected (HEU), and HIV-unexposed uninfected (HUU) children. Continued assessment of the association between HIV and adverse oral health outcomes as well as the effect of these adverse outcomes on quality of life will help Kenya and

other populations focus public health efforts on missions that will have the largest positive effect on the population.

Oral health-related quality of life (OHRQoL) has been designated by WHO as an important segment of the Global Oral Health Program since 2003[16]. The biopsychosocial model of health recognizes quality of life, defined as one's "perceptions of their position in life in the context of culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns", as an important aspect of health assessment[19]. OHRQoL has been further divided into five prongs including oral health, function, treatment expectations/satisfaction, environment, and social/emotional[16].

Assessing OHRQoL in children presents many obstacles, especially in preschool aged children. Preschool-aged children have limited ability to communicate their social and emotional insights. For this reason, caregivers of these children are used as a proxy to assess the child's OHRQoL. In 2007, Pahel, Rozier and Slade developed the Early Childhood Oral Health Impact Scale (ECOHIS) to address the need for a reliable and validated instrument for assessing OHRQoL in children[13]. Since then, the ECOHIS questionnaire has been translated and verified in over 25 languages including Kiswahili, the national language of Kenya [4,8]. The hypothesis of this study was that the children living with HIV will have higher ECOHIS scores compared to the HEU and HUU cohorts. This means that we suspect that oral health has a greater negative impact on OHRQoL for the cohort of children living with HIV.

II. MATERIAL AND METHODS

Study Design and Population

This longitudinal cohort study focused on children aged 3-4 years located in Kisumu, Kenya. The cohorts consisted of children living with HIV (HIV), children exposed but uninfected by HIV (HEU), and children unexposed and uninfected (HUU). Data were collected relating to how oral health impacts both the child and the family unit. Data were collected at 3 different instances: 0 months, 6 months, and 12 months. Oral health-related quality of life (OHRQoL) was measured using the Early Childhood Oral Health Impact Scales (ECOHIS). This study was approved by the Institutional Review Board (IRB) at the University of Washington (UW) (FWA #000006878) and Kenya's Jaramogi Oginga Odinga Teaching and Referral Hospital Ethics Review Committee (ISERC/JOOTRH/688/23).

This study's cohorts consisted of 360 patients aged 3-4 at the time of enrollment living in Kisumu County, Kenya. The three cohorts of HIV-infected (HIV+), HIV-exposed uninfected (HEU), and HIV-unexposed uninfected (HUU) were equally represented. The inclusion criteria included: aged 3 to 4 at time of enrollment, medical clearance from a primary care physician, and a resident of Kisumu County of Kenya for 12 months from the time of enrollment. Consent was obtained in the caregiver's preferred language (English, Luo, Swahili) and children living with HIV needed to have been on ART for a minimum of 6 months.

Recruitment and Enrolment of Participants

Recruitment of study participants was done from April 2023 to November 2023. Participants living with HIV were recruited from HIV treatment clinics. Nurses at each medical site were utilized to invite eligible participants to participate in the study. For participants who were exposed but unaffected, recruitment was undertaken at Prevention of Mother-to-Child Transmission clinics, while the HIV-unexposed participants, were recruited at Mother Child Health during Wellness checkups. Participants were supported with the necessary transportation, and informed consent was obtained in their preferred language. For families that gave consent, their child received a unique participant identification number (PID).

Oral Examination Training and Calibration

A senior pediatric dentist calibrated another pediatric dentist who examined all cohort participants. Calibration included: diagnosis of dental caries, presence of plaque, dental trauma, dental fluorosis, dental erosion, oral manifestations of HIV, and more based on the World Health Organization's (WHO) Oral Health diagnosis criteria[21]. A Kappa score of 0.95 was achieved for inter- and intra-calibration of assessments.

Data Collection Procedure

Oral examination

Oral examinations were done at 0, 6, and 12-months. WHO Oral Health Surveys and Record Form for Oral Manifestations of HIV/AIDS were used as a guideline for all clinical examinations. Intraoral examinations were completed using overhead light, a disposable mirror, and visual assessment done. Findings were recorded on the oral health assessment paper forms and later transferred to REDCAP. Plaque accumulation, dental caries, dental trauma, dental fluorosis, missing teeth, and other tooth-related pathologies were documented. Gingival health and gingival bleeding were assessed by the examiner using a gentle toothbrushing action.

Early Childhood Oral Health Impact Scale

Created by Pahel, Rozier, and Slade in 2007, the ECOHIS questionnaire measures oral health-related quality of life in preschool-aged children. Parent-caregiver reporting is used along with a biomedical model of clinical disease and diagnosis-oriented data to measure OHRQoL. The ECOHIS addresses the inability for preschool-aged children to communicate their emotional needs and wants by measuring the impact of oral health in this cohort using parent responses as a conduit for children's attitudes and feelings. Before the implementation of the ECOHIS, no instrument existed to reliably measure OHRQoL reliably measured in preschool-aged children. The ECOHIS consists of a 13-item questionnaire divided into 2 sections; 9 items make up the child impact section while the remaining 4 items make up the family impact section. Each section is further divided into subsections. The child impact section consists of 5 items measuring child symptoms, 2 items measuring psychological impact, and 2 items measuring self-image and social impact. The family impact section consists of 2 items measuring parental distress and 2 items measuring family function. The ECOHIS questionnaire was assessed for validity and internal consistency reliability using Cronbach's alpha and test-retest reliability using the intraclass correlation coefficient[14].

Measured Variables

Variables of child's age, sex, school type (public vs. private), and residence (rural, urban, or peri-urban) comprise the sociodemographic portion of the questionnaire. HIV status (HIV+, HEU, HUU) was assessed using medical records (Table 1). For children in the HIV cohort, duration of ART, viral load, and adherence were determined (Table 1). Oral lesions and hard tissue findings were recorded as present (1) or not present (0) (Table 2).

The ECOHIS questionnaire was measured using a 2-point scale with 0 indicating and answer of no to the question being asked and 1 indicating an answer of yes. "I don't know" was also given as an option to answer. ECOHIS scores are calculated for individual items and as a sum of the response codes after the "don't know" responses are recorded as missing. If parents responded to more than two items in the child impact section and one item in the family impact section as "don't know", the data were excluded from the study. Higher ECOHIS scores represent greater negative impact of oral health on quality of life (Table 3).

Data Analysis

Logistic regression was utilized to assess the association between oral disease and HIV status. Adjustments were made for sex, school type, and residence. Logistic regression was additionally used to assess the association between ECOHIS questionnaire scores and HIV status. Continuous variables such as population demographics, oral findings, and ECOHIS scores were analyzed with a one-way analysis of variance (ANOVA) to compare the HIV, HEU, and HUU cohorts. For categorical variables, the chi-squared test was utilized to compare the HIV, HEU, and HUU cohorts. Amongst the cohorts, the ECOHIS questionnaire scores were evaluated for the mean and standard deviation. SAS 9.4 and p-value <0.05 were used to determine statistical significance.

III. RESULTS

Cohort Characteristics (Table 1)

The average age of the participants at the time of enrollment was 3.4 years old (SD=±0.5), with slightly more than half being female (50.8%). No significant difference between the cohorts were observed in the age and sex categories. Overall, 47% of the research subjects attended private school, 31% did not attend school, and 22% attended public school. The HUU cohort was more likely to attend private school (60%) compared to the HIV (38%) and the HEU (43%) cohorts (p-value=0.007). Almost half (49%) of the children resided in rural areas, while 35% live in urban areas and 16% lived in peri-urban areas. Type of residence was not statistically significantly different between the cohorts.

All HIV infected children in the study were receiving ART. While 16.7% of the HIV cohort had been on ART for less than 12 months, 68.3% of this cohort had been receiving ART for more than 2 years. The viral load in the HIV cohort was in the majority undetectable (65%). 18.3% had a viral load between 50-400 copies per mL and 16.7% had a viral load over 400 copies per mL. Adherence to ART was over 90% in 78.3% of participants on ART.

Oral disease prevalence by HIV status (Table 2)

At time 0, based on a previous report using the same data set, only abnormal findings were found to be significantly different between the HIV, HEU, and HUU cohorts[20]. While statistical significance was not reported for the differences between cohorts in this study, general trends were noted. For dental caries, dental plaque, gingival bleeding at brushing, and abnormal

findings, the prevalence decreased in all cohorts from 0 months to 12 months. The only increase was in the HUU group, whose abnormal findings increased from 45% to 50.0% from 6 to 12 months.

Enamel fluorosis was similar between cohorts with anywhere from 3 to 8 children in each cohort diagnosed with enamel fluorosis at any time. Dental erosion, salivary gland swelling, angular cheilitis, herpetic lesions, and HPV/wart-like lesions were not prevalent ranging between 0 and 3 individuals in each cohort at any time.

ECOHIS scores by HIV status (Table 3)

Statistical analysis shows a statistically significant difference between HIV, HEU, and HUU cohorts of only one individual domain, difficulty drinking cold and hot beverages. This does not support our hypothesis that HIV status would affect OHRQoL.

Domain 1: Child Symptoms

Pain in teeth, mouth, or jaw: At time 0; 11%, 14%, and 15% of the HIV, HEU, and HUU cohorts reported pain with a mean of 13.6% overall and no significant difference between the cohorts. At 6 months; 10.8%, 13.3%, and 16.2% reported pain respectively with a mean of 13.3% and no significant difference between cohorts. At 12 months, the numbers increased to 24.6%, 18.1%, and 20.9% respectively with a mean of 21.1% and no significant difference between the cohorts.

Domain 2: Child Function

Difficulty drinking hot or cold beverages: At 0 and 6 months, this domain showed a significant difference between the HIV, HEU, and HUU cohorts. At time 0; 8.3% of the HIV cohort, 12.5 % of the HEU cohort, and 22.5% of the HUU cohort reported difficulty drinking hot or cold beverages. A P-value of 0.006 represents a significant difference, with the HUU cohort reporting the most difficulty and the HIV cohort reporting the least difficulty. At 6 months 8.1%, 12.5%, and 19.8% reported similar difficulties respectively. A p-value of 0.04 shows a weaker but still significant difference between the cohorts with the same pattern emerging. By time 12

months, 24.6%, 15.5%, and 20.6% reported difficulty drinking respectively, with no significant difference between the cohorts. (Figure 1)

Difficulty eating some foods: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 10.8%, 12.5%, and 19.2% of the subjects reported difficulty eating. At 6 months; 10.8%, 13.3%, and 18.9% reported difficulty. At 12 months; 21.1%, 17.2%, and 20.6% reported difficulty eating.

Difficulty pronouncing any words: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 5.8%, 7.5%, and 8.3% reported difficulty pronouncing words. At 6 months; 5.4%, 4.2% and 9.0% reported difficulty. At 12 months; 0%, 3.4%, and 1.9% reported difficulty pronouncing words.

Missed pre-school, day care or school: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 3.3%, 2.5%, and 2.5% reported missing school. At 6 months; 3.6%, 2.5% and 3.6% reported missed days. At 12 months; 1.8%, 3.4%, and 5.6% reported missing school.

Combined Child function domain: At 0 and 6 months, the combined domain showed a significant difference between the cohorts. At time 0; a combined 15%, 24.2%, and 35% has negative impacts on child function respectively with a mean of 24.7%. A p-value of 0.02 represents a significant difference, with the HUU cohort reporting the most negative impacts on child function. At 6 months, 14.2%, 20.8%, and 31.2% has negative impacts on child function respectively with a mean of 22.1%. A p-value of 0.04 shows a significant difference between the cohorts, with HUU reporting the greatest impact on child function. This effect was diminished at 12 months with 30.9%, 22.4%, and 27.3% reporting negative impacts on child function and no significant difference between the cohorts.

Domain 3: Child Psychology

Had trouble sleeping: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 4.2%, 5%, and 8.3% reported sleeping difficulty. At 6 months; 3.6%, 5.0% and 8.1% reported difficulty. At 12 months; 4.6%, 6.0%, and 6.5% reported difficulty sleeping

Been irritable or frustrated: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 3.3%, 4.2%, and 5% reported irritability. At 6 months; 3.6%, 4.2% and 3.6% reported difficulty. At 12 months; 2.8%, 2.6%, and 2.8% reported irritability.

Combined Child Psychology Domain: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 5%, 6.6%, and 10% reported negative impact on the child's psychology. At 6 months; 4.5%, 6.7% and 10.7% reported a negative impact on the child's psychology. At 12 months; 5.4%, 7.8%, and 8.2% reported a negative impact on the child's psychology.

Domain 4: Self-Image/ Social Interaction

Avoided smiling: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 1.7%, 2.5%, and 3.3% reported avoiding smiling. At 6 months; 2.7%, 2.5% and 3.6% reported avoiding smiling. At 12 months; 0.9%, 0.9%, and 0% reported avoiding smiling.

Avoided talking: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0; 0.8%, 3.3%, and 5% reported talking avoidance. At 6 months; 0.9%, 3.3% and 4.5% reported talking avoidance. At 12 months; 0%, 1.7%, and 0% reported talking avoidance.

Combined Domain: No significant differences were found between the HIV, HEU, and HUU cohorts. At time 0, 17.5%, 18.3%, and 24.2% reported negative impact on the child's self-image. At 6 months; 17%, 17.5% and 26.8% reported a negative impact on the child's self-

image. At 12 months; 15.4%, 14.7%, and 12.3% reported a negative impact on the child's self-image.

IV. DISCUSSION

The goal of this study was to assess whether HIV status impacts the OHRQoL of children aged 3-4 living in Kisumu, Kenya. We hypothesized that HIV status would negatively impact the OHRQoL of the children included in the study. However, the data obtained showed very little difference in OHRQoL for children living with HIV compared to their HEU and HUU counterparts. In fact, the only statistically significant difference was that children in the HUU cohort had a higher ECOHIS score in the domain of difficulty drinking hot or cold beverages than the HIV cohort.

Selection bias

The children in this study were selected from HIV treatment clinics, Mother to Child Transmission clinics, and during Wellness checkups. This restricts the study population to children that were receiving at least some medical care. Due to the study participants receiving medical care, it is likely that a greater percentage of these children receive dental care than those not receiving medical care.

The study participants had to have received ART for at least 6 months prior to the study. Given that only 76% on children in Kenya are receiving ART, this selection criteria excluded almost 25% of children living with HIV that may have less access to healthcare and therefore dental care[4].

For the children receiving ART, the family is required to bring them to frequent medical appointments. This may make it more likely that these children are being screened by medical professionals for oral health-related disease. With earlier diagnosis of oral health-related problems, these children could get better anticipatory guidance and preventative treatment. It follows that the population of children living with HIV who are receiving ART could have lower incidence of caries and other oral diseases.

Finally, the Kenya National AIDs spending assessment from fiscal years 2016-2020 estimated that roughly $600-700 million USD are spent each year in Kenya on HIV response[9]. Large-scale health initiatives targeting the population living with HIV leads to increased

healthcare access compared to their uninfected peers. For this reason, one could expect to see a decrease in unaddressed oral health issues. Given that oral health issues have a greater effect on quality of life in more advanced stages, it is possible that children affected by HIV are more likely to have intervention before their oral health negatively impacts their quality of life.

Location

The geological location of Kisumu County could also affect the risk of dental caries due to the high levels of fluoride in the well water in and around the East African Rift Valley, from where Kisumu is located just northwest[18]. Most of the population in Kisumu, Kenya sources their drinking water from Lake Victoria[7]. While the water in Lake Victoria was shown to have safe levels of fluoride, the surrounding areas have been shown to have levels of fluoride above the WHO recommended threshold of 0.7ppm[5]. These high levels of Fluoride could put the general population of Kisumu at a decreased risk of dental caries than the surrounding areas of Kenya. This could skew the data, making it difficult to extrapolate this data to represent the population of Kenya at large.

Proxy reporting

While the ECOHIS questionnaire is verified and is currently the best instrument available for measuring OHRQoL for children below the age of 6, there remains a potential for bias based on proxy reporting from parents and caregivers. During the creation of the ECOHIS questionnaire, the 13 items measured were selected from a pool of 36 items. The 13 items were selected by parental rating of the importance of each item[13]. Items that parents find to affect quality of life may be different than what their children consider impactful on their quality of life. For this reason, there may be an inherent disconnect between the items measured in the child impact section of the ECOHIS and the real-world quality of life implications for the study subjects.

Parents of children infected with HIV also face severe stressors associated with caring for a child with chronic illness. Research shows that over half of parents in a South African community reported a burden of caring for a child living with HIV[6]. There was an association found between health care status of the caregiver and the burden of caring for the child with HIV[6]. Given the high rate of mother-to-child transmission of HIV, many of these mothers likely

feel a strong burden of caring for their children. Research shows that parents in Africa caring for children with HIV may have increased anxiety, more health issues, and increased marital discord[11]. Due to the emotional, social, and financial burdens of caring for their children living with HIV, these caregivers may be less likely to notice the negative impacts of their child's oral health. This could explain the trend that we see in many of the combined domains, where the HUU cohort reports greater negative impact on OHRQoL. It is possible that the caregivers of this cohort may be more attentive to the negative impacts of OHRQoL for their children compared to the parents of the HIV and HEU children due to decreased stressors.

V. CONCLUSION

The findings from this study do not validate the hypothesis that HIV status negatively impacts OHRQoL in this population. In contrast, it was found that children living with HIV experience less difficulty drinking hot and cold beverages, but this effect had subsided by 12 months into the study. While there was very little difference in the OHRQoL between the cohorts, oral health had an impact on quality of life in all groups. This study highlights the importance of early and consistent oral health evaluation for all children. Further research is needed to understand the effect of receiving dental treatment on OHRQoL between the cohorts. While HIV status was not shown to significantly impact OHRQoL, it is important to continue to investigate other variables and characteristics as they relate to OHRQoL.

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VI. DATA TABLES

Table 1: Cohort Characteristics of 3-4-year-old Kenyan Children by HIV Status					
Variables	**HIV 120**	**HEU 120**	**HUU 120**	**Total 360**	***P Value***
	n (%)	n (%)	n (%)	n (%)	
Age					
Months	3.4 (SD=0.5)	3.4 (SD=0.5)	3.3 (SD=0.5)	3.4 (SD=0.5)	0.350
Sex					
Female	58 (48.33)	63 (52.50)	62 (51.67)	183 (50.83)	0.792
School					
Public	29 (24.17)	32 (26.67)	17 (14.17)	78 (21.67)	
Private	46 (38.22)	52 (43.33)	72 (60.00)	170 (47.22)	0.007
No school	45 (37.50)	36 (30.00)	31 (25.83)	112 (31.11)	
Residence					
Urban	39 (32.50)	41 (34.17)	47 (39.83)	127 (35.47)	
Peri-urban	21 (17.50)	21 (17.50)	15 (12.71)	57 (15.92)	0.697
Rural	60 (50.00)	58 (48.33)	56 (47.46)	174 (48.60)	
Duration of ART Treatment					
12 mo or less	20 (16.67)				
13-24 mo	18 (15.00)				
25-36 mo	37 (30.83)				
37-48 mo	37 (30.83)				
49 mo or more	8 (6.67)				

Viral load (copies/mL)	
VL <50, Not detectable	78 (65.00)
VL 50-400	22 (18.33)
VL 400+	20 (16.67)
Adherence	
>95%	17 (14.17)
90-94%	77 (64.16)
<90%	26 (21.67)

*HIV-infected (HIV), HIV-exposed uninfected (HEU), and HIV-unexposed uninfected (HUU)

Table 2: Oral characteristics												
	HIV			HEU			HUU			Total		
	N (%) time 0 m	N (%) time 6 m	N(%) time 12 m	N (%) time 0 m	N (%) time 6 m	N (%) Time 12 m	N (%) time 0 m	N (%) time 6 m	N (%) Time 12 m	N (%) time 0 m	N (%) time 6 m	N (%) Time 12 m
Oral Findings												
Dental Caries	68 (56.7)	66 (59.5)	63 (57.8)	52 (43.3)	51 (42.5)	44 (37.9)	64 (53.3)	70 (63.0)	59 (55.7)	184 (51.1)	187 (51.9)	166 (46.1)
Dental plaque	112 (93.3)	103 (92.79)	102 (93.6)	107 (89.2)	107 (89.2)	96 (82.8)	108 (90.0)	98 (88.3)	89 (84.0)	327 (90.8)	308 (85.6)	287 (80.0)
Gingival Bleeding at brushing	54 (45.0)	34 (30.6)	16 (14.7)	49 (40.8)	23 (19.2)	11 (9.5)	44 (36.7)	32 (28.8)	11 (10.4)	147 (40.8)	89 (24.7)	38 (10.6)
Abnormal findings*	97 (80.8)	62 (55.86)	76 (69.7)	72 (60.0)	59 (49.2)	67 (57.8)	65 (54.2)	50 (45.0)	60 (50.0)	234 (65.0)	171 (47.5)	203 (56.4)
Enamel fluorosis	8	7	8	9	6	6	7	3	6	184 (51.1)		
Dental erosion	2	1	1	1	0	1	0	0	0	327 (90.8)		
Salivary Gland Swelling	3	1	0	2	0	0	0	0	0	147 (40.8)		
Other oral diseases												
Angular Cheilitis	1	0	0	0	1	0	3	0	1			
Herpetic Lesions	1	0	0	0	0	0	0	0	0			
HPV/wart-like lesions	1	0	0	0	0	0	0	0	0			

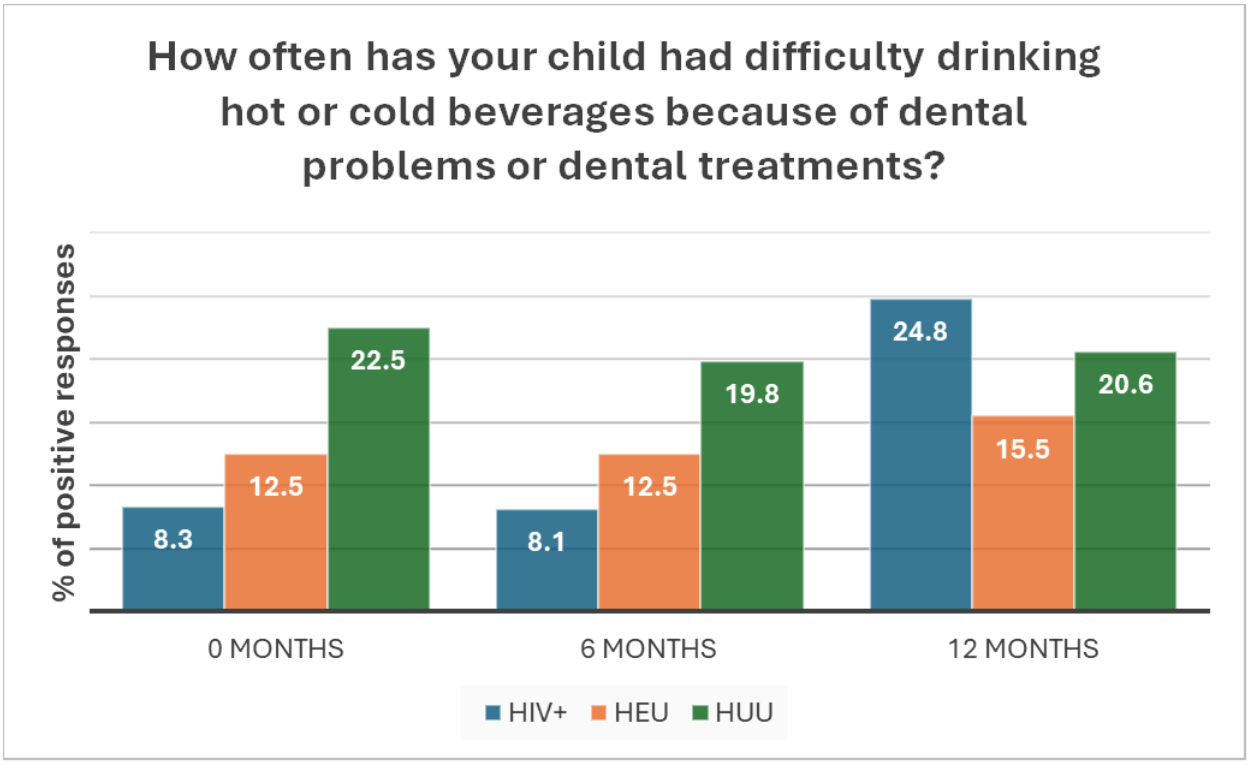
Table 3: ECOHIS questions

ECOHIS questions	HIV		HEU		HUU		Total		P value
	N(%)	Mean +/- SD	N(%)	Mean +/- SD	N(%)	Mean +/- SD	N(%)	Mean +/- SD	
Child Symptoms Domain (Has your child had ...?)									
Pain in teeth, mouth, jaw									
0 months	14 (11.7)	0.12 ±0.32	17 (14.2)	0.14 ±0.35	18 (15)	0.15 ±0.36	49 (13.6)	0.14 ±0.34	0.74
6 months	12 (10.8)	0.11 ±0.31	16 (13.3)	0.13 ±0.34	18 (16.2)	0.16 ±0.37	46 (13.3)	0.13 ±0.34	0.50
12 months	27 (24.6)	0.25 ±0.43	21 (18.1)	0.18 ±0.39	23 (20.9)	0.21 ±0.41	71 (21.1)	0.21 ±0.41	0.48
Child Function domain (Has your child had ... because of dental problems or dental treatments?)									
Difficulty Drinking hot or cold beverages									
0 months	10 (8.3)	0.08 ±0.28	15 (12.5)	0.13 ±0.33	27 (22.5)	0.23 ±0.42	52 (14.4)	0.08 ±0.28	0.006
6 months	9 (8.1)	0.08 ±0.27	15 (12.5)	0.13 ±0.33	22 (19.8)	0.20 ±0.40	46 (12.8)	0.13 ±0.34	0.04
12 months	27 (24.8)	0.25 ±0.43	18 (15.5)	0.16 ±0.36	22 (20.6)	0.21 ±0.41	67 (18.6)	0.20 ±0.40	0.22
Difficulty eating some foods									
0 months	13 (10.8)	0.11 ±0.31	15 (12.5)	0.13 ±0.33	23 (19.2)	0.19 ±0.4	51 (14.2)	0.11 ±0.31	0.15
6 months	12 (10.8)	0.11 ±0.31	16 (13.3)	0.13 ±0.34	21 (18.9)	0.19 ±0.39	49 (13.6)	0.14 ±0.35	0.21
12 months	23 (21.1)	0.21 ±0.41	20 (17.2)	0.17 ±0.38	22 (20.6)	0.21 ±0.41	65 (18.1)	0.20 ±0.40	0.73
Difficulty pronouncing any words									
0 months	7 (5.8)	0.06 ±0.24	9 (7.5)	0.08 ±0.26	10 (8.3)	0.08 ±0.28	26 (7.2)	0.06 ±0.24	0.75

6 months	6 (5.4)	0.05 ±0.23	5 (4.2)	0.04 ±0.20	10 (9.0)	0.09 ±0.29	21 (5.8)	0.06 ±0.24	0.29
12 months	0 (0)	0 ±0	4 (3.4)	0.03 ±0.18	3 (2.8)	0.03 ±0.17	7 (1.9)	0.02 ±0.14	0.16
Missed pre-school, day care or school									
0 months	4 (3.3)	0.03 ±0.18	3 (2.5)	0.03 ±0.16	3 (2.5)	0.03 ±0.16	10 (2.8)	0.03 ±0.18	0.90
6 months	4 (3.6)	0.04 ±0.19	3 (2.5)	0.03 ±0.16	4 (3.6)	0.04 (0.19)	11 (3.1)	0.03 ±0.18	0.86
12 months	2 (1.8)	0.02 ±0.13	4 (3.4)	0.03 ±0.18	6 (5.6)	0.06 ±0.23	12 (3.3)	0.04 ±0.19	0.33
Combined Child Function Domain									
0 months	18 (15)	0.28 ±0.78	29 (24.2)	0.36 ±0.72	42 (35.0)	0.55 ±0.84	88 (24.7)	0.40 ±0.79	0.02
6 months	16 (14.2)	0.28 ±0.79	25 (20.8)	0.33 ±0.73	35 (31.2)	0.53 ±0.87	76 (22.1)	0.38 ±0.80	0.04
12 months	34 (30.9)	0.48 ±0.78	26 (22.4)	0.40 ±0.83	30 (27.3)	0.50 ±0.92	90 (26.8)	0.45 ±0.84	0.64
Child psychology Domain (Has your child ... because of dental problems or dental treatments?)									
Had trouble sleeping									
0 months	5 (4.2)	0.04 ±0.2	6 (5)	0.05 ±0.22	10 (8.3)	0.08 ±0.28	21 (5.8)	0.04 ±0.20	0.35
6 months	4 (3.6)	0.04 ±0.19	6 (5.0)	0.05 ±0.22	9 (8.1)	0.08 ±0.27	19 (5.3)	0.06 ±0.23	0.32
12 months	5 (4.6)	0.05 ±0.21	7 (6.0)	0.06 ±0.24	7 (6.5)	0.07 ±0.25	19 (5.3)	0.06 ±0.23	0.81
Been irritable or frustrated									
0 months	4 (3.3)	0.03 ±0.18	5 (4.2)	0.04 ±0.2	6 (5)	0.05 ±0.22	15 (4.2)	0.03 ±0.18	0.81
6 months	4 (3.6)	0.04 ±0.19	5 (4.2)	0.04 ±0.20	4 (3.6)	0.04 ±0.19	13 (3.6)	0.04 ±0.19	0.99
12 months	3 (2.8)	0.03 ±0.16	3 (2.6)	0.03 ±0.16	3 (2.8)	0.03 ±0.17	9 (2.5)	0.03 ±0.16	0.99

Combined Child Psychology Domain									
0 months	6 (5)	0.09 ±0.43	8 (6.6)	0.13 ±0.49	12 (10)	0.17 ±0.56	26 (7.2)	0.13 ±0.50	0.50
6 months	5 (4.5)	0.10 ±0.49	8 (6.7)	0.13 ±0.49	12 (10.7)	0.15 ±0.49	25 (7.3)	0.13 ±0.49	0.71
12 months	6 (5.4)	0.08 ±0.39	9 (7.8)	0.09 ±0.35	9 (8.2)	0.09 ±0.32	24 (7.14)	0.09 ±0.35	0.96
Self image/social interaction domain (Has your child ... because of dental problems or dental treatments?)									
Avoided Smiling									
0 months	2 (1.7)	0.02 ±0.13	3 (2.5)	0.03 ±0.16	4 (3.3)	0.03 ±0.18	9 (2.5)	0.02 ±0.13	0.71
6 months	3 (2.7)	0.03 ±0.16	3 (2.5)	0.03 ±0.16	4 (3.6)	0.04 ±0.19	10 (2.8)	0.03 ±0.17	0.87
12 months	1 (0.9)	0.01 ±0.10	1 (0.9)	0.01 ±0.09	0 (0)	0 ±0	2 (0.6)	0.01 ±0.08	0.62
Avoided Talking									
0 months	1 (0.8)	0.01 ±0.09	4 (3.3)	0.03 ±0.18	6 (5)	0.05 ±0.22	11 (3.1)	0.01 ±0.09	0.17
6 months	1 (0.90)	0.01 ±0.09	4 (3.3)	0.03 ±0.18	5 (4.5)	0.05 ±0.21	10 (2.8)	0.03 ±0.17	0.27
12 months	0 (0)	0 ±0	2 (1.7)	0.02 ±0.13	0 (0)	0 ±0	2 (0.6)	0.01 ±0.08	0.15
Combined Self Image/Social Interaction Domain									
0 months	21 (17.5)	0.18 ±0.41	22 (18.3)	0.22 ±0.49	29 (24.2)	0.28 ±0.54	72 (20)	0.23 ±0.48	0.26
6 months	19 (17)	0.18 ±0.41	21 (17.5)	0.21 ±0.48	30 (26.8)	0.31 ±0.54	70 (20.4)	0.23 ±0.48	0.12
12 months	17 (15.4)	0.16 ±0.36	17 (14.7)	0.16 ±0.42	14 (12.7)	0.13 ±0.34	48 (12.3)	0.15 ±0.37	0.79

Figure 1


How often has your child had difficulty drinking hot or cold beverages because of dental problems or dental treatments?
% of positive responses
8.3
12.5
22.5
8.1
12.5
19.8
24.8
15.5
20.6
0 MONTHS
6 MONTHS
12 MONTHS
HIV+
HEU
HUU

VII. REFERENCES

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