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Factors associated with caregivers' perception of children's health and oral health status: a study of 6- to 36-month-olds in Uganda

MARGARET WANDERA[1,2,3], JOSEPHINE KAYONDO[1,2,3], INGUNN MARIE S. ENGEBRETSEN[2], ISAAC OKULLO[3] & ANNE NORDREHAUG ÅSTRØM[1,2]

[1]Institute of Clinical Dentistry, University of Bergen, Bergen, Norway, [2]Centre for International Health, University of Bergen, Bergen, Norway, and [3]Department of Dentistry, Makerere University, Kampala, Uganda

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Background. The impact of oral diseases on quality of life of children and their families has not been thoroughly investigated.

Aim. Focusing on Ugandan infants aged 6–36 months and their caregivers, this study examined the degree to which clinical and psychosocial factors were associated with caregivers' overall evaluation of their children's oral health and health status.

Design. Eight hundred and sixteen children were examined for dental caries and anthropometric status in 2007. A questionnaire was completed by the caregivers.

Results. Poor child oral health was reported by 40.2% and 17.5% of caregivers who reported their children's health as, respectively, poor and good. Having the least family wealth [odds ratio (OR) = 1.9] and reporting distressed family activities (OR = 2.3) were associated with higher odds of reporting poor child oral health, whereas being a rural resident (OR = 0.4) and reporting no symptoms during tooth eruption (OR = 0.3) were associated with lower odds. Perception of poor child oral health (OR = 2.8) and having the least family wealth (OR = 1.7) were associated with higher odds of reporting poor child health status, whereas no stunting was associated with lower odds (OR = 0.5).

Conclusion. The results support the growing recognition of oral health as a predictor of health and well-being in early childhood.

Introduction

Empirical evidence suggests that socio-demographic, clinical, and self-perceived oral health indicators affect oral health-related quality of life (OHRQoL) in adults[1–4]. Few attempts have been made to evaluate the full range of influencing factors in child populations[5–7], and the impact of oral diseases on the OHRQoL of preschool children and their families has not been thoroughly investigated[8,9]. In Uganda, about five of every ten children aged 3–5 years experience early childhood caries (ECC)[10]. Left untreated, ECC can lead to dental pain, affect play and sleep, and cause avoidance of certain types of food[6]. ECC might interfere adversely with body height and weight, and finally with the child's nutritional status, general health, and well-being[11]. Evidence suggests that ECC results in lost workdays for caregivers who have to stay home with their child or spend time and money to access dental care[12,13].

A few instruments are now available for measuring OHRQoL in school-age children: the Child Oral Quality of Life Questionnaire including the Parental Caregiver Perception Questionnaire; the Family Impact Scale; three Child Perception questionnaires for children aged 6–7, 8–10, and 11–14 years; the Child Oral Impacts on Daily Performance inventory; and Child Oral Health Impact profile for school-age children of 8–15 years[12–18]. As contemporary concepts of child health refer to both the child and the family, most of these measures contain items pertaining to the children themselves as well as their caregivers[19]. Recently, the Early Childhood Oral Health

Correspondence to:
Anne Nordrehaug Åstrøm, Institute of Clinical Dentistry, Faculty of Medicine and Odontology, University of Bergen, Bergen, Norway. E-mail: anne.nordrehaug@cih.uib.no

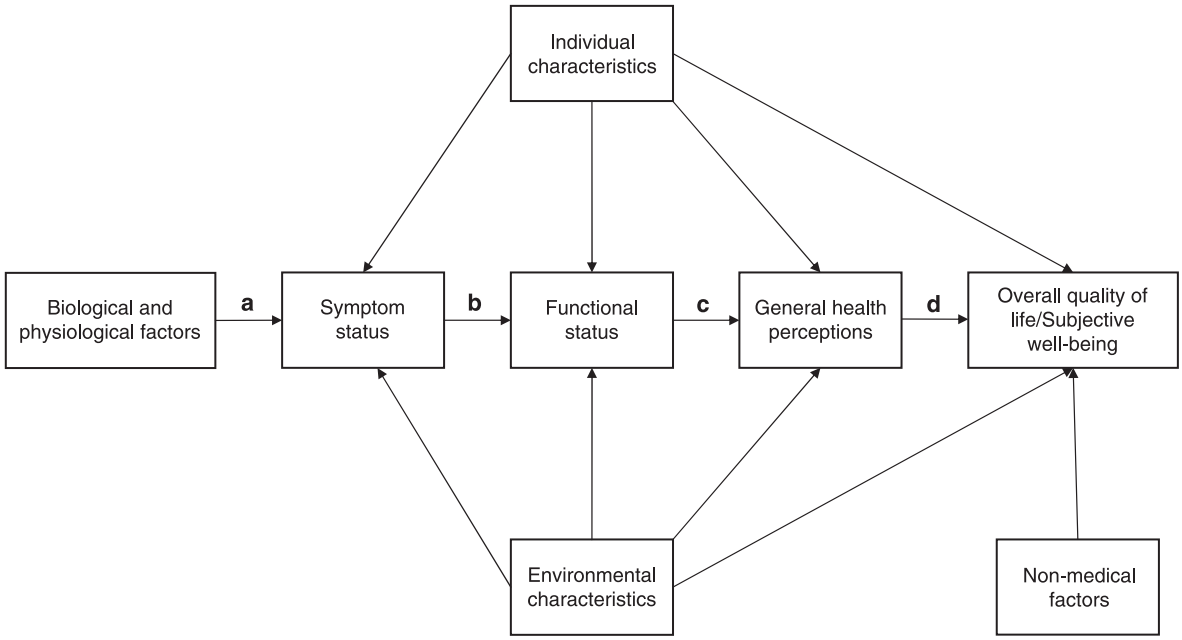

Fig. 1. Wilson and Cleary, modified conceptual model of patient outcomes.

Impact Scale (ECOHIS) was developed to assess oral health effects among preschool children aged 0–5 years, and the impact of the child's oral condition on the family[8,9]. In addition to several multi-item scales for assessing OHRQoL, single-item global indicators such as self-rated oral health status are also widely used in oral health research[20]. As summary indicators, integrating several oral health concepts such as biological state; symptoms; and physical, psychological, and social functioning, single-item global indicators can substitute for more complex multi-item scales. Single-item global indicators of oral health, however, have seldom been used as the primary outcome in dental studies focusing on young children in developing countries.

Wilson and Cleary[21] (Fig. 1) classified health outcomes into five main levels: biological and physiological variables, symptom status, functional status, general health perceptions, and overall quality of life or subjective well-being. Accordingly, studies of self-rated oral health status need to address the following main concepts: oral disease and disorder, oral health-related symptoms, and functional disadvantages. Within this terminology, *oral disease and tissue damage* refers to disorders at the organic level or tissue loss. *Oral pain* denotes the immediate consequences of disease and tissue damage, and *functional disadvantage* refers to the psychosocial and behavioural consequences of oral disease such as difficulties in performing daily activities. The final concept of *self-rated oral health* is the subjects' expressed overall evaluation of oral condition, incorporating expectations, values, and social and cultural background. Specifically, this conceptual model hypothesizes a progression from distal determinants such as oral diseases to more intermediate and proximal determinants such as pain, functional problems, and oral disadvantages. Distal determinants (e.g. oral disorder) might influence oral health perceptions directly or indirectly through factors at the intermediate (symptom status) and proximal (functional disadvantage) levels of the hierarchy. Finally, proximal-level determinants constitute the immediate direct influences on health and oral health perceptions. Focusing on Ugandan infants aged 6–36 months and their parents/caregivers, and guided by the conceptual framework of Wilson and Cleary[21], the purpose of this study was to examine the degree to which clinical and psychosocial factors relating to child oral health were associated with caregivers' overall evaluation of child oral health and general health status.

Materials and methods

A cross-sectional Mother and Child Health Clinic (MCH)-based study was conducted in Kampala district during June–October 2007. Kampala, the capital city of Uganda, covers an area of 197 km^2 and has a population of 1.2 million of whom 18% are under 5 years. Kampala has an overall literacy rate of 88.4%[22]. It is administratively divided into five divisions, two of which, Nakawa (42.5 km^2) and Makindye (40.6 km^2), constituted the study areas. In 2008, Nakawa had a total population of 300 000, including 80 000 females aged 15–49. The corresponding figures for Makindye were 380 000 and 100 000. One non-governmental (Kibuli) and one governmental (Naguru) MCH care facility was purposely selected in Makindye and Nakawa, respectively. Both facilities have large catchment areas and include community outreach clinics for the provision of child immunization. The Ministry of Health in Uganda, through the Uganda National Expanded Program for Immunization, requires all children aged 0–5 years to visit MCH clinics for immunization and growth monitoring. Uganda currently has an immunization coverage rate of 80% for all childhood vaccines[23]. The inclusion criteria were caregivers with children aged 6–36 months attending the Kibuli and Naguru clinics for immunization and/or growth monitoring. Caregiver–child pairs who presented at the clinics for treatment of any illness were excluded. All caregiver–child pairs who attended the clinics during the study period and satisfied the inclusion criteria predefined for the study were eligible for participation. Out of 831 caregivers approached, 816 agreed to participate (response rate 98%). This matched the required sample size of 800 mother/caregiver–child pairs precalculated on the basis of a 30% prevalence of ECC and a standard error of 3% among 3-year-old children. Another 5% was added to the sample size to account for children who had to be excluded from the analysis for being the second eligible child of the same mother/caregiver. Data were collected through oral clinical examinations, anthropometric measurements, and structured interviews with the caregivers. Permission to carry out this study was given by The Ethical Committee of Uganda National Council of Science and Technology and by the Research and Publication Committee at Makerere University, and by district administrative authorities. Informed verbal consent was obtained from all participating caregivers.

Interview

A structured interview schedule was constructed in English and translated into Luganda (the main local language of the central region) by trained research assistants. Health professionals reviewed the structured interview for semantic and conceptual equivalence. Sensitivity to culture and selection of appropriate words were considered. The interview schedule was piloted before it was administered in the main study. The Wilson and Cleary model[21] was applied to identify determinants of child health and oral health status, and to help structure the multivariate analysis. *Functional disadvantages* were assessed using a modified version (i.e. four items) of the original 13-item ECOHIS inventory[8]. Owing to the infrequent nature of oral problems and the young age of the children considered, the caregivers were asked to consider the child's whole lifespan. Children's oral impacts were assessed using four questions ('Has Name ever cried/failed to sleep/refused to eat/refused to play because of pain in mouth?') with response categories (1) yes and (0) no (instead of the 6-point response scale of the original ECOHIS inventory). For the purposes of statistical analysis, four dummy variables were summarized (range 0–4) and dichotomized into (0) 'no child impact' and (1) 'at least one child impact'. Family impacts caused by the child's oral problems were assessed using nine items ('How often due to child's oral problems have you or any other family member taken time off work, attention from you, less time for yourself, sleep disturbances, disturbance in family activities, upset, felt guilty, family disagreement, financial problems') emanating from the Family Impact Scale by Locker and colleagues[13]. Response categories were (1) never, (2) once/twice, (3) sometimes, (4) every day, (5) I do not know. All 'don't know' responses were recoded as missing, and each item was thereafter dichotomized into (0) 'never experienced impact' (based on the original category 1) and (1) 'experienced impacts' (based on the original categories 2–4). The dummy variables

were summarized (range 0–9) and dichotomized to (0) 'no family impact' and (1) 'at least one family impact'. *Perceived child health and oral health status* was measured by asking, 'Generally speaking – how would you describe the general health status/oral health status of (Name) (your child)?'. Response categories ranged from (1) 'very good' to (5) 'very poor', and were dichotomized into (0), (1) for use in logistic regression analyses. *Symptom status* was assessed as: 'ever experienced toothache' (1) 'yes', (0) 'no'; 'experience of symptoms during tooth eruption' (1) yes, (0) no; 'experience of fever during teeth eruption' (1) yes, (0) no; and 'ever experienced swollen gums' (1) yes, (0) no. *Socio-demographic variables* were: place of residence for most of life, place of recruitment, gender, and age. Family wealth was assessed as an indicator of socioeconomic status according to a standard approach in equity analysis[24]. Durable household assets indicative of family wealth (i.e. radio, television, telephone, refrigerator, lantern, cupboard, bicycle, motorcycle, car, boat) were recorded as (1) 'available and in working condition' or (0) 'not available and/or not in working condition.' These assets were analysed using principal component analysis. The first component resulting from this analysis was used to categorize households into four approximate quartiles of wealth ranging from the first quartile (least poor) to the fourth (poorest).

Clinical oral examination

The clinical oral examination was carried out by one dentist (JK), whereas a trained assistant recorded the observations. Caries of erupted teeth in the primary dentition was examined visually under field conditions using natural light and a mouth mirror. Lesions were recorded as present when a carious cavity was apparent on visual inspection. Data were collected on the tooth level, and caries was recorded on fully and partially erupted teeth in terms of decayed, missing, and filled teeth caused by caries, using the World Health Organization (WHO) recommendations for oral health surveys[25].

Anthropometric status

Before the children were examined clinically, their weight and recumbent length were taken in accordance with WHO recommendations[26]. Standardized 25-kg portable Salter Spring scales measuring to the nearest 0.1 kg were used to determine weight. Recumbent length was measured to the nearest 0.1 cm with specially designed length boards. Using the WHO Child Growth Standards (WHO Anthro 2005 software), anthropometric indices were constructed on the basis of weight, length, age, and sex[26]. Wasting was defined as weight-for-height z-scores < -2 SD, stunting as height-for-age z-scores < -2 SD, and underweight as weight-for-age z-scores < -2 SD[26].

Analysis

Data were analysed using SPSS version 15.0 (Chicago, IL, USA). Continuous data (anthropometric status) and categorical data were analysed using independent sample t-tests and cross-tabulation with chi-squared statistics, respectively. Determinants of parental perceptions of child health and oral health status were assessed using multiple logistic regression analysis, taking the hierarchical relationship between the various independent variables into account[27,28]. After controlling for socio-demographic variables, oral health outcome variables were grouped into a hierarchy ranging from distal determinants (clinical oral indicators) through intermediate determinants (symptoms) to proximal determinants (functional impairment and disadvantage) in accordance with Wilson and Cleary's model[21]. For each step, unconditional logistic regression was performed as a first step, and explanatory variables for the final model were selected if $P < 0.05$ after adjustment for all other 'same block variables'. Descriptive statistics were based on the total sample of 816 child/caregiver pairs, whereas bivariate and multiple binary regression analyses were based on the children with at least one erupted tooth ($n = 725$).

Results

Reproducibility

Duplicate clinical examinations of 50 randomly selected children and caregivers gave kappa statistics of 1.0 for children's prevalence of caries

Table 1. Frequency distribution of socio-demographic, clinical, and non-clinical independent variables and their categories by site of recruitment (*n* = 816).

Variable	Categories	Total % (*n*)	Makindye (total *n* = 541) % (*n*)	Nakawa (total *n* = 275) % (*n*)
Place of residence lived	Urban	75.0 (612)	77.6 (420)	69.8 (192)
	Rural	25.0 (204)	22.4 (121)	30.2 (83)*
Relationship to child	Mother	94.6 (772)	93.5 (506)	96.7 (266)
	Father/caregiver	5.3 (44)	6.7 (35)	3.3 (9)
Household assets index	First quartile – least poor	24.9 (203)	25.1 (136)	24.4 (67)
	Second quartile	24.5 (200)	26.8 (145)	20.0 (55)
	Third quartile	25.6 (209)	24.0 (130)	28.7 (79)
	Fourth quartile – poorest	25.0 (204)	24.0 (130)	26.9 (74)
Age of parent/caregiver	13–24 years	54.3 (443)	51.8 (280)	59.3 (163)
	25–52 years	45.7 (373)	48.2 (261)	40.7 (112)*
Sex of child	Boy	50.7 (414)	51.4 (278)	49.5 (136)
	Girl	49.3 (402)	48.6 (263)	50.5 (139)
Age of child	6–12 months	45.5 (371)	41.4 (224)	53.5 (147)
	13–24 months	29.7 (242)	31.6 (171)	25.8 (71)
	25–36 months	24.9 (203)	27.0 (146)	20.7 (57)**
Total number of teeth	Absent	11.2 (91)	7.6 (41)	18.2 (50)
	1–20 Teeth	88.8 (725)	92.4 (500)	81.8 (225)**
Tooth decay (at least one tooth)	Present	18.1 (148)	21.4 (116)	11.6 (32)**
Wasted	Yes	6.1 (50)	7.6 (41)	3.3 (9)*
Stunted	Yes	16.8 (137)	18.3 (99)	13.8 (38)
Underweight	Yes	8.6 (70)	11.6 (63)	2.5 (7)**
Symptoms during teeth eruption	Yes	85.6 (661)	83.9 (442)	89.4 (219)
Ever toothache	Yes	3.1 (25)	3.6 (19)	2.2 (6)
Ever swollen gums	Yes	7.2 (58)	7.1 (38)	7.4 (20)
Fever during tooth eruption	Yes	67.2 (444)	62.7 (277)	76.3 (167)**
Child impact	= 1 impact	37.7 (308)	36.6 (198)	40.0 (110)
Family impact	= 1 impact	47.1 (378)	47.4 (250)	46.5 (128)

*$P < 0.05$; **$P < 0.001$.

(dt > 0) and number of teeth erupted. Kappa statistics for parental perception of child oral impacts, family impacts, and perceived child oral health and general health status ranged from 0.24 to 0.91.

Sample characteristics

Table 1 gives the categories, coding, and percentage distribution of the independent variables in the total sample ($n = 816$) and according to recruitment site. Among the caregivers responding on behalf of the child, 94.6% were mothers and 5.3% were fathers or other caregivers. Their mean age was 24.8 years (95% CI 24.5–25.2). The total of 816 children with mean age 17.6 months (95% CI 16.9–18.3) included 414 boys (50.7%). Most (59.5%) had mothers with higher education and were resident in urban areas (75%). Totals of 6.1%, 16.8%, and 8.6% of the children were respectively wasted, stunted, and underweight, a pattern similar to that described previously among children of similar age in Uganda[28]. As shown in Table 1, children with at least one erupted tooth, experience of caries, underweight status, and wasting were more frequently found in Makindye than in Nakawa ($P < 0.05$). Direct age standardization, using the standard world population as reference population, did not accentuate the crude rate difference in perceived child oral impact. It did, however, accentuate the crude rate difference with respect to family impact (48% in Makindye vs. 34% in Nakawa).

Psychometric properties of the child and family oral impact scores

Regarding the frequency distribution of the four and nine items constituting, respectively, the early child oral health impact score and the family impact score adapted from the

ECOHIS[8] and Locker's Family Impact Scale[13], ever cried (36.5%) and ever refused to eat (32.5%) because of pain in the mouth were the two most frequently reported child impacts. Totals of 37.7% and 47.1% of caregivers scored ≥ 1 on the Child Oral Impact scale and the Family Impact scale, respectively. The internal consistency reliability for the Child Impact Score was Cronbach's alpha = 0.8. A total of 45.9% children with tooth decay vs. 35.9% without ($P < 0.05$) scored ≥ 1 on the Child Oral Impact scale. Moreover, 41.6% children with experience of symptoms during tooth eruption vs. 20.7% ($P < 0.001$) without had scores ≥ 1 on this scale. The Family Impact Scale data indicate that the percentages of caregivers reporting no impacts ranged from 58% (attention) to 94% (disagreement in family). Cronbach's alpha for the Family Impact Scale was 0.92. A total of 60% of parents having children with weight-for-age < –2 (underweight) vs. 45.9% of those having children with weight-for-age score ≥ –2 scored ≥ 1 on the Family impact scale ($P < 0.05$).

Correlates of parental perception of child's oral health and health status

In total, 23.0% (182) and 32.5% (244) of the caregivers reported poor child oral health and poor child health, respectively. The corresponding figures in Makindye and Nakawa were 24.0% and 21.1% for poor child oral health, and 33.3% and 30.9% for poor child health status. Direct age standardization did not accentuate the crude rate differences in perceived child oral health or health status. Caregivers' perceived child oral health and health status did not vary systematically with child's gender or recruitment site (Makindye/Nakawa), so it was decided to present the results for the two sites combined. Perceived child health and oral health status were statistically significantly associated: poor child oral health status was reported by 40.2% vs. 17.5% ($P < 0.001$) of caregivers who rated child health status as, respectively, poor versus good. As shown in Table 2, place of residence where raised, family wealth, fever during tooth eruption, child impact, and family impact scores were all statistically significantly associated with caregivers' perception of child oral health and general health status.

Initial unconditional regression analysis with child oral health status as the dependent variable selected place of residence where raised; family wealth; and child's age for the first, tooth decay for the second, symptoms and toothache for the third, and family impact score for the fourth step of the final multiple logistic regression analysis to control further for potential confounding and to identify any mediation of effect (Table 3). In the final model, place of residence where raised, family wealth, child's age, symptoms during tooth eruption, toothache, and family impacts were all statistically significantly associated with poor oral health status as perceived by the caregiver, and explained 15.9% of the variance in the outcome variable (Nagelkerke's $R^2 = 0.159$). As shown in Table 3, tooth decay did not remain a statistically significant predictor after controlling for family impacts, indicating that oral disadvantage mediated the effect of tooth decay on the outcome variable. Applying the same procedure for data analysis, the following predictors of perceived child health status were selected for subsequent modelling: household wealth index and low height for age, fever during tooth eruption, and family impacts. In view of the strong bivariate association between perceived child oral health and perceived child general health status, perceived child oral health status was entered as a final predictor after controlling for all other variables in the model. In the final step (Nagelkerke's R^2 0.133), family wealth, stunting, and perceived child oral health status turned out to be statistically significantly associated with perceived child health status (Table 4). Family impact did not maintain its statistically significant relationship in step IV, indicating that its effect on perceived child health status was mediated through perceptions of child's oral health status.

Discussion

In accordance with the propositions of Wilson and Cleary's model[21], this study confirmed the relationships of caregivers' perceived child oral health and general health status with sociodemographic, clinical, and reported oral health indicators. Thus, oral health indicators at various levels of the conceptual hierarchy

Table 2. Percentages of caregivers' perception of poor child oral health and health status by socio-demographic, behavioural, clinical, and psychosocial variables (*n* = 725).

Variable	Poor child oral health status % (*n*)	Poor child health status % (*n*)
Place of residence		
Urban	27.4 (149)	34.1 (185)
Rural	18.1 (33)*	32.4 (59)
Household assets index		
First quartile – least poor	19.6 (37)	25.4 (48)
Second quartile	27.0 (47)	33.3 (58)
Third quartile	23.2 (43)	38.9 (72)
Fourth quartile – poorest	31.1 (55)*	37.3 (66)*
Sex of child		
Boy	24.6 (92)	33.7 (126)
Girl	25.6 (90)	33.6 (118)
Age of child		
6–12 months	18.9 (53)	30.3 (84)
13–24 months	21.9 (53)	36.4 (88)
25–36 months	37.4 (76)**	35.5 (72)
Height for age < –2		
Yes	29.8 (37)	49.2 (61)
No	24.1 (145)	30.4 (183)**
Weight for age < –2		
Yes	29.7 (19)	48.4 (31)
No	24.7 (163)	32.2 (213)*
Ever toothache		
Yes	64.0 (16)	48.0 (12)
No	23.1 (159)**	33.0 (227)
Symptoms during teeth eruption		
Yes	26.6 (171)	34.4 (221)
No	13.3 (11)*	27.7 (23)
Fever during eruption		
Yes	30.1 (131)	37.9 (165)
No	19.3 (40)**	27.1 (56)**
Swollen gums		
Yes	42.9 (24)	42.9 (24)
No	23.3 (153)*	32.3 (212)
Any caries experience		
Yes	38.5 (57)	31.8 (47)
No	21.7 (125)**	34.1 (197)
Family impact > 0		
Yes	34.2 (121)	39.5 (140)
No	16.2 (58)**	27.1 (97)**
Child impact > 0		
Yes	34.9 (101)	40.1 (116)
No	18.6 (81)**	29.4 (128)**

*$P < 0.05$; **$P < 0.001$.

influenced caregivers' overall responses to the oral health status of Ugandan infants significantly although differently. ECC, when used in combination with socio-demographics, oral symptoms, and oral disadvantage, explained significantly more of the caregivers' concerns about children's oral health status than did the disease indicator alone. Similar findings were observed for perceived child health status, although the initial effect of fever during tooth eruption did not remain statistically significant after controlling for socio-demographic factors. Previous research suggests that oral health-related problems such as pain, and problems with eating, smiling, and communicating have a profound effect on people's general health and well-being[1,18]. The present results add to this evidence, showing that caregivers' perception of child oral health status was statistically significantly associated with child general health

Table 3. Caregivers' perception of poor oral health status regressed on socio-demographic, clinical, and reported oral health indicators (*n* = 725).

Independent variables	Adjusted OR 95% CI	*P* value
Step 1: socio-demographics		
Place of residence: Urban	1	0.001
Rural	0.5 (0.3–0.7)	
Household index: First quartile – least poor	1	
Second quartile	1.5 (0.9–2.5)	0.096
Third quartile	1.2 (0.7–2.1)	0.497
Fourth quartile – poorest	1.9 (1.1–3.3)	0.015
Age of child: 6–12 months	1	
13–24 months	1.0 (0.7–1.8)	0.565
25–36 months	2.4 (1.5–3.6)	0.036
Step II: clinical oral health indicators		
Place of residence: Urban	1	
Rural	0.4 (0.3–0.7)	0.001
Household index: First quartile – least poor	1	
Second quartile	1.5 (0.9–2.6)	0.088
Third quartile	1.3 (0.7–2.2)	0.476
Fourth quartile – poorest	2.0 (1.2–3.3)	0.013
Age of child: 6–12 months	1	
13–24 months	0.9 (0.6–1.5)	0.590
25–36 months	1.8 (1.0–2.6)	0.027
Any caries experience: No	1	
Yes	1.6 (1.0–2.6)	0.041
Step III: symptoms		
Place of residence: Urban	1	
Rural	0.4 (0.2–0.7)	0.001
Household index: First quartile – least poor	1	
Second quartile	1.5 (0.9–2.7)	0.078
Third quartile	1.2 (0.7–2.1)	0.384
Fourth quartile – poorest	2.0 (1.2–3.3)	0.011
Age of child: 6–12 months	1	
13–24 months	0.8 (0.5–1.3)	0.681
25–36 months	1.8 (1.1–1.9)	0.021
Any caries experience: No	1	
Yes	1.6 (1.0–2.6)	0.072
Symptoms during tooth eruption: Yes	1	
No	0.2 (0.1–0.5)	0.000
Ever toothache: Yes	1	
No	0.2 (0.1–0.7)	0.039
Step IV: functional disadvantages		
Place of residence: Urban	1	
Rural	0.5 (0.2–0.7)	0.001
Household index: First quartile – least poor	1	
Second quartile	1.5 (0.9–2.6)	0.072
Third quartile	1.2 (0.7–2.1)	0.414
Fourth quartile – poorest	1.9 (1.1–3.3)	0.014
Age of child: 6–12 months	1	
13–24 months	0.8 (0.5–1.4)	0.585
25–36 months	1.7 (1.0–2.8)	0.027
Any caries experience: No	1	
Yes	1.6 (0.9–2.6)	0.080
Symptoms during tooth eruption: Yes	1	
No	0.3 (0.2–0.7)	0.002
Ever toothache: Yes	1	
No	0.3 (0.1–0.9)	0.028
Family impact: No	1	
Yes	2.3 (1.5–3.2)	0.000

Table 4. Caregivers' perception of poor child health status regressed on socio-demographic and self-reported oral health indicators (*n* = 725).

Independent variables	Adjusted OR 95% CI	*P* value
Step 1: socio-demographics		
Household index: First quartile – least poor	1	
Second quartile	1.4 (0.8–2.1)	0.178
Third quartile	1.8 (1.2–2.7)	0.011
Fourth quartile – poorest	1.6 (1.0–2.5)	0.041
Height for age: < –2 SD	1	
> –2 SD	0.4 (0.3–0.7)	0.001
Step II: symptoms		
Household index: First quartile – least poor	1	
Second quartile	1.3 (0.7–2.1)	0.206
Third quartile	1.7 (1.0–2.6)	0.018
Fourth quartile – poorest	1.5 (0.8–2.1)	0.081
Height for age: < –2 SD	1	
> –2 SD	0.4 (0.3–0.8)	0.001
Fever during tooth eruption: Yes	1	
No	0.7 (0.5–1.1)	0.028
Step III: functional disadvantage		
Household index: First quartile – least poor	1	
Second quartile	1.3 (0.8–2.8)	0.203
Third quartile	1.7 (1.1–2.8)	0.019
Fourth quartile – poorest	1.5 (0.9–2.5)	0.086
Height for age: < –2 SD	1	
> –2 SD	0.4 (0.3–0.7)	0.001
Fever during tooth eruption: Yes	1	
No	0.7 (0.4–1.1)	0.107
Family impact: No	1	
Yes	1.5 (1.1–2.2)	0.010
Step IV: perceived oral health status		
Household index: First quartile – least poor	1	
Second quartile	1.2 (0.7–2.1)	0.329
Third quartile	1.7 (1.1–2.9)	0.022
Fourth quartile – poorest	1.4 (0.8–2.4)	0.144
Height for age: < –2 SD	1	
> –2 SD	0.5 (0.3–0.7)	0.002
Fever during tooth eruption: Yes	1	
No	0.8 (0.5–1.2)	0.0214
Family impact: No	1	
Yes	1.3 (0.9–1.9)	0.000
Perceived oral health status: Good	1	
Poor	2.8 (1.9–4.2)	0.010

status after controlling for all other variables. Moreover, it appeared that child oral health status mediated the effects of more distal non-clinical oral health indicators in the conceptual hierarchy. Parental perceptions of child oral impacts on family activities strongly influenced their perception of child oral health, as well as child general health status.

Overall, the findings of this study reflect a substantial burden from oral diseases in Ugandan infants, supporting previous findings among pre- and primary school children in East Africa[5,6]. Because early childhood (i.e. from prenatal development to 8 years of age) is recognized as the most important developmental phase of life, these results might have implications for public health policy[29]. Recent findings from the Newcastle Thousand Families cohort study indicated that self-perceived oral health in middle-aged men was heavily influenced by factors operating in very early childhood[3].

The caregivers' overall response to children's oral and general health condition was strongly influenced by their social and cultural contexts.

Caregivers who had lived mostly in rural areas and those with poor family wealth were, respectively, less and more likely than their counterparts to perceive poor child oral health status. Because the social disparities observed were independent of tooth decay, they might have originated from other oral conditions not measured and/or from mechanisms linked to material and social deprivation[30]. According to recent information extracted from the district profile, poverty in Kampala has a 'rural face'; however, the urban poor in Kampala are most disadvantaged as they live in very poor and shanty housing conditions, lack access to support networks, and cannot afford the costs of health care services[22]. Contemporary evidence suggests that the lower the material standard of living, the worse the oral health, irrespective of the measure used to assess it (clinical or self-report indicators)[31]. Consistent with a gradient effect of family resources on a variety of developmental and health outcomes, this study suggests that poor family wealth and stunting were the strongest predictors of the parents' response to children's overall health condition[28]. Anthropometric measures have been recognized as important indicators of health and nutritional status among children in low-income countries where malnutrition is still a public health problem. Previous studies of Ugandan infants have identified socioeconomic factors as strong predictors of stunting, supporting the use of stunting as an indicator of socioeconomic status itself[28].

Most of the caregivers interviewed were satisfied with their child's oral health and health status even though various levels of untreated disease, malnutrition, symptoms, and psychosocial disadvantages were evident. Caregivers were more satisfied with their children's general health status than with their oral health status, which contradicts findings reported elsewhere[8]. According to the results of this study, Ugandan caregivers based their ratings of child oral health and general health status more strongly on the family life consequences of the child's oral condition than on normative treatment needs alone. Given the importance of parents in care seeking for their children, this finding merits further studies. Whereas caregivers did not seem to be in touch with children's disease status (ECC) when responding to their overall health status, ECC was a significant indirect predictor of child oral health status, its effect being mediated through impacts on family life. Accordingly, missing and decayed teeth have been found to be important predictors of self-rated oral health in older children[7]. Jokovic *et al.*[19] noted that whereas parents had limited knowledge about the child's clinical oral condition, they agreed with their children regarding the assessment of their OHRQoL. In this study, the caregivers' perception of impacts on children's daily performances and on family activities with reference to the child's whole lifespan was substantial, amounting to 37.7% and 47.1%. In comparison, among US children aged 5 years, the corresponding figures were 58.3% and 45.6%[10].

A strength of this study was the application of a conceptual framework to guide the statistical analyses and the interpretation of results. Failure to take such conceptual frameworks into consideration by entering all exploratory variables at the same time might underestimate the effects from distal factors in the conceptual hierarchy[24]. The psychometric properties of the modified ECOHIS and the Family impact scales employed were acceptable and comparable to those reported elsewhere[8,9]. This study also showed good examiner consistency and few cases with missing data, and the difficulties of interpretation that caregivers might suffer were compensated by personal interviewing. Being cross-sectional, this study cannot determine causality and direction. Thus, cohort designs are proposed to provide more robust knowledge of the factors influencing parents' concerns about their children's oral health and general health status. Moreover, the sampling method employed might make the external validity questionable. Potential biases caused by parents who refused to participate and to answer questions during the interview, as well as biases because of poor recall are of some concern[32]. A potential selection bias might have occurred, because parents with children attending the MCH clinics for treatment were excluded from participation. Apparently, rates of perceived bad child health and oral health are substantially higher in parents attending MCH clinics for the purpose of child

treatment than in parents with presumably healthy children attending for weight monitoring and immunization purposes. The exclusion criteria used do not mean that children with diseases were not present in the study sample, but might have led to an underestimation of the rates of parental health and oral health perceptions as observed in this study. On the other hand, the fact that the overall response rate was good, and the number of missing items limited suggests that the group for whom there are complete data is fairly representative of caregiver/child pairs attending MCH clinics for the purpose of immunization and weight monitoring in Makindye and Nakawa districts. Evaluating the results of this study, the possibility of a caregiver burden bias should be kept in mind. Proxy reports of the burden of oral diseases in children might reflect the distress of the parent rather than that of the child[19]. A substantial caregiver burden bias is less likely, however, because the distributions of family impact items were all skewed towards the 'never experienced' end of the scale. For the youngest children, such as those investigated in this study, a proxy rating by caregivers is indispensable. Nevertheless, there are difficulties in assessing the adequacy of proxy ratings as they might be confounded by various factors.

This study is one of only a few that has investigated the influence of socio-demographic, clinical, and non-clinical oral health indicators upon caregivers' perceptions of infants' health and oral health status, taking into account the hierarchical relationships among determinants. Overall concern with child oral health and health status were both strongly influenced by family wealth and impacts of the child's oral condition on family activities. Perceived child oral health and general health status were positively associated. This study adds to the growing recognition of oral health as an important predictor of health and well-being in early childhood.

What this paper adds

- This study confirmed the relationship of caregivers' perceived child health and oral health status with socio-demographic, clinical, and self-reported oral health indicators reflecting a substantial burden from oral diseases in Ugandan infants.
- Family impacts caused by child oral problems and poor family wealth were the strongest predictors of caregivers' perception of child oral health status.
- Poor family wealth and stunting were the strongest predictors of caregivers' response to child health status.
- Caregivers' perceptions of child oral health and general health status were positively associated, supporting a growing recognition of oral health as a mediator of health and well-being in early childhood.

Why this paper is important to paediatric dentists

- Provides information necessary for the planning, implementation and evaluation of preventive and treatment programs..
- This study indicates that in children as young as 6-36 months, oral health significantly impacts family well-being.
- This study indicates that low family wealth and oral problems are strong predictors of ill health in children as reported by their caregivers.

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