

ORIGINAL RESEARCH

Impact of children's oral and general health on children's quality of life and family well-being in Saudi Arabia: a cross-sectional study

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Abstract

Background: Dental caries among children in Saudi Arabia is still one of the most prevalent conditions that may negatively influence the oral health-related quality of life (OHRQoL) and family well-being. **Methods:** This cross-sectional study was conducted at Taibah University Hospital among 434 children (October 2023–July 2024). Untreated caries was clinically evaluated by licensed dentists following World Health Organization (WHO) guidelines, and the data was collected using Child Perception Questionnaire (CPQ11–14) short form questionnaire, and Family Impact Scale (FIS). **Results:** There was a significant association between poorer perceived oral and general health and higher CPQ11–14 scores, indicating worse OHRQoL ($p < 0.05$). Children with poor oral health also showed significantly higher family impact scores, reflecting greater burden and disruption of family functioning ($p < 0.001$). Oral hygiene practices and irregular dentist visits were found to be significant predictors of poor oral health using logistic regression. **Conclusions:** Saudi children aged 11 to 14 years with poor oral and general health were linked with impaired OHRQoL and high family burden. These results emphasise the need to adopt a prevention-based, family-centred approach to dental care for children and emphasize the use of OHRQoL measures in routine dental practice in Saudi Arabia.

Keywords

Child oral health; Dental caries; OHRQoL; Family impact; Cross-sectional study, CPQ11–14; Saudi Arabia

1. Introduction

Dental caries remains a leading chronic disease affecting children worldwide, posing significant health concerns for both affected individuals and their communities [1]. Despite advances in preventive and restorative dental methods, untreated dental caries persists, continuing to significantly impact children in developing and middle-income countries [2]. Childhood dental caries is one of the most common conditions globally, particularly affecting developing nations. Unmanaged tooth decay results not only in oral health issues, but also impacts physical health, educational performance, and family relationships [3–5]. The Global Burden of Disease Study found that untreated dental caries exists in the primary teeth of 514 million children worldwide [6]. Such untreated decay causes pain and discomfort, and is a found cause of impaired growth [7]. Dental caries is a major public health challenge for Saudi Arabian children, with multiple studies indicating high prevalence rates of the condition [8]. Alwafi [9] reported that over 62–80% of Saudi Arabian preschool children suffer from dental caries, mainly due to limited access, financial hardships, and a lack of awareness about the importance of dental care [9]. Research by Akcay *et al.* [10] demonstrates that untreated dental caries has

high prevalence among school children, adversely affecting their oral health and overall quality of life. Similar trends are observed across the Middle Eastern region, echoing these findings.

Dental caries treatment rates raised concerns because Al-bishi [11] observed high numbers in Saudi Arabia, followed by another study reporting similar figures in the United Arab Emirates [12]. The populations experience high rates of dental caries and poor oral health due to their diet choices and limited access to preventive dental services, along with inadequate oral health understanding by their parents and guardians [13]. Current data show that untreated poor oral health leads to significant deterioration in children's quality of life because the disease causes ongoing soreness, disturbed rest, and eating difficulties, which can result in nutritional deficiencies [14]. Children's school performance declines because dental pain causes them to miss classes and struggle to focus on their studies [15]. Children with severely poor health sometimes develop psychological issues, such as reduced self-esteem and increased social withdrawal [16]. The onset of pain and emotional distress from untreated caries necessitate the immediate implementation of preventive approaches and treatment protocols, as severe oral health problems place a substantial

financial and emotional burden on the affected families [17]. Persistent dental pain in children causes their parents to experience worry and distress, which impairs their ability to concentrate at work and worsens their overall health status [18].

Severe dental treatment emergencies involving untreated caries generate substantial financial costs that deeply affect low-income families because of the high cost of emergency care [19]. The research conducted by Abanto *et al.* [18] showed that parents with severe dental caries children face both financial stress alongside emotional impact, thus emphasizing the importance of urgent primary preventive measures. The relationship between oral health-related quality of life (OHRQoL) and dental caries has been extensively studied using tools such as Child Perception Questionnaire (CPQ11–14) [14]. However, gaps still exist in the literature. The existing evidence has paid considerable attention to oral health outcomes alone and little attention to the overall health status of children, despite growing awareness of the close interdependence between oral and overall health in childhood and adolescence. Moreover, despite the fact that the family impact has also been measured based on the Family Impact Scale (FIS), limited literature has measured both child-reported OHRQoL and family-level outcomes in the same analytical model, especially in middle-income and Middle Eastern regions.

The literature on this evidence is particularly scarce in Saudi Arabia, especially among early adolescents aged 11–14 years, who would have performed well on self-report but are inadequately represented in studies of oral health in the country. Studies on caries in Saudi Arabia have mostly focused on prevalence and clinical factors, and there is a lack of studies on psychosocial effects, caregiver organisation, and culturally sensitive patterns of caregiving, including grandparent care that is popular in Saudi society. Furthermore, the synergistic effects of sociodemographic factors, oral health practices, overall well-being, and use of dental services on the well-being of children and families have not been fully investigated. In order to fill in these gaps, the current study used a combined approach that evaluates clinical oral health status, parent-reported general health, child-reported OHRQoL (CPQ11–14), and FIS in Saudi children who are 11 to 14 years old and patients at dental hospitals. Additionally, in the context of Middle Eastern region the relationship between oral health and perceived general health remains underexplored. These gaps were addressed in this study by integration of clinical oral examinations, child self-reported CPQ11–14, general and oral health ratings from the caregiver's perspective, and FIS. Also, this study captures the cultural context in Saudi households such as grandparents as caregivers. Through this, combined effects of oral and general health on child and family well-being can be achieved in a Saudi Arabian setting. The study is more than a confirmation analysis and provides new context-dependent insights into the joint effects of oral and general health on the quality of life experienced by children and the well-being of their families. The findings contribute to the existing body of evidence by providing culturally competent prevention and family-centred pediatric care, including dental services, in Saudi Arabia.

The main objective of the study is to determine the relation-

ship between children's oral and overall health and OHRQoL in children aged 11–14 years at Taibah University Hospital in Saudi Arabia. The secondary objective is to assess the effects of children's oral and general health on family well-being and to identify relationships among sociodemographic characteristics, oral health behaviour, and child health outcomes. The study is expected to contribute to the existing literature by providing evidence on the effects of oral and general health on OHRQoL in children aged 11–14 years. Particularly, worse oral and general health is expected to be correlated with high CPQ11–14 scores, which indicate poorer OHRQoL among this age group. Besides, the families with children having a worse health status are likely to be more affected by the family factor, showing higher FIS scores. The results can be used to highlight the broader psychosocial burden of untreated dental caries on children and their caregivers and to underscore the need for preventive oral health measures and timely dental treatment.

2. Materials and methods

2.1 Study design

This study was a hospital-based cross-sectional study conducted among pediatric patients between the ages of 11–14 years in Taibah University Hospital, Al Madinah, Saudi Arabia, between October 2023 and July 2024.

2.2 Sampling technique and sample size

The sample was selected using a simple probability sampling technique from a list of patients in a hospital, with randomization being conducted in Microsoft Excel by allocating a random number to the eligible patients. The 347 minimum sample size was derived based on a prevalence of 65.6% dental caries in Saudi school children [20], with a 5% margin of error and a 95% interval because it was carried out in a hospital cohort, rather than a population-based random sample.

2.3 Inclusion and exclusion criteria

The participants in the study were children living in the Al-Madinah Province and enrolled patients at Taibah University Hospital. The sample comprised 11–14 years old children who had clinically-identified untreated dental caries that had been confirmed by a licensed dentist. The rationale of this age group is that the CPQ11–14 short-form questionnaire has been verified among children aged 11–14 years and in this age group, children can provide self-reported data relating to OHRQoL [21]. The parents or legal guardians were informed of their participation in advance. Children were also exempted when they had any systemic disorders that would affect oral health (including diabetes or autoimmune diseases), had been dentally treated in the last six months, or had no parental or guardian consent to the oral health assessment (due to language barriers, cognitive impairment, *etc.*).

2.4 Study tool and data collection

Licensed dentists accredited by the Saudi Commission for Health Specialties (SCFHS) and affiliated with the Taibah University Hospital conducted the clinical examinations. A struc-

tured questionnaire was used to gather data (**Supplementary material 1: English Questionnaire**). The questionnaire included both demographic data regarding the child (age and gender) and parents/caregivers (level of education, income status, and relations to the child).

The questionnaire was divided into three parts. Section one collected demographic and socioeconomic data of the child and caregiver. Section two evaluated oral health behaviors and status, including the level of dental health, the frequency of tooth brushing and flossing, dental attendance, and a dental history. Section three assessed OHRQoL through the Arabic short form CPQ11–14, which was developed on children aged 11–14 years and FIS which involves the impact of untreated dental caries on the daily functioning of the child, the emotional well-being, and the overall quality of life of the child and family. CPQ11–14 had high internal consistency, with a Cronbach's alpha greater than 0.80. Kassis *et al.* [22] have determined its validity and reliability within the Arabic-speaking population through the cross-cultural adaptation and validation studies. The validity and reliability of both CPQ11–14 and FIS as globally accepted measures of child OHRQoL and family-level effects of oral conditions are also supported by previous studies [21, 23–25].

The CPQ11–14 short-form version was used to assess OHRQoL. The instrument consists of 16 items distributed across four domains: oral symptoms, functional limitations, emotional well-being, and social well-being. Responses were recorded on a five-point Likert scale as follows; (0 = Never, 1 = Once or twice, 2 = Sometimes, 3 = Often, 4 = Every day or almost every day). Total CPQ11–14 scores ranged from 0 to 64, with higher scores indicating poorer OHRQoL. The FIS contained 14 items that measured four areas, namely, parental and family activities (5 items), family conflict (4 items), financial burden (1 item), and parental emotions (4 items). The responses were noted on a five-point Likert scale (0 = never, 1 = once or twice, 2 = sometimes, 3 = often, 4 = every day), with total scores ranging from 0 to 56, where higher scores reflect greater family impact. The oral and general health status of children was collected based on caregiver-reported ratings on a five-level scale (very good, good, fair, poor, very poor), and all five categories were both preserved and analysed as an ordinal health-status group.

2.5 Data collection procedures

The oral health examinations were conducted based on oral health survey guidelines as recommended by the World Health Organisation (WHO) by certified dentists of SCFHS [26]. All children were taken to a dental clinic and assessed with a mouth mirror and a dental explorer under the appropriate lighting conditions. The evaluation was dedicated to the existence of untreated dental carious lesions as opposed to calculating Decayed, Missing, and Filled Teeth (DMFT/dmft) indices.

A two-day training workshop was conducted on the dental caries diagnosis and the interpretation of intraoral photographs among the four clinical examiners. Inter- and intra-examiner reliability was also tested, and examiner calibration was performed before data collection on 30 children, with an overall Kappa value of more than 0.80, which is good agree-

ment. Clinical examiners only performed oral examinations and caries diagnosis.

Sociodemographic information and questionnaires were handled by two of the trained research assistants to reduce bias. Questionnaires in Arabic and English were structured and closed-ended. The Arabic short versions of CPQ11–14 and FIS were validated to ensure cultural and linguistic appropriateness.

The family income was divided into two groups according to the Saudi minimum wage, less than three times the minimum wage, and more than three times the minimum wage, and equal to it, which is similar to the socioeconomic classification applied in the preceding Saudi oral health research.

A pilot test with a sample of 30 children was conducted to determine feasibility, the comprehensibility of the questions, and logistical processes. Modifications to wording and administration were made slightly with respect to pilot feedback, and no substantial alteration of the study design. This study was not blinded because the cross-sectional clinical characteristics of the study prevented blindness due to direct oral examination, and the subjects were informed about the contents of the questionnaire.

2.6 Data analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS), version 27.0 (IBM Corp., Armonk, NY, USA). Demographic variables were recorded as categorical data and summarized using frequencies and percentages. Survey outcomes, including the CPQ11–14 short-form quality of life scores and FIS scores, were treated as continuous variables and reported as medians and interquartile ranges. Incomplete or partially completed questionnaires were excluded from the final analysis. Only fully completed surveys with no missing data for the main study variables were included, and no imputation methods were applied. The normality of continuous variables was assessed using the Shapiro-Wilk test, which indicated a non-normal distribution due to which Median and Interquartile range were reported. Consequently, non-parametric statistical tests were employed. The Kruskal-Wallis H test was used to compare continuous variables across multiple groups, while the Chi-square test was applied to examine associations between categorical variables. Variables derived from Likert-scale responses were treated as ordinal data; however, total CPQ11–14 and FIS scores were analyzed as continuous variables for statistical purposes. Multivariate regression analyses were conducted where appropriate to evaluate independent associations between oral health status, general health variables, and quality of life outcomes, while adjusting for potential confounding factors. Corresponding odds ratio (OR) and 95% confidence interval (CI) were reported, and assumptions underlying regression analyses, including independence of observations and absence of multicollinearity, were assessed prior to model interpretation. All statistical tests were two-tailed, and statistical significance was set at $p < 0.05$.

3. Results

3.1 Demographic characteristics of participants

The demographic characteristics of the participants are summarized in Table 1. The study sample included children aged 11–14 years, with a slightly higher proportion of females than males. Participants aged 11–12 years constituted the majority of the sample. Parental educational levels varied across the cohort, ranging from no formal education to higher education, indicating heterogeneity in educational backgrounds. Family income distribution was also diverse, with a substantial proportion of households earning less than three times the Saudi minimum wage. Regarding caregiving arrangements, although parents were the primary caregivers for most children, a notable proportion were cared for by grandparents. This finding reflects variation in household caregiving structures within the study population. In terms of health perceptions, 29.0% of children were reported to have very good general health, while 19.1% were reported as having very poor general health. Oral health status assessments showed that 14.7% of children were rated as having very good oral health, whereas 21.9% were rated as having very poor oral health (Fig. 1).

TABLE 1. Frequency distribution of demographics characteristics.

	n (%)
Age (yr)	
11–12	244 (56.2%)
13–14	190 (43.8%)
Gender	
Male	189 (43.5%)
Female	245 (56.5%)
Parents Educational Level	
No Education	92 (21.2%)
Primary	107 (24.7%)
Secondary	114 (26.3%)
Higher	121 (27.9%)
Family Income	
<3 times the minimum wage	198 (45.6%)
>3 times the minimum wage	236 (54.4%)
Relationship with Child	
Mother	73 (16.8%)
Father	107 (24.7%)
Grandparent	133 (30.6%)
Others	121 (27.9%)

3.2 Dental health assessment

The clinical and behavioral trends were identified as significant in the dental health assessment of participants. As Fig. 2 demonstrates, the percentage of children with irregular oral hygiene habits was high. The majority of children brushed their teeth less frequently than recommended, and only half of them used dental floss regularly. According to parental

reports, oral health problems, including trouble with chewing, gum problems, and pain during eating, were commonly reported and may reflect untreated caries or other oral conditions. Inconsistent dental attendance pattern was observed, as a significant percentage of the children did not visit a dentist at all or did so intermittently, which implied gaps in preventive care. Especially, regardless of these concerns, around a one-third of the participants reported no dental issues, which is an indication of the inconsistency in oral health conditions of the participants.

3.3 Quality of life measurement based on the CPQ11–14 questionnaire and family impact scale

The median CPQ11–14 self-reported score was 18 (16–20) according to the children's perception, while the parental self-reported score was 15 (12–17). The total CPQ11–14 score was 34 (29–38) (Supplementary Table 1). Regarding the FIS, the median score for the Parental and Family Activities domain was 16 (13–18), Parent Emotions was 12 (10–13), and Family Conflict was 12 (11–14). The total Family Impact Scale score was 42 (38–45) (Supplementary Table 2).

3.4 Children's general health based on dental health assessment

The overall health of children was associated with the oral health behaviours and conditions of children (Supplementary Fig. 1). Regular tooth brushing and flossing were positively associated with general health outcomes, and poor hygiene practices were also associated with poor health ratings. Dental visit patterns differed across health categories. The loss of teeth and inability to chew were especially isolated clinical issues in children with worse general health, which leads to the high level of oral cavity and systemic health interconnection.

3.5 Children's oral health based on dental health assessment

There was a difference in oral health status, hygiene practices, and dental attendance (Supplementary Fig. 2). Three times daily brushing and flossing were significantly associated with a very good oral health rating ($p < 0.001$), confirming the protective nature of regular preventive practices. On the other hand, children with fewer hygiene behaviours or no regular dental visits were more inclined towards falling into poor or very poor oral health categories and pain during eating and high number of fillings in these groups. The presence of a stable correlation among positive oral hygiene habits, regular dental visits, and desirable oral health status provides evidence of the importance of daily preventive habits in determining children's oral health.

3.6 Comparison of child general health and child oral health with the quality of life and family impact scale

The comparison of the general health status of children showed significant differences in OHRQoL and family-impact outcomes (Table 2). Parent-reported measures had a statistically

Child's General Health vs. Oral Health (Percentages)

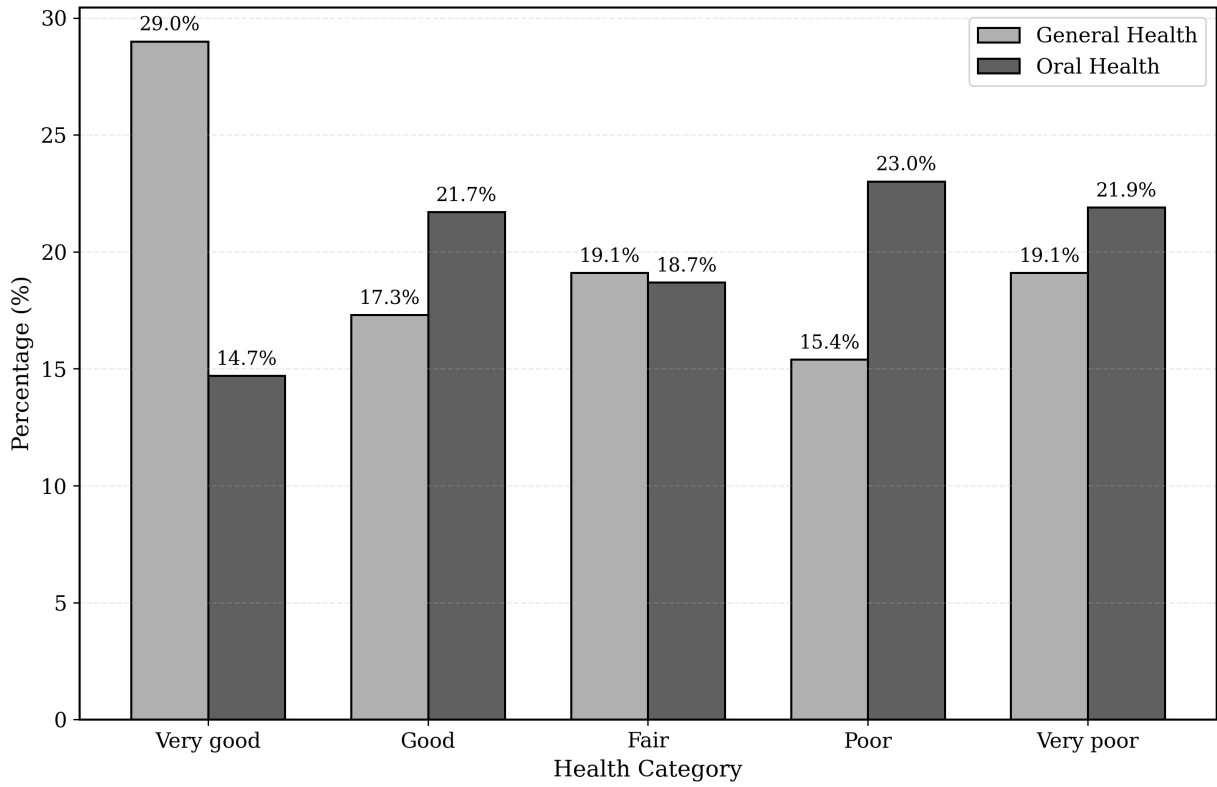


FIGURE 1. Children general and oral health.

Dental Health Behaviors and Issues

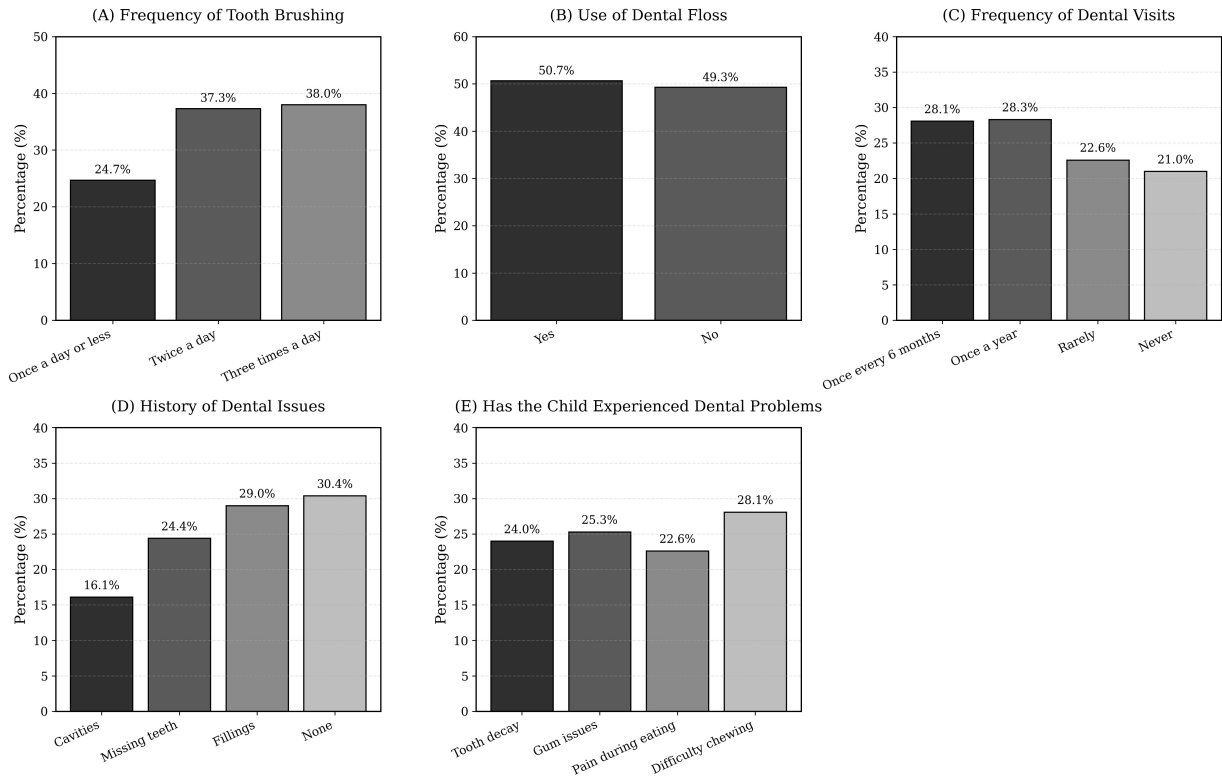


FIGURE 2. Dental health assessment: (A) Frequency of Tooth Brushing (B) Use of Dental Floss (C) Frequency of Dental Visits (D) History of Dental Issues (E) Has the child experienced dental problems.

TABLE 2. Comparison of child general and oral health status with quality of life and family impact scale.

Variable	Median (IQR)					η^2	<i>p</i> -value
	Very Good	Good	Fair	Poor	Very Poor		
Comparison of Child General Health with the Quality of Life and Family Impact Scale							
Child Self-Report Total	18 (16–20)	17 (15–20)	16 (14–22)	18 (16–20)	19 (16–21)	0.006	0.163
Parent Self-Report Total	15 (12–17)	14 (12–18)	14 (13–16)	15 (14–17)	13 (12–17)	0.015	0.021
CPQ11–14 short-form questionnaire	36 (30–37)	29 (27–39)	35 (30–39)	35 (28–41)	29 (27–36)	0.017	0.014
Parent Emotions Total	10 (8–13)	12 (12–14)	11 (10–13)	11 (9–13)	12 (11–14)	0.025	0.003
Parental Family Activity Total	16 (14–17)	14 (12–16)	16 (10–18)	15 (14–17)	17 (15–18)	0.137	<0.001
Family Conflict Total	13 (10–14)	13 (12–14)	11 (10–13)	12 (11–13)	11 (11–12)	0.064	<0.001
Family Impact Scale	41 (37–45)	42 (41–45)	41 (37–45)	41 (40–43)	43 (42–44)	0.034	0.001
Comparison of Child Oral Health with the Quality of Life and Family Impact Scale							
Child Self-Report Total	17 (16–20)	18 (17–20)	19 (15–20)	17 (15–21)	17 (14–20)	0.022	0.006
Parent Self-Report Total	15 (12–17)	14 (11–16)	15 (14–17)	16 (12–18)	14 (12–16)	0.039	<0.001
CPQ11–14 short-form questionnaire	36 (31–37)	33 (27–36)	29 (28–41)	36 (29–40)	34 (29–36)	0.030	0.001
Parent Emotions Total	11 (9–12)	12 (10–14)	12 (10–13)	12 (10–13)	11 (10–15)	0.041	<0.001
Parental Family Activity Total	14 (12–17)	16 (14–18)	15 (13–18)	15 (12–17)	16 (13–19)	0.006	0.109
Family Conflict Total	11 (10–12)	11 (11–15)	13 (11–14)	12 (10–14)	12 (10–13)	0.007	0.087
Family Impact Scale	39 (37–42)	43 (38–45)	42 (41–45)	41 (38–43)	43 (42–45)	0.068	<0.001

IQR: Interquartile range; CPQ: Child Perception Questionnaire.

significant difference in general health categories ($p = 0.021$), and the overall CPQ11–14 score had statistically significant variance ($p = 0.014$), with poorer perceived general health being correlated with higher CPQ11–14 scores and hence poorer quality of life. Moreover, the major differences were found in various family-related areas, such as parental emotions ($p = 0.003$) and family conflict ($p < 0.001$), which indicated that the overall health condition of a child is strongly correlated with the emotional and functional well-being of the family. These results show that child general health was significantly associated with the quality of life and the family outcomes. Statistically significant differences existed in oral health categories of the child self-report ($p = 0.006$), parent self-report ($p < 0.001$), and the overall CPQ11–14 score ($p = 0.001$), which demonstrated that poor oral health was associated with higher CPQ11–14 scores and worse influence on the daily life of the child. Family-related outcomes also had a strong influence, as demonstrated by the variation in parental and family activity limitations ($p < 0.001$) and the FIS in general ($p < 0.001$). Even though a statistically significant difference in the parent emotions domain was not observed ($p = 0.109$), the general trend indicates that poor oral health not only decreases the quality of life of children, but also imposes a quantifiable psychosocial and functional burden on the family.

3.7 Factors associated with poor child oral health

In the logistic regression model, there were a number of variables significantly linked to the poor child oral health (Supplementary Table 3). Male children were much less likely to have poor oral health than female children (OR = 0.30, 95% CI: 0.18–0.50, $p < 0.001$). Inadequate tooth

brushing, and irregular dental visits were significantly associated with poor oral health, while regular flossing and routine dental visits showed protective effects ($p = 0.001$). The model accounted for 26–35% of the variation and accurately predicted 71.9% of the cases, but the calibration was poor ($p < 0.001$) by the Hosmer-Lemeshow test, indicating that the predictive results should be interpreted cautiously.

3.8 Factors associated with poor child general health

Several variables were found to be significantly associated with poor child general health in the logistic regression model (Supplementary Table 4). The children who were 13–14 years old had much lower odds of poor general health than children of 11–12 years (OR = 0.51, 95% CI: 0.32–0.80, $p = 0.003$). Parental education level was also a significant predictor (OR = 0.51, 95% CI: 0.27–0.97, $p = 0.039$). Gender, family income, and oral hygiene practices were not significantly associated with poor general health. There were mixed relationships found between dental visit frequency and poor general health, with visits every six months having higher odds (OR = 2.41, 95% CI: 1.27–4.59, $p = 0.007$) and annual visits having lower odds (OR = 0.35, 95% CI: 0.17–0.73, $p = 0.005$). In general, this model accounted for 12–16% of the variance and correctly classified 66.4% of the cases, the logistic regression model for poor general health in children was calibrated using the Hosmer-Lemeshow goodness-of-fit test. The test showed poor calibration ($p = 0.003$), meaning that the observed rates across risk groups did not closely match the model's predicted probabilities. Therefore, the model should not be used for individual risk prediction, even though the odds ratios can be interpreted as significant associations

(e.g., age and parental education). The best way to interpret these findings in this hospital-based sample is as exploratory associations.

3.9 Factors associated with oral health-related quality of life (CPQ11–14 scores)

Multiple linear regression was performed to investigate factors associated with CPQ11–14 scores (**Supplementary Table 5**). In Model 1, children general health and oral health were entered, and found to be statistically significant ($R^2 = 0.024$, $p = 0.005$). Child general health was significantly correlated with CPQ11–14 scores ($B = -0.66$, $p = 0.001$), indicating that better general health was associated with lower CPQ11–14 scores (i.e., better OHRQoL). Oral health in children was not a significant predictor in this model ($p = 0.568$). The demographic and behavioral variables were included in Model 2, and the explained variance ($R^2 = 0.145$, $p < 0.001$) was significantly better. Age showed a positive correlation with CPQ11–14 scores ($B = 1.19$, $p = 0.047$), with older children showing slightly higher scores. Gender also showed a significant effect ($B = -3.86$, $p < 0.001$), with the male score being lower on CPQ11–14 than the female score. The CPQ11–14 scores were positively associated with family income ($B = 1.57$, $p = 0.007$), and dental visit frequency was also positively associated with CPQ11–14 scores ($B = 0.66$, $p = 0.015$). Frequency of tooth brushing, flossing frequency, and parental education were not statistically significant in the full model ($p > 0.05$). In general, Model 2 accounted for only a small percentage of the variance in CPQ11–14. From a clinical perspective, even the modest effect size can identify children and their families are at a higher risk of functional and psychosocial burden, thereby guiding targeted screening, early counselling, and family-centred preventive interventions in routine pediatric dental practice.

3.10 Factors associated with family impact (family impact scale)

A multiple regression analysis was also conducted to determine the predictors of FIS scores (**Supplementary Table 6**). Model 1 included children general health and oral health and the model was statistically significant ($R^2 = 0.034$, $p = 0.001$). Children general health ($B = 0.44$, $p = 0.002$) and children oral health ($B = 0.42$, $p = 0.007$) had significant association with FIS scores and poor child health status was related to greater family impact. The other demographic and behavioral variables were added in Model 2. The overall model was statistically significant ($R^2 = 0.054$, $p = 0.004$), but it did not show much increase in explained variance. Child general health remained a strong predictor ($B = 0.38$, $p = 0.011$), whereas child oral health remained insignificant ($p = 0.068$). Dental floss use was also found to be associated with higher FIS scores, this can represent confounding, whereby more preventive behaviors are adopted by families that are more burdened ($B = 0.97$, $p = 0.038$), which was also among the behavioral variables. Other factors, such as age, gender, parental education, family income, frequency of tooth brushing, and frequency of dental visits, were not important predictors in

the second model ($p > 0.05$). Overall, the regression models accounted for a small percentage of the variance in family impact, indicating that other unmeasured variables may be part of family outcomes beyond those used in the analysis.

4. Discussion

This cross-sectional study was carried out among Saudi children aged 11–14 years in a hospital-based setting, adding to the growing body of literature showing that perceived oral and overall health are closely associated with OHRQoL and family functioning. The cross-sectional design was appropriate for assessing the prevalence and associations between oral and general health and quality of life outcomes in a hospital-based pediatric sample. However, causality cannot be inferred because exposures and outcomes were measured concurrently. The descriptive data indicate several factors relevant to pediatric dentistry in this population. Previous studies in Saudi Arabia mainly focused on dental caries pervasiveness or psychometric validation of Arabic CPQ11–14. However, this study was the first that simultaneously assessed both oral and general health in the age bracket of 11–14 years. Also, most of the earlier studies examined oral conditions separately. This study explicitly integrates caregiver rated general health as a key element, showing its association with CPQ11–14 and FIS scores. In addition, nearly one-third of cases offers cultural insights that impact oral health behaviors in Saudi families.

Low R^2 values do not contradict the practical value of these findings, but rather highlight the multifactorial nature of OHRQoL and the need for broader, multi-level interventions in Saudi Arabia. The two main performance aspects of logistic regression are discrimination (represented in odds ratios) and calibration (agreement between predicted and observed event rates) in estimating the probability of a binary outcome. Poor calibration indicates that the observed outcomes across risk strata in this sample do not closely match the predicted probabilities from the models. Therefore, the models should not be used as predictive tools for individual risk estimation without external validation and recalibration, even though the identified associations (such as the protective effects of regular tooth brushing, flossing, and dental visits) are interpretable as meaningful risk indicators within this hospital-based cohort. These restrictions, which are common in cross-sectional observational studies, highlight the necessity of interpreting the results cautiously and associatively, rather than predictively.

The percentage of children with poor or very poor oral and general health was high. Oral hygiene practices were not at the recommended level, and a significant proportion of primary caregivers were grandparents. These types of caregiving structures can affect everyday health-related behaviours, health literacy, and care-seeking behaviours in culturally relevant family settings. These findings align with the world statistics that the prevalence of oral disease is on the increasing trend and the disease is largely influenced by the social and behavioral determinants [27–29]. They also align with the findings of national evidence that caries in childhood is a sustained and regionally diverse community health problem in Saudi Arabia, highlighting the necessity of contextually-responsive strategies to prevent this issue [8, 9, 20]. Across all health categories,

poor oral health and poorer general health were associated with poorer OHRQoL and greater family impacts. The conceptual framework of OHRQoL is supported by this pattern due to the fact that it considers functional, emotional, and social outcomes of oral conditions, which might not be as measured by clinical indices alone [23, 30, 31]. The differences in CPQ11–14 scores among health groups further support the idea that subjective ratings of health can indicate meaningful real-world functioning at an early age of adolescence, where children can give believable self-reports of their health [24, 30, 32, 33]. Meanwhile, the results of the FIS reveal that children oral and general health are not personal issues, but are also connected with quantifiable problems in family functioning and emotional burden of the caregivers. This coincides with previous studies that have reported that the oral and orofacial status of children can impact family lifestyles, emotional warmth, and daily activities [24, 34, 35]. Similarly, family burden has been reported in the pediatric oral health literature, in which symptomatic disease and pain have been shown to interfere with eating, sleeping, school activities, and the caregiver productivity [31, 34, 35]. Children oral hygiene behavior are mainly shaped by caregiver/parental involvement [36, 37].

Behavioral trends observed in this study, such as low usage of flosses and inconsistent visits to the dentist, have significant preventive consequences. Global studies stress that oral hygiene practices and dietary risk factors are key predictors of caries development and underline the focus of preventive behaviour as an important outcome in the context of community preventive strategies [27, 33]. In the community, these results indicate that the preventive approach to dental care should focus on the practical implementation of preventive strategies by caregivers, including non-parent caregivers such as grandparents. More recent findings also emphasize the role that caregiver oral health literacy plays in determining oral health outcomes in children, making family-based education interventions valuable [38–40]. The symptomatic disease should be identified earlier, and preventive recall pathways should be incorporated, especially in at-risk groups, given the clustering of chewing difficulty, pain during eating, and reported dental problems among children with lower health ratings [40–42].

Dental visits every 6 months were associated with higher odds of poor general health than annual visits. Instead of implying that high frequency of dental treatment is harmful to overall health, reverse causation and confounding by indication in cross-sectional data are the most-likely explanation of this trend. Children with poor overall health or more complicated oral health may seek dental treatment more often due to symptoms, referrals, or ongoing treatment needs [40, 43]. Evidence for this interpretation can be found in the fact that symptomatic attenders frequently have poorer oral health than those attending only for preventive reasons [34]. In practice, it means that better results can be obtained not only by the enhancement of the number of visits, but also by the change of care patterns from problem-based attendance to the preventive visits that are organized based on education of the caregiver and the risks-based recall schedules [34, 38, 44]. Clinically grounded interpretation is also applicable to the regression

analyses. The CPQ11–14 and Family Impact models only explained a small percentage of the variance used to psychosocial outcomes since quality of life constructs are affected by various interacting factors, including pain perception, coping strategies, parental stress, family functioning, and social factors, more broadly that may not be well represented in a single clinical study [35, 45]. However, statistically significant associations with low explained-variance, are statistically useful as they assist in determining groups at higher risk of daily-life disruption and informs family-focused counseling in pediatric practice. More than that, logistic regression models were unable to calibrate well on the Hosmer-Lemeshow test, hence can only be viewed as associative results on this sample as opposed to being predictive tools that have not been validated externally and are prone to recalibration [32, 33]. In general, the results aligns with a family-based prevention model of pediatric dentistry in Saudi Arabia. Interventions focused on home-based behavior change, caregiver involvement, oral health literacy, and prevention-oriented dental care may also be the most beneficial to the overall health of the population [8, 20, 38] due to a large national caries burden and continual disparities in the regions. Short-term OHRQoL screening might be useful to clinicians to determine both functional and psychosocial effects that cannot be detected by clinical indices alone to help prioritize children with major limitations and family burden [23, 24, 33, 36].

There are a few limitations that should be considered in interpreting these findings. The cross-sectional design fails to permit causal implausibility and validation of time-dependency among oral health condition and general health versus the OHRQoL and family impact. The hospital recruitment environment could also be a constraining factor to the external validity, in that the children dealt with at a hospital-based dental clinic could be more in need of care or have more caregiver anxiety compared with the populations of community-based dental clinics. Moreover, despite validation of the CPQ11–14 and the FIS in Arabic, the use of child and caregiver reports can introduce recall and social desirability biases. Some relevant confounders were not directly measured, such as diet, sugar consumption, exposure to fluoride, psychosocial stressors, and overall environmental factors, which could affect oral health and quality of life. The relatively brief explanatory rationale for the multivariate models further suggests that child and family well-being is a complex combination of factors [35].

Despite these limitations, from a clinical point-of-view, the outcomes support the incorporation of OHRQoL measures in routine pediatric dental practices. These outcomes also suggest that child well-being is multifactorial and both oral and general health can be involved in functional and psychosocial limitations. This will help the clinicians in recognizing the functional and psychosocial impact as well, other than identifying the clinical disease only. Early recognition of OHRQoL burden can facilitate preventive interventions. This necessitates the need for family-centered preventive strategies that enforces the inclusion of care-givers. Also, as grandparents have been identified as care-givers, oral health awareness programs should be adapted in order to improve oral health literacy and practice of preventive strategies within households. The study's main

takeaway is that oral health in children cannot be considered in a void. Rather, it should be observed in the context of a broader biopsychosocial and familial framework, where general and oral health interact to affect children's and their families' everyday lives.

5. Conclusions

This study found that poor oral and general health among Saudi children aged 11–14 years was associated with poor OHRQoL. Poorer child health was associated with greater caregiver emotional distress, disruption of family activities, and increased family burden, as reflected by higher CPQ11–14 scores, indicating worse OHRQoL. Children with poor health status had higher CPQ11–14 scores, indicating greater functional and psychosocial difficulties in their everyday life. Additionally, FIS scores indicate poorer child health was associated with greater caregiver emotional distress, disruption of family activities, and increased family burden. Family and behavioural determinants were also important, as children's oral health outcomes were associated with oral hygiene practices, dental attendance patterns, and caregiver characteristics. The results support the close interconnection among oral and general health and family well-being, although the cross-sectional study design and relatively small explained variance do not allow causal interpretation. In summary, this study demonstrates the combined impact of poor oral and general health on child-reported CPQ11–14 and FIS in early adolescents while simultaneously highlighting the role of cultural factors. These findings extend beyond prevalence-focused or oral-health-only research by underscoring the value of integrating OHRQoL and family impact measures into routine clinical practice and prevention strategies in the region.

AVAILABILITY OF DATA AND MATERIALS

The data will be available to review from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

SAB—designed the research study, performed the research, analyzed the data, and wrote the manuscript. The author contributed to editorial changes in the manuscript. The author read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The protocol of the study was revised and approved by Taibah University, College of Dentistry Research Ethics Committee (Approval No.: TUCDRDCi 151224). All the participating children and their parent/guardians gave written informed consent before data collection according to the approved procedures by the committee.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at <https://oss.jocpd.com/files/article/2072913611791974400/attachment/Supplementary%20material.zip>.

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