

# Untreated dental caries prevalence and impact on the quality of life among 11 to 14-year-old Egyptian schoolchildren: A cross-sectional study

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## Research article

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## Abstract

**Background:** This study aimed to assess caries prevalence and experience among 11-14 years schoolchildren, analyze demographic, socioeconomic, personal and professional dental care in relation to untreated carious lesions, and evaluates the effect of decayed teeth on early adolescents' oral health-related quality of life (OHRQoL).

**Methods:** A cross-sectional analytical investigation conducted on 1020 preparatory schoolchildren selected on the basis of a multistage sampling technique. Caries status for the participants detected via recording their caries experience and untreated cavities using DMFT and DT indices. OHRQoL was determined using a validated Arabic CPQ11-14 short-form questionnaire. Statistical methods for descriptive analysis chi-square test, Independent-Samples T-Test and one-way analysis of variance (ANOVA) were used. Multilevel Poisson regression analysis through a hierarchical approach was used to detect the influence of independent variables on DT scores. To declare the association between independent variables and QoL, a step-by-step, multivariate regression analysis was conducted.

**Results:** The average scores of DMFT and DT in this study were  $2.97 \pm 1.29$  and  $1.66 \pm 1.24$ . Poisson regression analysis demonstrates that school children with untreated carious lesions are 2.51 times have poor OHRQoL than their peers without caries. Untreated cavities affected mainly by mother education, school type, family income, and regular dental appointments. Children with  $DMFT \leq 3$  or  $DT = 0$  recorded a statistically significant lower CPQ11-14 average scores ( $p \leq 0.01$ ) and ( $p \leq 0.0001$ ) respectively.

**Conclusions:** Untreated carious cavities and caries experience were associated with lower socioeconomic, maternal education and tooth brushing, untreated carious cavities have a significant negative impact on schoolchildren's QoL.

## Background

Dental caries is one of the global health issues in both industrialized and developing communities. However, dental caries incidence and prevalence is more pronounced in developing countries like Egypt. Dental caries is an age-related disease involving about 60–90% of schoolchildren [1, 2]. Caries is an outcome of several interplaying factors such as cultural, social, and political factors which in turn rule the individual behaviors and commitment to preventive oral hygiene measures [3]. Dental caries studying has a raised attention in a critical life-stage like adolescence because caries progression increases at this stage [4]. In addition, at this stage good oral hygiene, proper diet and regular dental check-up behaviors should be enforced. Untreated carious cavities especially when associated with pain may influence children's physical and psychological development as well as school and daily-life achievements [5]. Plenty of studies revealed the association between oral health and adolescent's quality of life (QoL) physical, psychological, social and emotional aspects [6, 7]. One of the tools designed by Jokovic et al. to measure the oral-health related quality of life (OHRQoL) in children is a child perception questionnaire for 11–14 years age group (CPQ<sub>11-14</sub>) short form [8]. OHRQoL has a multidimensional structure to measure different aspects of oral health in a subjective way including oral symptoms, functional limitations, emotional and functional well-being [9]. Caries prevalence among Egyptian inhabitation is high [1]. The number of investigations conducted in Egypt especially among the early adolescents age group is limited. Moreover, up to the available data, the relation between decayed teeth and OHRQoL among teenagers Egyptian students is still not clarified.

The current study aimed to (1) assess caries prevalence and experience among 11–14 years schoolchildren, (2) analyze demographic, socioeconomic, personal and professional dental care in relation to untreated carious lesions, (3) evaluate the effect of decayed teeth on early adolescents' OHRQoL.

## Methods

### 1. Design, setting and sampling

This cross-sectional analytical study conducted in Minia City, Upper Egypt between September 2016 and April 2019. The number of children participating in the study calculated on the basis of the following formula [10];  $N = (Z_{\alpha/2})^2 s^2 / d^2$ , where (N) is the number of participants and (d) is the degree of precision adjusted at 0.05. A pilot study conducted before launching the procedures on 56 children aged from 12 to 14 years and the standard deviation (s) of DMFT was 0.92. The total sample size was 1020 children after adding 10% to compensate the drop-off. After obtaining the necessary permissions from the Ministry of Education, the sampling process has been launched. The type of sample adopted in this study was a multistage stratified random sample. The selected strata based on gender (males and females), school type (public, private and international) and finally the school district (North, South, East and West). Details of sampling procedures illustrated in Fig. 1.

### 2. Eligibility criteria

Children aged from 11 to 14 years should fulfill the following criteria; (1) No orthodontic treatment or malocclusion or severe gingival or periodontal diseases. (2) Absence of any systemic, emotional or intellectual disabilities. (3) No emergency dental recall in the last three months reference

### 3. Study variables

An anonymous questionnaire used in this study which was divided into 2 principal sections; the first section included the following variables; (1) demographic data; (a) gender and (b) age, (2) socioeconomic data (a) mother's level of education; dichotomized according to the number of education years into  $\geq 9$  years (greater than secondary and secondary school) and  $< 9$  years (less than secondary school or illiterate), (b) school type; classified into public and private schools, (c) household expenditures which recorded according to the cut-off poverty line in Egypt which is 3.20 US\$ per day and [11, 12], (3) dental self-care

and use of dental services; (a) frequency of tooth brushing, (b) frequency of mouth rinse use. The response of both 'a' and 'b' dichotomized into regular use (frequency is  $\geq 1$  time per day) and irregular (no tooth brushing or mouth wash use or  $\leq 3$  times per week), (c) use of dental floss, (d) frequency of dental visits per year for regular check-up. The response of 'c' and 'd' dichotomized into (yes or no). (5) clinical oral examination and recording dental caries status through recording the decayed, missing, filled teeth (DMFT) index for permanent teeth according to data into ( $\leq 3$  and  $\geq 3$ ) based on the global target of score three announced by World health organization (WHO) for the year 2000 [13]. Untreated carious cavity scores "i.e. Decayed tooth (DT) index" dichotomized into 0 and  $\geq 1$ . The second section concerned with evaluating the OHRQoL using a previously validated Arabic version of CPQ<sub>11-14</sub> short-form including 4 domains to assess oral symptoms (OS), functional limitation (FL), emotional well-being (EW) and social well-being (SW) and one self-perception question reported by each participant about his/her OHRQoL evaluation [8, 14].

## 4. Calibration, pilot study, and data collection

Firstly, two dentists with at least two years of residency at the Pediatric and Dental Public Health Department, Faculty of Dentistry, Minia University, trained for two weeks for calibration. The second step was conducting a pilot study on 67 children. The pilot study aimed to determine QoL mean and standard deviation required for sample size calculation and to test the intraexaminer and inter-examiner reliability. The results of the pilot study did not include in the final statistical analysis. Dental caries examination performed at two appointments with one-week interval. The clinical examination carried out using a visual-tactile method using a dental mirror and WHO probe five seconds per dental surface under artificial light use [15, 16].

## 5. Statistical methods

A Statistical Program Statistical Package for the Social Sciences (SPSS) version 20 has been used for statistical analysis. Data normality was examined and descriptive analysis including frequency tables, chi-square test for categorical variables, Independent-Samples T-Test and one-way analysis of variance (ANOVA) to compare CPQ<sub>11-14</sub> overall score means of independent predictors. The mean/standard deviation, and median/Interquartile range (IQR) of the CPQ<sub>11-14</sub> different domains were calculated. Univariate Poisson regression analysis was performed to determine the associations between decayed teeth (i.e. outcome variable) and demographic, socioeconomic, dental care and oral health related quality of life self-perception independent predictors. Predictors with a significant level exceeding 0.2 ( $p \geq 0.2$ ) were excluded from the final adjusted multivariate regression model. A conceptual model was released according to a hierarchy approach of determinants and risk factors and it was structured according to the model made by Paula et al. as shown in Fig. 2 [17]. Predictors categorized into four models; Model 1 included gender, Model 2 incorporated model 1 plus socioeconomic variables Model 3 contained Model 2 plus child's dental care and Model 4 implicated model 3 plus child's oral health-related quality of life self-perception.

To declare the association between independent variables and QoL, a step-by-step, multivariate regression analysis was performed. The best fit defined by the highest  $R^2$ . The level of significance was 5% ( $p$ -value  $\leq 0.05$ ) and 95% confidence interval (95% CI).

## Results

Intra and inter-observer reliability; Kappa coefficients ( $\kappa$ ) were 0.91 and 0.86 for intra-examiner and inter-examiner reliability respectively. More than two-thirds of participants are from the public. The prevalence of dental caries among school children is 58.5% Frequency of different variables while approximately half of the participants showed caries experience exceeded score three (DMFT $\geq 3$ ). The frequency of different predictors illustrated in Table 1.

Table 1  
 Frequency of demographic, socioeconomic,  
 dental care, relation caries experience  
 (DMFT) and decayed teeth (DT)

Predictors	N (%)
Gender	575(56.4)
Male	445(43.6)
Female	
Age (years)	323(31.6)
12	299(29.3)
13	398(39.1)
14	
School type	721(70.7)
Public	299(29.3)
Private	
Mother education (years)	735(72.1)
≥ 9	285(27.9)
<9	
Household expenditure	547(53.6)
>3.20\$/day	473(46.4)
≤ 3.20\$/day	
Tooth brushing frequency	713(69.9)
Irregular	307(30.1)
Regular	
Mouth washing frequency	865(84.8)
Irregular	155(15.2)
Regular	
Dental appointment per year	671(65.8)
No	349(34.2)
Yes	
Dental floss use	887(87.0)
No	133(13.0)
Yes	
DMFT	513(50.3)
≤ 3	507(49.7)
>3	
DT	423(41.5)
0	597(58.5)
≥ 1	

The average scores of DMFT and DT in this study were  $2.97 \pm 1.29$  and  $1.66 \pm 1.24$ . Caries experience shows no statistically significant difference between males and females while the number of carious cavities was more among male participants and the difference was highly significant ( $p < 0.0001$ ). Maternal education, school type as an indicator of economic status, regular toothbrush and professional check-up reveals a significant impact on DMFT and DT scores (Table 2).

Table 2  
 Frequency of demographic, socioeconomic, dental care, in relation caries experience (DMFT) and untreated decayed teeth (DT)

Predictors	DT		p-value*	DMFT		p-value *
	DT = 0 N(%)	DT ≥ 1 N(%)		DMFT ≤ 3 N(%)	DMFT ≥ 3 N(%)	
Gender Male Female	104(10.2) 187(18.3)	471(46.1) 258(25.3)	0.0001	326(32) 261(25.6)	249(24.4) 184(18)	0.53
Age (years) 12 13 14	106(10.4) 88(8.6) 99(9.7)	217(21.3) 211(20.7) 299(29.3)	0.06	191(18.7) 179(17.5) 217(21.3)	132(12.9) 120(11.8) 181(17.7)	0.29
School type Public Private	136(13.3) 155(15.2)	585(57.4) 141(13.8)	0.0001	213(20.9) 179(17.5)	508(49.8) 120(11.8)	0.001
Mother education (years) ≥ 9 ≤ 9	423(41.5) 85(8.3)	312(30.6) 200(19.6)	0.0001	513(50.3) 170(16.7)	182(17.8) 115(11.3)	0.0001
Household expenditure ≥ 3.20\$/day ≤ 3.20\$/day	255(25) 134(13.1)	292(28.6) 339(33.2)	0.01	323(31.7) 264(25.9)	224(22) 209(20.5)	0.29
Tooth brushing frequency Irregular Regular	125(12.3) 176(17.3)	588(57.6) 131(12.8)	0.0001	330(32.4) 204(20)	383(37.5) 103(10.1)	0.0001
Mouth washing frequency Irregular Regular	268(26.3) 23(2.3)	686(67.3) 43(4.2)	0.24	358(35.1) 93(9.1)	507(49.7) 62(6.1)	0.34
Dental appointment per year No Yes	136(13.3) 196(19.2)	535(52.5) 153(15)	0.0001	267(26.2) 214(20.1)	404(39.6) 135(13.2)	0.0001
Dental floss use No Yes	260(28.4) 30(2.9)	597(58.5) 103(10.1)	0.07	372(36.5) 72(7.1)	515(50.5) 61(5.9)	0.39
*Chi-square test						

Poisson regression analysis demonstrates that school children with untreated carious lesions are 2.51 times have poor OHRQoL than their peers without caries. Untreated cavities affected mainly by the mother education, school type, family income and regular dental appointments (Table 3).

Table 3

Poisson analysis for decayed teeth (DT) in relation to demographic, socioeconomic, dental care and oral health related quality of life self-perception

Predictors	Univariate analysis		Model 1		Model 2		Model 3		Model 4	
	Unadjusted PR 95% CI	p-value	Adjusted PR 95% CI	p-value	Adjusted PR 95% CI	p-value	Adjusted PR 95% CI	p-value	Adjusted PR 95% CI	p-v
Gender Male Female	1.07(0.98;1.14) 1	0.17	0.94(0.80;1.11) 1	0.47	1.07(0.86;1.18) 1	0.11	0.99(0.84;1.16) 1	0.90	1.06(0.98;1.14) 1	0.1
Mother education (years) ≥ 9 ≤ 9	1.21(1.06;1.24) 1	0.002			1.58(1.27;1.95) 1	≤ 0.0001	1.56(1.25;1.95) 1	≤ 0.0001	1.41(1.14;1.74) 1	0.0
School type Public Private	1.14(1.09;1.29) 1	0.01			1.34(1.09;1.64) 1	0.006	1.48(1.18;1.85) 1	0.001	1.27(1.17;1.38) 1	0.0
Household expenditure ≥ 3.20\$ /day ≤ 3.20\$/day	1.16(1.06;3.19) 1	0.02			1.21(1.03;1.33) 1	0.018	1.23(1.11;1.39) 1	0.01	1.22(1.12;1.49) 1	0.0
Tooth brushing Irregular Regular	1.21(1.06;1.49) 1	0.05					1.02(0.75;1.15) 1	0.51	1.14(0.80;1.84) 1	0.4
Dental appointments No Yes	1.11(1.05;1.23) 1	0.03					1.20(1.04;1.29) 1	0.04	1.25(1.16;1.46) 1	0.0
Mouth wash use No Yes	1.03(0.79;1.33) 1	0.85					1.08(0.89;1.94) 1	0.14	1.18(0.89;1.84) 1	0.1
Dental floss use No Yes	1.07(0.70;1.22) 1	0.30					1.12(0.91;1.28) 1	0.48	1.05(0.8;1.36) 1	0.7
OHRQoL self- perception Poor Good	1.4(1.27;1.54) 1	≤ 0.0001							2.51(2.09;3.03) 1	≤ 0.0
PR: Prevalence Rate										

Females report a higher score of CPQ<sub>11-14</sub> means, indicating lower satisfaction with their OHRQoL than male counterparts ( $p \leq 0.0001$ ). Regarding caries status, both caries experience ( $DMFT \leq 3$ ) and decayed teeth score ( $DT = 0$ ) record a statistically significant lower CPQ<sub>11-14</sub> average scores ( $p \leq 0.01$ ) and ( $p \leq 0.0001$ ) respectively than those with higher DMFT and DT scores (Table 4).

Table 4  
Mean of Decayed, Missed, Filled (DMFT) index and decayed teeth (DT) scores in relation to demographic, socioeconomic, dental care, relation

Predictors	CPQ <sub>11-14</sub> Mean (SD) scores	p-value *
Gender Male Female	38.07(12.60) 42.20(10.49)	0.0001
Age (years) 12 13 14	40.96(12.14) 42.82(9.64) 41.32(12.66)	0.13
School type Public Private	44.64(8.28) 30.16(12.18)	0.0001
Mother education (years) ≥ 9 ≤ 9	40.46(11.67) 38.13(11.50)	0.014
Household expenditure ≥ 3.20\$/day ≤ 3.20\$/day	36.36(13.26) 45.06(6.94)	0.0001
Tooth brushing frequency Irregular Regular	41.73(11) 35.33(12.56)	0.0001
Mouth washing frequency Irregular Regular	40.79(11.46) 34.77(12.68)	0.0001
Dental appointment per year No Yes	43.40(9.41) 34.67(13.23)	0.0001
Dental floss use No Yes	40.65(11.55) 38.73(12.10)	0.076
DMFT ≤ 3 ≥ 3	34.05(12.46) 42.22(10.14)	0.002
DT 0 ≥ 1	27.66(12.76) 45.48(5.81)	0.0001
*Independent-Sample T test; One Way (ANOVA)		

Oral symptoms domain especially, pain figures out the highest mean scores ( $11.16 \pm 3.58$ ) among CPQ<sub>11-14</sub> different domains. Functional limitations, emotional well-being, and social well-being domains average scores are illustrated in Table 5.

Table 5  
Perceived oral health related quality of life (OHRQoL) based on the scores of child perception questionnaire CPQ<sub>11-14</sub> domains

CPQ <sub>11-14</sub> domains	Mean (SD)	Median (IQR)	Cronbach's alpha
Oral symptoms (OS)	11.16 ± 3.58	12(4.75)	0.71
Functional limitations (FL)	10.45 ± 3.25	11(5)	0.67
Emotional well-being (EW)	10.15 ± 3.42	11(5)	0.61
Social well-being (SW)	9.75 ± 2.98	10(3)	0.67
Overall score	42.40 ± 11.63	43(11.75)	0.84

Multiple regression analysis showed that untreated carious lesions (DT), socioeconomic status and constant toothbrush explain 64% of the variance in participant's QoL (Table 6).

Table 6  
Multiple regression analysis of factors influencing oral health related quality of life (OHRQoL) in 11 to 14 years school children

Predictors	$\beta$	95% CI	p-value	Adjusted R <sup>2</sup>
Step 1	0.18	2.75;5.58	0.0001	0.04
Gender	-0.83	-1.67; -0.26	0.007	
Age (years)				
Step 2	0.08	0.68;2.98	0.002	0.38
Gender	-0.02	-0.82;0.31	0.38	
Age (years)	0.16	2.30;5.01	0.0001	
Household expenditure	-0.54	-15.34;-12.38	0.0001	
School type	-0.23	-8.42;-5.30	0.0001	
Mother education				
Step 3	0.08	0.75;3.05	0.001	0.4
Gender	-0.2	-0.79;0.33	0.43	
Age (years)	0.14	1.99;4.67	0.0001	
Household expenditure	-0.5	-14.26;-11.04	0.0001	
School type	-0.22	-8.18;-5.04	0.0001	
Mother education	-0.05	-5.24;0.16	0.07	
Mouth washing frequency	-0.11	-1.59;0.56	0.0001	
Tooth brushing frequency	-0.07	-3.15;-0.21	0.025	
Dental appointment	-0.07	-2.21;-0.17	0.014	
Dental floss use				
Step 4	-0.03	-1.54;0.28	0.17	0.64
Gender	-0.03	-0.77;0.09	0.12	
Age (years)	0.07	0.62;2.70	0.002	
Household expenditure	-0.38	-10.97;-8.45	0.0001	
School type	-0.17	-6.36;-3.93	0.0001	
Mother education	-0.04	-3.89;0.28	0.09	
Mouth washing frequency	-0.07	-1.05;-0.26	0.001	
Tooth brushing frequency	-0.08	-1.58;0.73	0.47	
Dental appointment	-0.05	-1.53;1.44	0.95	
Dental floss use	0.02	-0.34;1.45	0.23	
DMFT	0.54	12.88;15.03	0.0001	
DT				

## Discussion

Dental caries may have negative impacts, especially on early adolescence life, through reducing the efficiency of masticatory function and general appearance which is reflected in growth and development as it affects emotional and social health. The current observational cross-sectional study intended to assess the caries experience and its impact on OHRQL among a group of Egyptian school children aged from 12 to 14 years. This age group has been chosen to carry out this study based on the following aspects; (1) caries rate is higher among children [18], (2) this age group is the WHO target group for dental caries global comparison [13]. Data gathered through a face-to-face interviews to eschew data missing, reduce information bias and enhance the accuracy of data [19]. The response rate was (87%), this may be related to the use of anonymous CPQ<sub>11-14</sub> questionnaire which also guarantees the participant's confidentiality.

Although the flood of data concerning the worldwide caries experience at various age groups, it still a significant issue to concern. Up to the available data, studies measuring caries experience among 11- to 14-year-old students were limited. Moreover, this work is leading research in studying the association between caries and OHRQoL among early adolescent Egyptian students. The mean DMFT scores in this study were  $2.97 \pm 1.29$  which within does approximately similar to the DMFT target declared by the World Health Organization (WHO) in 2000 [13]. Untreated cavities mean values were higher among girls than boys. This difference may be attributed to the higher commitment of girls toward oral hygiene habits like tooth brushing than boys. This finding was in agreement with prior studies [1, 20]. In the present study, caries experience was less than that reported by two former studies conducted in a nearly similar Egyptian age group. The first study performed in 2011, on 976 schoolchildren [21]. The average DMFT score was  $1.68 \pm 1.92$ , and this may be assigned to the use of a distinct sampling method which relied on choosing only two public schools (one for boys and the other for girls) from the Giza governorate. In addition, school enrollment of children in Egypt depends fundamentally on geographic distribution. Therefore, the approach might consider children who nearly have similar socioeconomic and parents' educational backgrounds. The DMFT score of the other study published in 2019, was also lesser than the results of the current study ( $1.68 \pm 1.92$ ) [1]. The reason may be due to the difference between the two studies in sample size. Caries prevalence of untreated carious cavities in the present study was 58.5% which was higher than that reported by a pontigo-loyola et al. who reported a caries prevalence of 48.6% among 12 and 15 age children in high altitudes [22]. The difference may be related to the higher community water fluoridation. The findings of skinner et al. published a caries prevalence of 45% among 14- and 15-year-olds in New South Wales, Australia [23]. In comparison, global DMFT scores reported in other countries showed a wide range of diversity. Some researches revealed lower DMFT scores than the finding of the current research [24–28]. Other research reported nearly similar results [29–31]. While a number of researches recorded higher DMFT scores [13, 32, 33]. This wide range of diversity attributed to the differences in study designs, sample sizes, eating habits and socioeconomic and cultural backgrounds. In the current study, children with lower DMFT and DT scores were belonging to families with higher income as well as education level in comparison to children with high caries experience. This inverse relationship between DMFT scores and both maternal education level and economic status denotes their significant impact on caries experience. Several previous studies confirmed this relationship [34–36]. Lower socioeconomic status might hinder the adherence to preventive interventions such as tooth brushing and regular professional dental examination which consistent with other studies. Moreover, these associations were also evident with untreated carious cavities [37].

Dental caries has a negative impact on the adolescent's QoL. The present study utilized CPQ<sub>11-14</sub> short form which reported by Jokovic et al. to have excellent validity and maintained its multidimensional properties [8]. Direct comparison between the results of this study and the findings of global researches concerned with the impact of caries on OHRQoL may be influenced with the diversity of socioeconomic, traditions and cultural backgrounds. However, it was salutary to consider some of these studies. In the present, oral symptoms especially pain demonstrated the highest mean scores which demonstrated the prominent influence on eating, speaking and sleeping aspects. These were in agreement with the findings of former studies [38, 39]. Untreated carious lesions can lead to what can be called a "vicious cycle" because pain or teeth loss as a result of the carious tooth will reduce the mastication performance due to the difficulty in hard food chewing and subsequently, a shift toward more soft and processed food will take place. This food usually more cariogenic and of little nutritional benefits which will increase the caries progression and subsequent increase in more soft food consumption. Another negative aspect of soft and highly processed foods is their passive effect on children's growth and development [40, 41]. Unfortunately, oral symptoms not the only consequences of pain or missing teeth due to decay in this study, but also, the emotional effect on the participants in this study was announced. This can be explained by the undermining of children's self-esteem due to altered eating, chewing, speaking and social appearance [41, 42]. The current study emphasized the connection between low socioeconomic status and OHRQoL. The education level of mothers and financial status plays a vital role in an individual's lifestyle decisions and adherence to routine preventive measures such as tooth brushing and get access to dental services.

The findings of this study spotlight the importance of adopting strategies aimed to increase awareness about oral health among mothers and school children at this age and emphasize the importance of oral hygiene habits. It is also recommended to reduce socioeconomic inequalities.

The present study has a number of strong features such as the representative sample, high response rate as well as intra-examiner and inter-examiner reliability. All of these points are positively reflected in the study generalization as well as its internal validity. On the other hand, the main weak point in this study was attributed to the cross-sectional design as data collected at one point of time in contrast to the prospective design.

## Conclusions

The present study clarifies that more than half of schoolchildren aged from 11- to 14-years showed untreated cavities. This may declare the negative impact of untreated carious lesions and negative QoL. However, caries experience recorded no significant alliance with OHRQoL. Both untreated cavities and caries experience were significantly associated with lower household expenditure, lower maternal education and irregular adherence to tooth brushing habit. Oral symptoms were the chief domains that adversely influencing early adolescent's OHRQoL. Further studies especially the longitudinal study are required to assess the correlation between these different variables and OHRQoL different aspects.

## Declarations

### Ethics approval and consent to participate

This study reviewed and signed by the Ethics Committee of Faculty of Dentistry, Minia University (registration number 174/2015). The current study conducted in full accordance with the World Medical Association Declaration of Helsinki. All participants or their legal guardians signed the informed consent form before participating in any part of the research

### Consent for publication

All authors give the ptheir acceptance for publication of that work in BMC Oral Health

### Availability of data and material

Not applicable

### Competing interests

Authors declare that they have no conflict of interest.

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The search was self-funded and other sources for funding for the research

### Authors' contributions

Author EAA was responsible for the research idea, paper writing and formatting and statistical analysis. Author ES was responsible for the clinical aspects of the study and data gathering. Author KN was responsible for revising the work

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## Figures

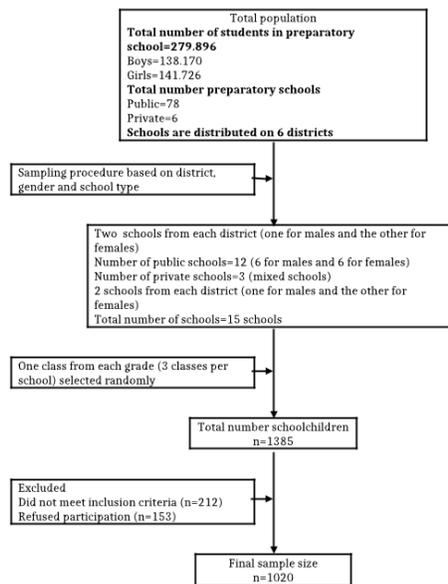


Fig 1. Multistage sampling procedures

Figure 1

Multistage sampling procedures

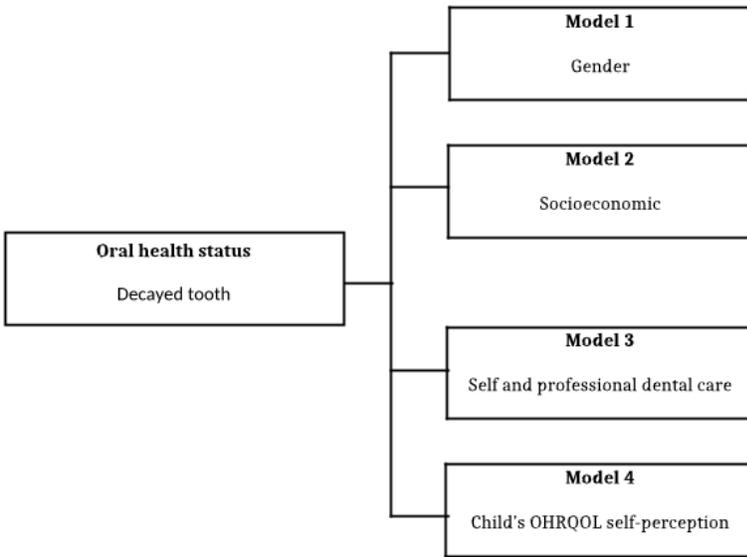


Figure 2

A conceptual model was released according to a hierarchy approach of determinants and risk factors and it was structured according to the model made by Paula et al.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBEchecklistv4combined.pdf](#)