

Clinical, social and psychosocial factors associated with self-rated oral health in Brazilian adolescents

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Abstract - Objective: The objective of this study is to investigate the main social, psychosocial and clinical factors associated with poor self-rated oral health in adolescents. Methods: A cross-sectional survey was carried out in two cities of the Distrito Federal, Brazil. Data were collected by clinical examinations and by self-administered questionnaires from 1302 adolescents aged 14-15 years in 39 schools. Data analysis was carried out using a Poisson regression model taking into account the cluster sample. Results: Adjusting for social, psychosocial and clinical factors, results showed that poor self-rated oral health was significantly associated (P < 0.001) with sex (males) [prevalence ratio (PR) = 0.8, 95%confidence interval (95% CI): 0.7-0.9]; low social class (PR = 1.4, 95% CI: 1.2-1.6); poor self-rated general health (PR = 2.6, 95% CI: 2.3-3.1); mouth appearance (PR = 1.9, 95% CI: 1.6-2.2) and with presence of untreated dental decay (PR = 1.4, 95% CI: 1.3–1.6). Conclusions: The single question on selfrated oral health appears to be a simple and easy way to collect dental health information in adolescents. Assessment and understanding of self-rated oral health should take into account social, psychosocial and oral factors.

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One of the most frequently used measures of selfrated health status is a single question asking people to rate their overall health on a scale from excellent to poor. Many studies have shown that this simple question is a strong predictor of future morbidity and mortality even after controlling for a variety of physical, sociodemographic and psychosocial health status indicators (1–5). Despite its use in medical studies, a single question of self-rated oral health has been seldom used as the primary outcome in dental studies.

The main factors associated with self-rated oral health include both clinical and subjective oral factors. Clinical factors include dental decay, missing teeth, bleeding gums and dental care. Subjective measures include reported general health, appearance of mouth and dental pain. In addition, demographic and socioeconomic variables such as sex, age and social class have been associated with self-rated oral health (6–13).

There are several reasons for investigating lay peoples' perceptions of their dental health. First, self-reporting is a part of the routine diagnostic procedure of clinicians. Secondly, realistic assessment of treatment needs requires information not only about normative (professional) but also about perceived (lay defined) needs (14). Thirdly, assessing self-rated oral health status is relatively simple and it may be an easier and complementary method to collect dental information on adolescents and adults (15). Fourthly, it can be a useful tool for planning and monitoring health services and health promotion interventions (16).

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However, relatively little has been published on a comprehensive appraisal of the full range of factors that may affect adolescents' perceptions of their oral health status, as measured by a single question as the main outcome. Therefore, the objective of this study is to investigate the main social, psychosocial and clinical factors associated with poor self-rated oral health by adolescents.

Methods

A cross-sectional survey was carried out in two cities of the Distrito Federal, Brazil. A pilot study was carried out among 140 students in 10 schools to test the feasibility of the study, instruments and examinations and to obtain reliable estimators for sample size calculations.

The population studied was adolescents born in 1987 (14–15 years of age at the time of examination) attending urban state-funded public schools. A two-stage sampling method was used. It consisted of first taking a random sample of first-stage units (schools) and then a random sample of students as second-stage units within each school.

To explore the association between poor selfrated oral health and the independent variables, calculations indicated that a sample of 938 adolescents would be necessary. This calculation used the following parameters: 80% of power, 5% significance level, excess due to multivariate analysis 15%, excess due to nonresponse 10%, ratio unexposed (high/middle class) to exposed (low social class) 3:1, design effect of 1.5 and the prevalence ratio (PR) to be detected of 1.4 or higher. The actual sample contacted, 1500 adolescents, was because this study was part of a larger investigation including other outcomes that required larger samples.

The main fieldwork was carried out over a period of 8 months in 2002. Data were collected by clinical examinations and by self-administered questionnaires. The questionnaire was also piloted and proved to be understandable and applicable to the Brazilian population. There was no need to change the methodology previously proposed. Examinations were conducted in schoolrooms and subjects were positioned so as to receive maximum illumination. A lightweight batteryoperated portable examination light was used. Plane mouth mirrors and CPI periodontal probes were used for conducting the examinations. Adolescents were examined with the subject's head on the backrest of a chair and the examiner standing in front of the mouth of the participant. All examinations were conducted by one examiner (MPP). Intra-examiner diagnostic consistency was assessed by duplicate examinations conducted on 5.5% of participants and using the kappa statistic on a tooth-by-tooth basis (17).

The outcome was measured by the question: 'Generally speaking, would you say that your oral health is 1, excellent; 2, very good; 3, good; 4, fair and 5, poor.' This was dichotomised into good (codes 1–3) and poor oral health (codes 4–5) (18).

Social class was assessed using the classification of the Brazilian Association of Research Institutes (ABEP), divided into five categories, where A is the highest group. This classification considers both household assets (car, television, washing machine, etc.) and education of the head of the household (19). Because of the small number of observations in classes A and E, data were categorised into three groups: high (classes A and B), middle (class C) and low (classes D and E) social class. Demographic variables included sex (male/female) and skin colour (white, black or other) ethnicity.

Psychosocial variables included self-rated health, behaviour problems, social support and family structure. Self-rated health was measured by the question: 'Generally speaking, would you say that your general health is excellent/very good/good/ fair/poor' and the variable was dichotomised into good health (excellent/very good/good) and poor health (fair/poor).

Behaviour and emotional problems were assessed by the total scores of the strengths and difficulties questionnaire (SDQ) (20). The SDQ is a brief behavioural screening questionnaire that asks about 25 attributes. The 25 items are divided between five scales of five items each, generalising scores for conduct problems, hyperactivity, emotional symptoms, peer problems and pro-social behaviour; all but the last are summed to generate a total-difficulties score ranging from 0 to 40. The cut-off points adopted were as proposed by the original author and dichotomised into normal (0– 13) and borderline/high difficulties (\geq 14).

The instrument adopted to measure social support was the revised Kaplan scale. This is a storyidentification technique composed of nine sets of vignettes which measure two types of cognitive social support: emotional and network support (21). It ranges from 9 to 45 and was categorised according to the tertiles into low, moderate and high support. Turner (21) tested the psychometric properties of this scale in two large samples of psychiatric patients and physically disabled community residents. The internal consistency of the scale was 0.83 in the physical disability study and 0.81 in the mental study. Results from factor analysis were also highly satisfactory. The reliabilities for the two dimensions were, for the physical disability and mental health studies, respectively, 0.79 and 0.87 for the love-esteem dimension and 0.73 and 0.78 for the network support dimension.

Both instruments were translated (English to Portuguese) and back translated (Portuguese to English) (22, 23) by three bilingual epidemiologists. Final translations were compared with the original version and discussed among the group.

Family structure was assessed by a variable describing whether the adolescents lived in a twoparent family or in some other situation.

Clinical oral conditions were prevalence of dental decay, missing teeth and periodontal disease measured according to WHO criteria (24). The categories for untreated decay were decayed teeth equal to zero or to at least one; for prevalence of missing teeth were number of missing teeth equal to zero or to at least one; and, for periodontal disease, presence or not of gingival bleeding/ calculus in at least one sextant.

Nonclinical oral conditions were self-reported dental pain, mouth appearance and chewing ability. Dental pain was assessed by asking whether the person had a toothache in the last 6 months (25).

Appearance of mouth and chewing ability were assessed by the questions: 'Generally speaking,

would you say that the appearance of your teeth and gums/chewing ability is excellent/very good/ good/fair/poor' (13) and the variables were dichotomised into excellent/very good/good and fair/ poor.

Data analysis was carried out using the Stata 7.0 program. Because the outcome was common, a Poisson regression model was used to provide estimates of adjusted PRs. A logistic model would overestimate the odds ratios of the effects of the independent variables in relation to the outcome (26). The analysis took into account the cluster sample and design effect. This was carried out using the command svypois in Stata. A hierarchical approach to variable selection and modelling technique was used (27). Three levels were incorporated in the model (Fig. 1). A distal level (highest) including socioeconomic and demographic variables, an intermediate level incorporating psychosocial variables and the proximal level including first clinical and then reported oral health conditions. Variables were controlled for all others in the same level (horizontal), and those with a significance level of 5% or lower for at least one comparison category were retained to the next level down (vertical). Both combined and sexspecific analyses were undertaken. The protocol of the research was approved by Regional Education and Health Authorities and by the Bioethics committee of the University of Brasilia and of the Ministry of Health of Brazil. Informed consent was obtained from all participants and their parents.



Fig. 1. Theoretical framework of the determinants of self-rated oral health in adolescents.

Results

A total of 1500 adolescents in 40 schools were selected and 1302 adolescents in 39 schools took part in the study (response rate = 87%). The intraexaminer agreement was above 0.8 for all teeth for all clinical conditions, indicating very good diagnostic consistency of the examiner.

Of the 1302 adolescents, 52.3% were males, 50.1% were aged 14 years, 19.9% were black, 28.2% rated their health as fair or poor, 60.3% lived in twoparent families, 37.4% reported borderline or high behaviour problems, 52.1% had gone to the dentist in the last year, 33.3% had untreated dental caries, 8.8% had at least one missing tooth, 37% had calculus or bleeding, 19.7% reported to have had dental pain in the last 6 months, 30.3% reported fair or poor chewing ability and 42.1% reported the appearance of their mouth as fair or poor. The highest number of missing values was 117 in the behaviour problems variable (Table 1).

The prevalence of poor self-rated oral health was 44.6% [95% confidence interval (95% CI): 41.8–47.3]. Girls had a higher prevalence of poor self-rated oral health than boys: 50.2% (95% CI: 46.3–54.2) and 39.4% (95% CI: 35.7–43), respectively.

In the unadjusted analyses, self-rated oral health was associated with several variables. The prevalence of poor self-rated oral health was higher in adolescents from lower compared with higher social classes, poor compared with good reported health, with high/borderline compared with normal behaviour, with untreated decay and missing teeth compared with those without it, and in those who reported dental pain compared with those who did not, reported poor compared with good chewing ability and mouth appearance. Poor reported oral health was lower in boys compared with girls, adolescents from two-parent families compared with other situations, and in those who visited a dentist in the last year compared with those who did not. The multivariate analysis demonstrated the effects of social class, sex, selfrated health, untreated decay prevalence, reported chewing ability and mouth appearance (Table 1).

Separate analysis by sex confirmed associations observed in general analysis. Self-rated health, untreated dental caries and mouth appearance were significantly associated with poor oral health in both sexes and in both unadjusted and adjusted analyses. Behaviour problems, reported dental pain and poor chewing function were also associated with poor oral health in the unadjusted analysis, but they lost their statistical significance in the multivariate models (Tables 2 and 3).

All analyses were repeated using logistic regression, and again the variables associated with poor self-rated oral health remained the same, but with severe overestimates of the odds ratios because baseline prevalence of poor reported oral health was high. For example, the unadjusted odds ratio between poor self-rated oral health and poor self-rated health was 11.8 (95% CI: 8.7–16), whereas the unadjusted PR was 2.8 (95% CI: 2.5–3.2).

Discussion

This study introduced a conceptual model to explain self-rated oral health and helped to identify the domains that are assessed by a single self-rated oral health measure in adolescents. It showed that, in this population, good self-rated oral health was related to socioeconomic factors, perceived general health and mouth appearance, and on objective clinical factors such as presence of untreated dental decay.

The previously reported association between socioeconomic factors on self-rated oral health was confirmed in this study. Adolescents from upper class families and those with higher education tend to rate their oral health better than lower class and less educated subjects (10-12). Similar associations have been reported in adults (13). The stratified analyses by gender, and an interaction between sex and social class, might suggest that gender is an effect modifier, that is, the association with social class is stronger in girls than in boys. However, the differences in the estimates between boys and girls were relatively small and the lack of significance in boys may be due to the reduction in power in the subgroup analyses.

The common finding that girls tended to rate their oral health worse than boys was also confirmed (28–30). Similar findings were also reported for perceived general health (10, 18, 31, 32).

Adolescent appraisals of their health are shaped by their overall sense of functioning, which includes both physical health and nonphysical health dimensions (28). The strongest effect in the variables considered was between self-rated oral health and self-rated general health, confirming the other studies (12, 33, 34). General health and dental health behaviours also appear to be related (34) and

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Table 1. Study sample by socioeconomic, demographic, psychosocial and oral variables with unadjusted and adjusted prevalence ratios for each independent variable in relation to poor self-rated oral health (Distrito Federal, Brazil, 2002)

Boys ar	nd girls	Unadjusted ana	lysis	Multivariate analysis			
Level ^a	Variable ^b	п	Poor self-rated oral health (%)	PR ^c (95% CI ^d)	P^{e}	PR (95% CI) ^f	$P^{\rm e}$
1	Social class ^g						
-	High (0)	401	37.7	1.0	_	1.0	_
	Middle (1)	565	44.1	1.17(1.00-1.37)	0.047	1.16 (0.99–1.36)	0.057
	Low (2)	291	53.6	1.42 (1.20–1.69)	< 0.001	1.38 (1.17–1.64)	< 0.001
	Sex			(,	
	Female (0)	621	50.2	1.0	_	1.0	_
	Male (1)	681	39.4	0.78 (0.69–0.88)	< 0.001	0.78 (0.69–0.89)	< 0.001
	Ethnicity						
	White (0)	341	41.3	1.0	_	1.0	_
	Black (1)	259	44.8	1.08 (0.91-1.28)	0.342	1.05 (0.90-1.22)	0.537
	Other (2)	702	46.0	1.11 (0.99–1.25)	0.065	1.10 (0.98–1.22)	0.094
2	Social support						
	High (0)	439	39.4	1.0	-	1.0	_
	Moderate (1)	393	46.3	1.17 (1.01–1.37)	0.039	1.10 (0.93–1.29)	0.248
	Low (2)	433	47.6	1.21 (1.04–1.40)	0.014	1.05 (0.91–1.20)	0.499
	Family structure						
	Two-parent (0)	785	41.0	1.0	-	1.0	-
	Other situation (1)	517	49.9	1.22 (1.06–1.40)	0.007	1.10 (0.96–1.25)	0.148
	Behaviour problems						
	Normal (0)	698	39.5	1.0	-	1.0	-
	Borderline/high (1)	487	52.6	1.33 (1.15–1.54)	< 0.001	1.09 (0.96–1.23)	0.172
	Self-rated health						
	Excellent/very good/good (0)	935	29.4	1.0	-	1.0	-
	Poor/fair (1)	367	83.1	2.83 (2.47–3.23)	< 0.001	2.64 (2.28–3.06)	< 0.001
3A	Dental attendance						
	Yes (0)	678	41.0	1.0		1.0	-
	No (1)	624	48.4	1.18 (1.04–1.34)	0.014	1.07 (0.94–1.22)	0.297
	Untreated dental caries						
	No (0)	869	36.9	1.0	-	1.0	-
	Yes (1)	433	59.8	1.62 (1.44–1.82)	< 0.001	1.39 (1.26–1.55)	< 0.001
	Missing teeth	4400	10.0			1.0	
	No (0)	1188	43.3	1.0	-	1.0	-
	Yes (1)	114	57.9	1.34 (1.14–1.57)	0.001	1.01 (0.86–1.18)	0.931
	Periodontal disease	000	4.4.4	1.0		1.0	
	Sound (0)	820	44.4	I.U 1.01 (0.07 1.17)	-		-
20	Bleeding/calculus (1)	482	44.8	1.01 (0.8/-1.1/)	0.899	0.96 (0.85–1.09)	0.535
3B	Dental pain	1040	42.0	1.0		1.0	
	NO(0)	1046	42.0 EE 1	1.0 1.21 (1.15 1.40)	-0.001	1.0 1.04 (0.02, 1.17)	0 474
	Yes (1)	256	55.1	1.31 (1.15–1.49)	<0.001	1.04 (0.93–1.17)	0.474
	Finallerst (see a d (see d (0))	754	$\mathcal{O}(7)$	1.0		1.0	
	Excellent/very good/good (0) Poor/foir (1)	/ 34 E 10	20.7 60.2	1.0	- -0.001	1.0 1.99 (1.64 - 0.17)	-0.001
	roor/lair (1)	348	09.2	2.39 (2.28–2.94)	<0.001	1.00 (1.04–2.17)	<0.001
	Evcollont/voru good / good (0)	007	38.3	1.0		1.0	
	Poor/fair (1)	205	50.5 59.0	1.0	- -0.001	1.0	- 0.017
	1 001/1all (1)	575	59.0	1.34(1.30-1.73)	<0.001	1.10 (1.03–1.31)	0.017

^aLevel in the hierarchical model.

^bMaximum of 117 missing values (behaviour problems).

^d95% confidence interval.

^fControlled for all variables of same level (horizontal) and variables from higher levels with a significance level of 5% or lower for at least one comparison category.

^gClassified according to the Brazilian National Association of Research Institutes.

some connections between oral and general diseases may be due to an accumulation of similar unhealthy behaviours (35). Although these selfrated measures share similar wording and use the same response scale, it has been argued that these similarities do not explain the association between

^cPrevalence ratio (PR).

eWald test.

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Girls				Unadjusted analysis		Multivariate analysis	
Level ^a	Variable ^b	п	Poor self-rated oral health (%)	PR ^c (95% CI ^d)	$P^{\mathbf{e}}$	PR (95% CI) ^f	$P^{\mathbf{e}}$
1	Social class ^g						
1	High (0)	181	42.0	10	_	10	_
	Middle (1)	267	48.3	1.15(0.92 - 1.43)	0.202	1.15 (0.91–1.44)	0.228
	Low (2)	157	62.4	1.49 (1.22–1.81)	< 0.001	1.46 (1.19–1.79)	0.001
	Ethnicity						
	White (0)	173	43.9	1.0	_	1.0	_
	Black (1)	124	54.0	1.23 (0.97-1.55)	0.078	1.17 (0.94–1.46)	0.156
	Other (2)	324	52.2	1.19 (0.99–1.43)	0.065	1.17 (0.97–1.40)	0.090
2	Social support			(,		(,	
	High (0)	238	42.4	1.0	_	1.0	_
	Moderate (1)	189	54.5	1.28 (1.04–1.59)	0.023	1.18 (0.96–1.46)	0.117
	Low (2)	185	55.7	1.31 (1.06–1.63)	0.015	1.09 (0.91–1.30)	0.352
	Family structure			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		(,	
	Two-parent (0)	349	47.6	1.0	_	1.0	_
	Other situation (1)	272	53.7	1.13 (0.93–1.37)	0.212	1.06 (0.88-1.28)	0.508
	Behaviour problems						
	Normal (0)	300	46.0	1.0	_	1.0	_
	Borderline/high (1)	254	57.1	1.24 (1.02-1.51)	0.031	1.04 (0.86-1.24)	0.699
	Self-rated health			. , ,		. , ,	
	Excellent/very good/good (0)	424	34.4	1.0	_	1.0	_
	Poor/fair (1)	197	84.3	2.45 (2.07-2.89)	< 0.001	2.30 (1.93-2.74)	< 0.001
3A	Dental attendance						
	Yes (0)	328	48.2	1.0	_	1.0	_
	No (1)	293	52.6	1.09 (0.92–1.29)	0.302	0.96 (0.81-1.15)	0.699
	Untreated dental caries						
	No (0)	410	42.0	1.0	_	1.0	_
	Yes (1)	211	66.4	1.58 (1.35–1.85)	< 0.001	1.42 (1.20-1.66)	< 0.001
	Missing teeth						
	No (0)	556	49.3	1.0	-	1.0	-
	Yes (1)	65	58.5	1.19 (0.94–1.49)	0.140	0.98 (0.79–1.23)	0.874
	Periodontal disease						
	Sound (0)	454	48.9	1.0	_	1.0	_
	Bleeding/calculus (1)	167	53.9	1.10 (0.94–1.29)	0.224	1.02 (0.90-1.16)	0.734
3B	Dental pain						
	No (Ô)	479	47.6	1.0	-	1.0	_
	Yes (1)	142	59.2	1.24 (1.05–1.47)	0.013	1.03 (0.89–1.19)	0.698
	Mouth appearance						
	Excellent/very good/good (0)	333	30.9	1.0	-	1.0	_
	Poor/fair (1)	288	72.6	2.35 (1.97-2.79)	< 0.001	1.79 (1.48–2.16)	< 0.001
	Chewing function						
	Excellent/very good/good (0)	407	42.0	1.0	-	1.0	_
	Poor/fair (1)	214	65.9	1.57 (1.38–1.78)	< 0.001	1.22 (1.07–1.39)	0.003

Table 2. Girls' sample by socioeconomic, demographic, psychosocial and oral variables with unadjusted and adjusted prevalence ratios for each independent variable in relation to poor self-rated oral health (Distrito Federal, Brazil, 2002)

^aLevel in the hierarchical model.

^bMaximum of 67 missing values (behaviour problems).

^cPrevalence ratio (PR).

^d95% confidence interval.

eWald test.

^fControlled for all variables of same level (horizontal) and variables from higher levels with a significance level of 5% or lower for at least one comparison category.

^gClassified according to the Brazilian National Association of Research Institutes.

them (34). Reverse causality between reported oral and general health cannot be ruled out.

The health-protective influence of social support on several health outcomes is well documented (36). The effect of social support was confounded mainly by the sex, behaviour and self-rated health variables. However, measurement error may be present because the psychometric properties of this variable were not assessed in this study.

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Table 3. Boys'	sample by	socioeconomic	z, demographic,	psychosocial	and oral	variables	with u	nadjusted	and ad	ljusted
prevalence rat	ios for each	independent v	variable in relati	on to poor sel	f-rated o	ral health	(Distri	to Federal,	Brazil	, 2002)

Boys				Unadjusted analysis		Multivariate analysis	
Level ^a	Variable ^b	п	Poor self-rated oral health (%)	PR ^c (95% CI ^d)	$P^{\mathbf{e}}$	PR (95% CI) ^f	$P^{\mathbf{e}}$
1	Social class ^g						
-	High (0)	220	34.1	1.0	_	1.0	_
	Middle (1)	298	40.3	1.18 (0.93–1.51)	0.175	1.19 (0.93–1.52)	0.165
	Low (2)	134	43.3	1.27 (0.93–1.74)	0.135	1.29 (0.92–1.80)	0.136
	Ethnicity			, , , , , , , , , , , , , , , , , , ,		. , ,	
	White (0)	168	38.7	1.0	_	1.0	_
	Black (1)	135	36.3	0.94 (0.72–1.22)	0.630	0.91 (0.68–1.23)	0.544
	Other (2)	378	40.7	1.05 (0.87-1.27)	0.585	1.01 (0.84–1.22)	0.901
2	Social support						
	High (0)		35.8	1.0	-	1.0	_
	Moderate (1)	204	38.7	1.08 (0.87-1.34)	0.472	1.07 (0.88-1.30)	0.495
	Low (2)	248	41.5	1.16 (0.93–1.45)	0.188	1.02 (0.82-1.28)	0.826
	Family structure						
	Two-parent (0)	436	35.8	1.0	-	1.0	-
	Other situation (1)	245	45.7	1.28 (1.06–1.53)	0.010	1.11 (0.94–1.32)	0.205
	Behaviour problems						
	Normal (0)	398	34.7	1.0	-	1.0	-
	Borderline/high (1)	233	47.6	1.37 (1.10–1.71)	0.006	1.16 (0.96–1.39)	0.114
	Self-rated health						
	Excellent/very good/good (0)	511	25.2	1.0	-	1.0	-
	Poor/fair (1)	170	81.8	3.24 (2.73–3.84)	< 0.001	3.11 (2.61–3.70)	< 0.001
3A	Dental attendance						
	Yes (0)	350	34.3	1.0	-	1.0	-
	No (1)	331	44.7	1.30 (1.09–1.56)	0.005	1.18 (1.02–1.37)	0.031
	Untreated dental caries						
	No (0)	459	32.5	1.0	-	1.0	-
	Yes (1)	222	53.6	1.65 (1.34–2.03)	< 0.001	1.31 (1.10–1.56)	0.004
	Missing teeth						
	No (0)	632	38.0	1.0	-	1.0	-
	Yes (1)	49	57.1	1.50 (1.15–1.97)	0.004	1.10 (0.85–1.42)	0.461
	Periodontal disease						
	Sound (0)	366	38.8	1.0		1.0	_
	Bleeding/calculus (1)	315	40.0	1.03 (0.83–1.29)	0.782	0.90 (0.74–1.08)	0.245
3B	Dental pain	-	27.2	1.0		1.0	
	No (0)	567	37.2	1.0	-	1.0	-
	Yes (1)	114	50.0	1.34 (1.11–1.62)	0.003	1.06 (0.88–1.29)	0.518
	Mouth appearance	101	22.2	1.0		1.0	
	Excellent/very good/good (0)	421	23.3	1.0	-	1.0	-
	Poor/tair (1)	260	65.4	2.81 (2.24–3.52)	<0.001	2.03 (1.63–2.53)	<0.001
	Cnewing function	500	25.2	1.0		1.0	
	Excellent/very good/good (0)	500 101	55.Z	1.0	-0.001	1.0	-
	Foor/fair (1)	181	50.8	1.44 (1.19–1.75)	<0.001	1.08 (0.90–1.29)	0.393

^aLevel in the hierarchical model.

^bMaximum of 50 missing values (behaviour problems).

^cPrevalence ratio (PR).

^d95% confidence interval.

eWald test.

^fControlled for all variables of same level (horizontal) and variables from higher levels with a significance level of 5% or lower for at least one comparison category.

^gClassified according to the Brazilian National Association of Research Institutes.

General self-rated health is believed to principally reflect physical health problems (36). Much the same could be said of oral health. A higher prevalence of untreated dental caries was associated with poor self-rated oral health in this study. This agrees with most studies, which show that poor clinical dental conditions are associated with poor perceived oral health (6–8). That finding has important implications for oral health policies because it shows that this simple and easy way to

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collect dental information may be a good predictor of untreated decay. The PR of poor self-rated oral health for adolescents with untreated dental decay compared with those without was 1.62 (95% CI: 1.44–1.82) (Table 1) in this study. The lack of association between self-rated oral health and clinical periodontal conditions, a finding reported elsewhere (37), may be due to low levels of severe periodontal disease in this age group (38).

Appearance of the mouth was shown to be strongly associated with self-rated oral health in this study. Perceived oral health reflects individual and subjective impressions that include not only health conditions, but also aesthetics and satisfaction with oral health (39). The identification by children of abnormal or unacceptable dentofacial characteristics is influenced not only by objective dental criteria but also by the social and cultural context (40).

Associations between self-rated oral health, retained as a five-category-variable, and untreated dental caries, mouth appearance and chewing function showed a gradient from protection to risk across all categories. Therefore, the grouping into good (excellent/very good/good) and poor (fair/ poor) may have underestimated the strength of some associations.

This study had good external validity because of the high response-rate and representativeness of the sample. The prevalence of poor self-rated oral health (44.6%; 95% CI: 41.4–47.3) was similar to those for this age group in Brazil (47%; 95% CI: 46.2–47.8) (41) and in Distrito Federal (52.5%; 95% CI: 39.2–65.5) in 2003. The study also had good examiner consistency. However, although singleitem measures of self-assessed general health have relatively good validity and test–retest reproducibility (42), new studies should assess whether this single item of self-rated oral health is a valid and reliable measure.

One of the limitations of this study is that it used self-completed questionnaires, thus assuming the reading and understanding capabilities of participants. This problem may not have influenced this study much because all participants had at least 7 years of formal education. In addition, all doubts raised about questions were clarified when students were completing their questionnaires.

Variables with more missing values were behaviour problems and social class. Cases with missing data were not analysed in this study. This may not have influenced the study much because when the effect of a dummy variable with code (1 = missing data on behaviour/social class/ social support and 0 = otherwise) on poor oral health was assessed, it did not show any statistical significance or important effect. Previous selfreport surveys reporting on parental education or occupation have been characterised by high levels of missing data, indicating that a significant proportion of adolescents may not know their parents' socioeconomic status (43). Self-reports of different types of behaviours are affected by cognitive and situational factors in varying degrees (44). Therefore, the control of information bias is beyond the control of the researcher.

Because of the cross-sectional nature, the study cannot determine causality and direction. However, it does suggest future research questions on the development and generalisability of the model of self-rated oral health in adolescents. Longitudinal designs would increase the knowledge on determinants of self-rated oral health further.

There is a movement from the biomedical paradigm of absence of disease to more holistic models of health and disease with increasing focus on patient-centred measures (45, 46). This study is one of few to investigate the factors associated with perceived oral health in adolescents. Results suggest that the assessment and understanding of selfrated oral health should take into account social, psychosocial and oral factors.

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