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Prevalence and determinants of oral impacts on daily performance: results from a survey among school children in Italy

Aida Bianco, Leonzio Fortunato, Carmelo Giuseppe Angelo Nobile, Maria Pavia

Background: The use of health status measures to assess health-related quality of life is not widespread. The objectives of this study were to assess the prevalence, characteristics and severity of oral impacts on health using the Child-Oral Impact on Daily Performance (Child-OIDP). **Methods:** The survey was conducted on 11–16 years old randomly selected students in Catanzaro. Data were collected through a self-administered questionnaire, an interview for the calculation of Child-OIDP and the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) and an oral examination. **Results:** Only 5.5% out of 530 children did not report any dental problem in the previous 3 months and 66.8% had experienced dental impacts according to the Child-OIDP. Sex, fruit intake frequency, mouthwash habits and IOTN AC score assessed by dentist were significant risk factors for dental impacts. **Conclusion:** Our findings suggest that the measurement of Oral Health-Related Quality of Life (OHRQoL) should be an essential component of oral health surveys.

Keywords: children, Child-OIDP, Italy, oral health, quality of life.

Introduction

Despite that oral health has improved significantly over the past few decades, problems still remain in many communities, primarily among people living in poverty, some racial/ethnic minority populations, disabled and children with HIV infection. Dental caries, the most important global oral health burden, is largely preventable, but remains the most common chronic disease among children and adolescents.[1]

Moreover, there is an increasing recognition that oral disorders can have a significant impact on physical, social and psychological well-being.[2,3] This has resulted in a greater clinical focus on the quality of life improvement as a major, if not a primary outcome of dental care,[4,5] and has led to the development of a number of instruments that aim to measure dental outcomes in terms of the impact of changes in oral health on quality of life.[6–8]

However, traditionally dentists have been trained to recognize and treat diseases such as caries, periodontal disease and tumors. Consequently, various indices have been used to describe the prevalence of these diseases in the population.[9–11] However, these important objective measures only reflect the end point of the disease processes, giving no indication about the impact of the disease process on function or psychosocial well-being.

Therefore, the objectives of this study were to use an oral health-related quality of life (OHRQoL) measure, the Child-Oral Impact on Daily Performance (Child-OIDP), to assess the prevalence, characteristics and severity of oral impacts on health and daily activities in secondary school children, and to identify determinants such as children's socio-demographic profile, oral hygiene habits, nutrition practices and oral health conditions, such as dental caries, periodontal diseases and orthodontics, that can predict oral impacts.

Chair of Hygiene, Medical School, University of Catanzaro 'Magna Græcia', Catanzaro, Italy
Correspondence: M. Pavia, Chair of Hygiene, Medical School, University of Catanzaro 'Magna Græcia', Via Tommaso Campanella, 88100 Catanzaro, Italy, tel: +39-961-712371, fax: +39-961-712382, e-mail: pavia@unicz.it

Methods

Study design

The survey was conducted during the period January–April 2006 and information was collected on 780 potential 11–16 years old participants, randomly selected from the list of all students attending randomly selected secondary schools in Catanzaro (Italy). The research team provided oral and written description of the study emphasizing the purpose of the investigation and reassured the students that the information obtained would remain confidential. A letter informing about purposes of the study and a consent form were sent to parents of sampled children inviting them to participate.

A pilot study was carried out to ensure clarity of interpretation and ease of completion of the questionnaire to improve the validity of responses and desired information before using them in the main data collection.

Survey instruments

Socio-demographics included information on personal characteristics such as age, sex, occupation of the father and mother or male and female guardians. The questions on utilization of dental services included information on dental problems, number of visits, main reason for each visit and time since last visit. Oral hygiene practices, investigated through frequency of tooth brushing, were scored on a 4-point scale, ranging from never or less than once a day to three or more times a day. Sweets intake frequency was scored on a 5-point scale, ranging from never to more than once a day. The interview procedure for using the Child-OIDP began with a question reporting a list of common oral problems that children are likely to perceive. The Child-OIDP has been subjected to a cross-cultural translation and adaptation process into Italian. The methods to translate the questions in the Child-OIDP index from English (the original version) to Italian and to adapt the index to the Italian culture followed published guidelines.[12] The process of cross-cultural adaptation involved several steps: translation from English to Italian; first meeting of a group of experienced researchers on the specific topic, in survey design and questionnaire development and administration to produce the first Italian draft;

pilot-testing on a focused group of children; second meeting of the group to produce a new consensus version; back-translation to English; re-evaluation by the group members.

Validation of the Italian version of the Child-OIDP was performed through the assessment of internal and test–retest (external) reliability in addition to face, content and concurrent validity. Internal reliability was done through the evaluation of inter-item correlation coefficients among the eight items of Child-OIDP. Test–retest reliability was checked in the pilot study through an additional interview of 50 children at a time interval of 20 days by the first administration. Validity was examined in terms of face, content and concurrent validity. Face and content validity were examined in order to assess the clarity of the wording of the items and, eventually, generating new items. Modifications were made according to the comments recorded by the children in order to clarify the content of the questionnaire and to simplify its wording. Since there is no gold standard of OHRQoL index, concurrent validity was examined by testing the index against proxy measures. The hypothesis was that the higher the Child-OIDP total impact scores a child had, the more negative would be the child's perception of his/her oral health problems. Moreover, the scores were also compared with the number of decayed teeth, as a pointer of oral disease.

The Child-OIDP index is different from the original index developed for adults[13] in terms of the sequence of the questions, the Likert type scales of severity and frequency and the recall memory period. However, the overall concept remains the same as the original OIDP and it attempts to quantify relative frequency of the impact of oral problems on eight daily tasks, namely eating and enjoying food, speaking and pronouncing clearly, cleaning teeth, smiling, sleeping, laughing and showing teeth without embarrassment, maintaining usual emotional state without being irritable, carrying out major work or social role and enjoying contact with other people. Children were asked to identify oral problems that they perceived in the last 3 months.

If children reported at least one impact on any activity, the frequency of the impact and the severity of its effect on their daily life were scored. The oral impact score was calculated by the two methods described by Gherunpong *et al.*[14] According to the first method, the oral impact score of each activity was obtained by multiplying severity and frequency scores (0, 1, 2 or 3 each) in relation to that activity. We also followed the alternative scoring method that classifies each weighted performance score into six levels of intensity: none, very little, little, moderate, severe and very severe. Finally, we calculated the extent of impact that refers to the number of performances with impacts (PWI) that affected a child's quality of life over the past 3 months.

Students also assessed dental aesthetics using the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) that consists of a scale of 10-color photographs of anterior teeth displaying varying degrees of malocclusion, and were asked to indicate which photograph resembled most closely with their own dentition, ranging from no. 1 that represents the most attractive smile to no. 10 that represents the less attractive smile. Cut-off points for aesthetic need for orthodontic treatment were as follows: grades 1–4 represent 'no need for treatment', grades 5–7 'borderline need' and grades 8–10 'definite need for treatment'.

Oral examination

Following the interview, the children were taken to a separate room in small groups at a time and an oral examination was performed by the same community dentist (LF) with extensive clinical experience. Assessment of the oral health conditions of each subject was done using portable equipment with the subject seated on a chair facing a window by means of plane mouth mirror, explorer and a periodontal ball-pointed probe. The World Health Organization caries diagnostic criteria for decayed, missing and filled teeth (DMFT) and surfaces (DMFS) were used to evaluate dental caries status.[9] The presence of visible dental plaque was measured using the criteria of the Plaque Index (Pl) according to Silness and Löe (1964).[10] Gingival condition was evaluated using the criteria of the Gingival Index (GI) according to the method of Löe and Silness (1963).[11] The dentist also calculated the AC of IOTN.[15]

The Ethics Committee of the 'Mater Domini' Hospital of Catanzaro (Italy) approved the protocol of the study (Prot. EC no.5/2006).

Statistical analysis

Stepwise multiple linear and logistic regression models were constructed to assess the independent effect of several covariates after adjusting for the effect of confounders on the following outcomes: having experienced one or more dental impact on their daily life activities in the past 3 months (0 = no, 1 = yes) (model 1) and overall impact score (continuous) (model 2). The following predictor variables were included in all models: age (continuous), gender (0 = male, 1 = female), father's employment status (categorical: 1 = high professional and managerial, 2 = lower managerial, 3 = senior clerical, small commercial operators; 4 = artisans and farmers, 5 = others), utilization of dental health care services (1 = regular, i.e. never in the previous year, 1 = irregular, i.e. at least once in the previous year), tooth brushing habits (ordinal: 0 = less than once a day, 1 = once a day, 2 = twice a day, 3 = more than twice a day), mouthwash habits (ordinal: 0 = less than once a day, 1 = once a day, 2 = twice a day, 3 = more than twice a day), dental floss habits (ordinal: 0 = less than once a day, 1 = once a day, 2 = twice a day, 3 = more than twice a day), sweetened drinks intake frequency (ordinal: 0 = never, 1 = less than once a day, 2 = once a day, 3 = more than once a day), fruits intake frequency (ordinal: 0 = never, 1 = less than once a day, 2 = once a day, 3 = more than once a day), DMFT (continuous), IOTN AC grade assessed by student (continuous), IOTN AC grade assessed by dentist (continuous), PI score (continuous) and GI score (continuous).

The significance level for variables entering the linear and logistic regression models was set at 0.2 and for removing from the model at 0.4. The measure used for the analysis of internal reliability of the Child-OIDP was the Cronbach's alpha coefficient. The test–retest reliability was checked using the weighted-kappa score. Since the Child-OIDP score was not normally distributed, concurrent validity was measured with non-parametric tests (Mann–Whitney or Kruskall–Wallis tests). All analyses were conducted using the Stata version 8.1 software program.[16]

Results

Of the total 780 children eligible, 530 participated in the study, thus giving a response rate of 67.9%. The main socio-demographics and dental characteristics of the study population are reported in table 1.

In terms of internal reliability, the inter-item correlation coefficients among the eight items of Child-OIDP ranged from 0.02, which represented the relationship between cleaning and speaking, to 0.33. No correlation was negative

indicating homogeneity among the items and no correlation was high enough for any item to be redundant. Cronbach's alpha coefficient was 0.57. The alpha coefficients did not increase when any of the items were deleted.

The test–retest reliability showed satisfactory results for Child-OIDP with high kappa scores (>0.7).

In relation to concurrent validity the OIDP-total impact scores discriminated in the expected direction between subjects who rated their oral health status as good compared to those that perceived their oral health as poor; indeed, the mean OIDP total scores increased significantly with decreasing satisfaction with their mouth health ($P < 0.001$) and number of decayed teeth ($P = 0.033$).

Of the 528 subjects who had oral examination, 57% had no history of dental caries experience with a DMFT = 0. Only 39% of the participants were free of visible dental plaque on any of the index teeth and the overall mean PI score was 0.24. Less than half (40.5%) of subjects showed that they had a perfect status of gingival condition and the average GI was 0.24.

Scores for the AC of IOTN as perceived by the dentist and child showed that definite treatment need (AC score 8–10) was reported for 5.8% of subjects by the dentist and 3.4% by children, whereas most of the subjects were considered to have no need of orthodontic treatment (AC score 1–4) and particularly 68.3% by dentist and 88.9% by children.

Only 5.5% of children did not report any dental problem in the previous 3 months, and among those with problems the most frequent reasons were sensitive tooth (27.9%), toothache (23.5%), tooth decay (18.6%) and exfoliating primary tooth (17.3%). Results on oral impacts are reported in table 2. The prevalence of oral health impacts was high: 66.8% of children reported having experienced one or more dental impact on their daily life activities in the past 3 months according to the Child-OIDP, and difficulty in eating was the most prevalent oral impact (30.4%). The distribution of overall impact scores ranged from 0 to 30 with a mean score of 1.9 (±3.7).

Only 3.5% had very severe and 12.9% severe intensity of impacts. The intensity of impacts on each activity showed that sleeping and emotion were the most severely affected while speaking and eating were the least. Among the children with impacts, the extent of impacts varied from 1 (35.3%) to 8 (0.2%) PWIs, whereas 16.8% had 2, 7.9% had 3 and 4% had 4 PWIs.

Toothache was reported as the most frequent specific cause of the impact for four of the eight dimensions assessed by the Child-OIDP. Furthermore, oral conditions that were related to appearance frequently affected children; position of teeth was reported as the main cause of the impact for speaking (29.9%) and smiling (36.9%); color of teeth (19.3%) was the second perceived cause of impacts on social contact. Sensitive tooth was the most frequently reported (50%) as a specific cause related to eating, followed by the toothache (26.6%).

Table 3 presents the results of the multivariate logistic and linear regression analysis. Results of the stepwise logistic regression analysis indicated that sex, fruit intake frequency, mouthwash habits and IOTN AC score assessed by dentist

Table 1 Selected characteristics of the study population

Characteristic	*N*[a] (%)	Mean ± SD
Sex		
Male	251 (47.4)	
Female	279 (52.6)	
Age, years		12.8 ± 0.9
Father's employment status		
High professional and managerial	7 (1.4)	
Lower managerial	251 (48.6)	
Senior clerical, small commercial operators	129 (25.0)	
Artisans, farmers	115 (22.3)	
Others	5 (1.0)	
Frequency of tooth-brushing		
Less than once a day	23 (4.4)	
Once a day	101 (19.1)	
Twice a day	265 (50.1)	
More than twice a day	140 (26.4)	
Frequency of mouth-washing		
Less than once a day	111 (51.2)	
Once a day	62 (28.6)	
Twice a day	32 (14.8)	
More than twice a day	12 (5.5)	
Frequency of dental-floss use		
Less than once a day	99 (61.1)	
Once a day	35 (21.6)	
Twice a day	21 (12.9)	
More than twice a day	7 (4.4)	
Sugared drinks intake frequency		
Never	48 (9.1)	
Less than once a day	137 (26.1)	
Once a day	135 (25.6)	
At least once a day	206 (39.2)	
Fruits intake frequency		
Never	23 (4.4)	
Less than once a day	90 (17.1)	
Once a day	70 (13.3)	
More than once a day	344 (65.2)	
Dental attendance in the previous year		
Irregular	154 (29.1)	
Regular	376 (70.9)	
Sweets consumption		
Never	148 (27.3)	
Less than once a day	272 (50.3)	
At least once a day	121 (22.4)	

a: The numbers that do not add to 530 are due to missing values

Table 2 Prevalence of OIDP, mean OIDP total impact score, and impact intensity scores of secondary school children (*N* = 530)

	Overall *N* (%)	Eating *N* (%)	Speaking *N* (%)	Cleaning *N* (%)	Sleeping *N* (%)	Smiling *N* (%)	Emotion *N* (%)	Work *N* (%)	Social contact *N* (%)
OIDP prevalence	354 (66.8)	161 (30.4)	68 (12.8)	128 (24.2)	37 (6.9)	124 (23.4)	80 (15.1)	33 (6.2)	32 (6.1)
OIDP score									
Range	0–30	0–9	0–6	0–9	0–9	0–9	0–9	0–6	0–9
Mean (SD)	1.9 (3.7)	0.4 (1.1)	0.2 (0.8)	0.3 (1.0)	0.1 (0.7)	0.4 (1.3)	0.3 (1.1)	0.1 (0.5)	0.1 (0.8)
Impact intensity[a]									
Very little	37 (18.4)	11 (11.6)	6 (11.8)	16 (19.5)	4 (13.3)	12 (15.6)	6 (12.3)	1 (4.2)	3 (11.5)
Little	61 (30.4)	31 (32.6)	13 (25.5)	23 (28.1)	8 (26.7)	18 (23.4)	7 (14.3)	8 (33.3)	4 (15.4)
Moderate	70 (34.8)	37 (38.9)	21 (41.2)	32 (39)	11 (36.7)	27 (35.1)	23 (46.9)	10 (41.7)	11 (42.3)
Severe	26 (12.9)	13 (13.7)	10 (19.6)	8 (9.8)	5 (16.7)	16 (20.7)	10 (20.4)	4 (16.7)	7 (26.9)
Very severe	7 (3.5)	3 (3.2)	1 (1.9)	3 (3.6)	2 (6.6)	4 (5.2)	3 (6.1)	1 (4.1)	1 (3.9)

a: Impact intensity: percentage of children with impact

Table 3 Results of the logistic and linear regression models

Variable	OR	SE[a]	95% CI	*P*-value
Model 1: Having experienced one or more dental impacts				
Log-likelihood = −306.877, chi-square = 32.2, P-value = 0.0002				
Sex, *dichotomous*	1.74	0.36	1.16–2.62	0.008
Frequency of mouth-washing, *ordinal*	1.65	0.34	1.10–2.47	0.015
IOTN AC grade by dentist, *continuous*	1.12	0.05	1.02–1.23	0.018
Fruit intake frequency, *ordinal*	0.83	0.07	0.70–0.97	0.018
Frequency of tooth-brushing, *ordinal*	0.78	0.10	0.60–1.01	0.058
Sugared drinks intake frequency, *ordinal*	1.11	0.08	0.96–1.29	0.174
IOTN AC grade by child, *continuous*	1.07	0.07	0.93–1.21	0.342
PI, *continuous*	0.72	0.26	0.36–1.48	0.375
DMFT, *continuous*	1.06	0.07	0.93–1.22	0.391
Variable	**Coeff**	**SE[a]**	***t***	***P*-value**
Model 2: Overall impact scores				
F (7,498) = 4.26; *P*-value = 0.0001; $R^2 = 0.06$; Adjusted $R^2 = 0.04$				
Frequency of tooth-brushing, *ordinal*	−0.63	0.21	−2.94	0.003
Sex, *dichotomous*	0.93	0.34	2.76	0.006
IOTN AC grade by dentist, *continuous*	0.17	0.08	2.17	0.030
Frequency of mouth-washing, *ordinal*	0.69	0.34	2.05	0.041
IOTN AC grade by child, *continuous*	0.17	0.11	1.62	0.105
DMFT, *continuous*	0.16	0.11	1.45	0.147
Age, *continuous*	0.23	0.19	1.19	0.233
Constant	−1.77	2.56	−0.69	0.489

a: Standard error

were significant risk factors for dental impacts. Indeed, evidence for having experienced one or more dental impacts on daily life activities in the past 3 months was significantly more likely among female children, among those who had poor intake of fruits, in those who used mouthwash more frequently and in schoolchildren with high IOTN AC score indicated by dentist (Model 1 in table 3).

Results of the stepwise multiple linear regression analysis showed that sex, tooth-brushing and mouth-washing habits, and IOTN AC grade assessed by dentist significantly predicted overall impact scores, since female children, those who brushed their teeth less frequently, who used mouthwash more frequently and those with higher IOTN AC score indicated by dentist were significantly more likely to show higher oral impact scores (Model 2 in table 3).

Discussion

The results of this cross-sectional study from a large sample of children 11–16 years old provided a unique opportunity for analysing the oral impact in this group, since to our knowledge this is the first investigation in Italy that has addressed the prevalence, characteristics and severity of oral impacts and it may contribute toward the improvement of knowledge on epidemiological patterns where information is lacking.

The prevalence of oral impacts experienced during the previous 3 months by the study population was very high (66.8%). Direct comparison with the earlier literature published in several countries is difficult, and one must take care to interpret the results since the nature and magnitude of impacts could vary among populations with different cultural backgrounds.[17,18] Some studies have reported a higher prevalence of OIDP,[14,19] whereas our value was clearly higher than those found in Brazilian and Asian young population.[20–22]

The importance of OHRQoL is particularly relevant for children. Younger children are more sensitive to a variety of impacts, such as appearance, than older age groups; perceptions about health and quality of life of children change as they mature. These impacts will affect their current quality of life and psychological development and may ultimately result in influencing their social skills and education.[23,24] Psychological impacts of oral health, such as avoiding laughing and being teased about teeth, were more prevalent in children than in adults and elderly.[25]

Despite the fact that oral impacts were very frequent in this Italian child population, they were not severe; this population had a mean Child-OIDP score of 1.9 (±3.7) and almost half of those with impacts had very little or little intensity of impacts. Difficulty with eating due to oral problems was the most common activity affected and this finding is similar to other studies using the OIDP in all age groups.[13,26–29] Difficulty with cleaning was another important aspect of children's OHRQoL and it affected 24.2% of children.

We evaluated the determinants of the presence of dental impacts in the logistic regression model and those of severity of impacts in the linear regression model, and we found that most of predictors were similar in the two models. Indeed, the relationship between having experienced one or more dental impact on daily life and increase of overall impact score and IOTN AC score assessed by dentist was intriguing. This finding is similar to that found in a cross-sectional study conducted in public and private secondary schools in Brazil, where the adolescents who had never had orthodontic treatment with clinically assessed orthodontic needs reported more oral health impacts than those who had treatment.[30] The only demographic determinant of having experienced one or more dental impact on daily life and increase of overall impact scores in our study was female sex, and this difference may be partially explained by the consideration that females are more sensitive to perception of their own appearance than males. This is supported with the finding that female sex was one of the independent risk factors for the aesthetic impact of malocclusion on daily life of Brazilian school children aged 10–14 years as assessed by OIDP.[21]

Moreover, our results indicated that poor fruit intake frequency was a significant risk factor for dental impacts. The most significant effect of nutrition on teeth is the local action of diet in the mouth on the development of dental

caries and enamel erosion, and epidemiological studies have shown that consumption of starchy staple foods and fresh fruit is associated with low levels of dental caries.[31]

It is noteworthy that this study reported that low frequency of tooth brushing was accompanied by a significant increase of overall impact scores, and this is in accordance with a study addressing the social dimensions of oral health by relating oral quality of life to oral health status, in which the authors found that children's OHRQoL was positively associated with more frequent brushing and flossing and oral health status were closely associated with OHRQoL for both adults and children.[25]

Although the participants had relatively good oral health, as shown by classic oral health status indices such as DMFT, their quality of life was still adversely affected by oral problems.

We conceptualized OHRQoL using Child-OIDP. Although this is widely used, other instruments to measure OHRQoL also exist. However when different indices are used to compare OHRQoL measurement, studies' conclusions are essentially the same,[32,33] and conclusions about factors influencing OHRQoL are often similar, even when studies use different measures of OHRQoL. The Child-OIDP index has demonstrated to be a valid instrument; it has few items and is able to capture all the dimensions related to OHRQoL, particularly in very young populations.

The major limitations of our study are its cross-sectional nature and the absence of information about the bias which could arise from non-response. It is well known that cross-sectional surveys pose many problems in relation to hypothesis testing since data on risk factors and outcome are assessed at the same time, but this particular issue does not seem to affect our results. Moreover, the proportion of responding subjects (67.9%) is comparable with other population-based surveys,[34] and the data available for use were of high quality. Another minor limitation is related to the age range of recruited children, since the Child-OIDP has been primarily developed for children aged 11–12 years. However, there are several papers already published that have used this instrument in younger and older children.[35–37] Moreover, since the differences with the OIDP validated for adults were substantially simplifications, such as language simplification, elimination of a question, reduction of Likert scale from five to three options and shortening of the recall period from 6 to 3 months, we believe that this would not be a problem for older children. It should also be noted that most of the sample comprised 11–14 year old children, and although we included age in both models, age does not appear to be a significant determinant of the outcome of interest.

Although this was not a primary objective of our study, we measured internal and test–retest reliability in addition to face, content and concurrent validity of the survey instrument and the results from this study showed that the Italian Child-OIDP index is a reliable and valid instrument, also in terms of internal reliability. Indeed, reliability of 0.5 or above is considered to be acceptable in the case of Child-OIDP, which has few items.[38]

Most oral diseases and their consequences interfere with, or have impacts on, daily life activities; however traditional methods of measuring oral health mainly use clinical dental indices and focus on the absence or presence of oral diseases, but do not inform us about the oral well-being of people in terms of feelings about their mouths, or, for example, their ability to chew and enjoy their food. Our findings strongly suggest that the measurement of OHRQoL should be an essential component of oral health surveys, clinical trials and studies evaluating the outcomes of preventive and therapeutic programs intended to improve oral health.

Key points

- There is evidence that the importance of oral health-related quality of life measure is particularly relevant for children because they are more sensitive to a variety of impacts than older age groups, but it is not known how much these impacts affect the current quality of life of Italian children.
- The results provided a unique opportunity for analysing the oral impact in a large sample of Italian children, since to our knowledge this is the first investigation addressing the prevalence, characteristics and severity of oral impacts in this country.
- The Child-Oral Impact on Daily Performance represents a reliable and valid instrument to measure the oral health-related quality of life and to assess the prevalence, characteristics and severity of oral impacts on health and daily performance among children 11–16 years old in Italy.
- The study results may be useful to oral healthcare policymakers, since the assessment of oral health outcomes is vital for planning oral healthcare programs in order to acquire accurate data to promote health resources and address oral health needs and demands.

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