

Diagnostic Validity of Self-Perceived Dental Caries in Indonesian Young Adolescents Aged 12-15 Years

Diah Ayu Maharani¹, Jessica Kurniawan², Ary Agustanti³, Robbykha Rosalien⁴, Anton Rahardjo⁵, Alessandro Leite Cavalcanti⁶

¹Department of Preventive and Public Health Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.

 0000-0001-6713-786X

²Oral Epidemiology and Clinical Studies in Dentistry Research Cluster, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0002-4237-3791

³Oral Epidemiology and Clinical Studies in Dentistry Research Cluster, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0003-0123-2746

⁴Oral Epidemiology and Clinical Studies in Dentistry Research Cluster, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0003-0207-409X

⁵Department of Preventive and Public Health Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.

 0000-0001-7836-9084

⁶Associate Professor, Department of Dentistry, State University of Paraiba, Campina Grande, PB, Brazil.  0000-0003-3572-3332

Author to whom correspondence should be addressed: Diah Ayu Maharani, Department of Preventive and Public Health Dentistry, Faculty of Dentistry, Universitas Indonesia, Jalan Salemba No. 4, Jakarta, Indonesia. 10430. Phone: +62 818164623. E-mail: diah.ayu64@ui.ac.id.

Academic Editors: Alessandro Leite Cavalcanti and Wilton Wilney Nascimento Padilha

Received: 12 November 2018 / Accepted: 26 November 2018 / Published: 05 December 2018

Abstract

Objective: To compare self-perceived information and clinically diagnosed dental caries status among Indonesian children aged 12–15 years. **Material and Methods:** In this cross-sectional study, a questionnaire was used to obtain self-perceived information. Clinical examinations were conducted to determine the mean number of decayed, missing or filled teeth (DMFT) and the presence of severely decayed teeth with visible pulpal involvement, ulceration caused by dislocated tooth fragments, fistula, and abscess (PUFA). The study included 494 children aged 12–15 years recruited from six junior high schools in Jakarta, Indonesia. The clinical examination results and responses to the self-perceived assessment questionnaire were compared to determine the sensitivity and specificity. **Results:** The proportions of children with dental caries and clinical consequences of untreated dental caries in this study were 69.4% and 17.6%, respectively, with mean DMFT and PUFA index scores of 2.4 and 0.2, respectively. For the DMFT index, the self-perceived need for oral treatment had the highest sensitivity (86%), while the dental pain had the highest specificity (89%). For the PUFA index, the self-perceived oral health condition had the highest sensitivity (92%), while the self-perceived dental pain had the highest specificity (82%). However, none of the self-perceived variables had both high sensitivity and specificity. **Conclusion:** Self-perceived information obtained from the questionnaire can not properly evaluate the clinical status of dental caries.

Keywords: Epidemiology; Oral Health; Dental Caries; Adolescent.

Introduction

Dental caries is considered one of the most common chronic diseases worldwide with an incidence of 60%-90% among school-aged children [1,2]. According to a previous study, the prevalence of dental caries in 12-year-old children living in Jakarta, the capital of Indonesia, and its satellite cities was 84%, with a mean number of decayed, missing or filled teeth (DMFT) of 3.2 [2]. However, the latest study on 12-year-old school children living in Jakarta reported that number had decreased to 63% with a mean number of DMFT of 1.7 [3]. This high number of dental caries might result from the low utilization of dentists in Jakarta, especially among children. A previous study indicated that fewer than 20% of 12-year-old school children visit a dentist annually [3].

Dental services may not be used because of perceived discomfort and hesitation to undergo dental treatment, even for routine health assessment [4,5]. Traditionally, normative assessment is used to evaluate oral health status in epidemiology studies [6]. This assessment, however, has some disadvantages, including assessment time, invasiveness, expense, and lack of resources. Consequently, self-perceived assessment via questionnaires and interviews has become a more common method of oral health surveys. According to previous studies, comparing clinical (normative assessment) and subjective (self-perceived) assessments could evaluate a person's oral health status, particularly regarding the number of teeth and presence of dentures [4].

Comparisons of clinical and subjective assessments could demonstrate the efficacy of self-evaluation of an individual's oral health status and confirm the accuracy of self-perceived assessment [4]. The effective use of a subjective oral health assessment could improve understanding of oral health problems, allowing implementation of an oral health promotion strategy that would offer a more affordable and acceptable method of conducting an epidemiological oral health survey [7,8]. Today, self-assessed oral health also aids in identifying the needs of the regular dental check-up, assists the dentists in assessing the routine diagnostic procedures to determine required treatment needs and is resourceful in gathering the information related to oral health [9].

In previous studies of the correlation between self-perceived assessment and clinically diagnosed disease, the samples usually consisted of children and adults aged >18 years [4,5,10]. No study has yet compared assessment strategies in younger, preteen children. Moreover, studies in India [11], New Zealand [12] and Brazil [13] revealed that self-perceived dental pain in adolescents was associated with the presence of dental caries and dental service use, and that its substantial effects indicates an urgent need for public health strategies. Therefore, present study was limited to children aged 12-15 years as the mixed dentition period has already ended and all permanent teeth, except for the third molars, have erupted by this age. Children in this age group tend to be more cooperative and are, therefore, usually used for epidemiological studies. Also, children in this age group are easily identified because they are still in the school system, so it is possible to achieve optimum sample homogeneity when conducting follow-up examinations.

The study objectives were to compare self-perceived and clinically diagnosed dental caries status in children aged 12-15 years and to assess the sensitivity and specificity of a self-perceived assessment questionnaire.

Material and Methods

Study Design

This was a cross-sectional study to collect evidence on self-perceived assessment and clinically diagnosed dental caries in Indonesian children aged 12-15 years in Jakarta.

Sampling

Six of the 287 public junior high schools in five districts of Jakarta province had an equal opportunity to participate and were randomly selected for inclusion. Children aged 12-15 years old, from selected schools located throughout Central Jakarta, East Jakarta, South Jakarta, and North Jakarta, were invited to take part in this research.

The sample size was calculated by considering a power of 80% power with confidence interval 95%. Further, an effect of 1.2 due to recruiting a cluster sample and 15% for nonresponse were calculated. Thus, 597 children were invited to participate in this study.

Data Collection

Information sheets and consent forms were distributed by the teachers to the parents and children. The participants were examined by one trained examiner through a brief, visual, non-invasive clinical oral examination. The oral examination detected dental caries in accordance with the World Health Organization (WHO) criteria, using DMFT index [14]. While PUFA index is used to assess the presence of oral conditions resulting from untreated caries. The index is recorded separately from the DMFT and scores the presence of either a visible pulp, ulceration of the oral mucosa due to root fragments, a fistula or an abscess [15]. Two indices were used to assess the dental caries status using plane mouth mirrors. For each index, only one score is assigned per tooth.

The DMFT and PUFA score per person is calculated in the same cumulative way and represents the number of teeth that meet the DMFT or PUFA diagnostic criteria. Thus, for an individual person the score can range from 0 to 32 for the permanent dentition. The proportion of dental caries status is calculated as percentage of the population with a DMFT or PUFA score of one or more.

Each participant was asked to answer a questionnaire through an interview. Regarding self-perceived dental caries status, the following two questions were included for analysis in the present study with 5 likert scale: (1) Overall, what would grade the health of your teeth and mouth; (2) Overall, are you satisfied with your oral health condition. Further, three questions were asked with a dichotomous answer (3) Overall, do you think that you need oral health treatment; (4) In the past three months, have you ever had a toothache; (5) In the past three months, have you experienced any tooth decay. The clinical examination results and the self-perceived assessment questionnaire were compared for Sensitivity - Participants with an oral disease who are clinically diagnosed as having the disease will have a positive result [10,16] where a is a true positive and c is a false negative [16].

Specificity - Participants with no oral disease who are clinically diagnosed as not having the disease [10], as calculated using the formula based on previous study [16].

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows Software, version 20 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to calculate the absolute and relative frequencies.

Ethical Aspects

The study protocol was approved by the Dental Research Ethics Committee, Faculty of Dentistry, Universitas Indonesia (No.17/Ethical Approval/FKGUI/IV/2017).

Results

Of the 597 children aged 12-15 years who were invited to participate in this study, 71 (11.9%) did not undergo both a clinical examination and questionnaire interview, and 32 (5.4%) children only underwent a clinical examination without completing a questionnaire interview. Therefore, only 494 children, consisted of 196 (58.5%) girls and 139 (41.5%) boys, were included for analysis (response rate of 82.7%).

The overall proportion of dental caries status evaluated with the DMFT and PUFA indices was 69.4% with mean score of 2.40 ± 2.56 and 17.6% with mean score of 0.22 ± 0.52 , respectively. Among 494 children included in the study, 343 (69.4%) children were identified as having dental caries experience based on DMFT score > 1 . Of that, 34 (10.1%) children reported having good oral health condition and 68 (20.3%) feeling satisfied with their oral health condition. While 87 (26%) and 211 (63%) children reported experiencing a dental pain and tooth decay, respectively. Reflecting on their subjective assessment of oral health status, 229 (68.4%) children expressed the needs to get a dental treatment.

According to the clinical examination results, 185 (37.4%) participants had a lower dental health status with DMFT score of >2.4 and 309 (62.6%) had a better dental health status with DMFT score of $0-2.4$. While the clinical examination results using PUFA index showed 87 (17.6%) participants had a PUFA score of >0.2 and 407 (82.4%) had a PUFA score of $0-0.2$.

Data regarding the sensitivity and specificity values for different cut-off points of the DMFT score are summarized in Table 1. The question about oral treatment needs at all three cut-off points of the DMFT score had the highest sensitivity, while the question about dental pain at all three cut-off points of the DMFT score had the highest specificity. PUFA was categorized according to the mean value of the current PUFA status. Data regarding the sensitivity and specificity values of the PUFA score are summarized in Table 2. The question regarding the oral health condition had the highest sensitivity of 0.92%, while the question regarding dental pain had the highest specificity of 0.82.

Table 1. Sensitivity and specificity for perceived dental caries according to different DMFT score.

Questions		DMFT Scores		
		= 2.4	= 1	Decay = 1
Opinion Regarding Oral health Condition	SN (%)	73.3	67.6	68.2
	SP (%)	57.8	82.9	83.3
Satisfaction with Oral health Condition	SN (%)	72.2	64.8	65.5
	SP (%)	48.3	52.9	54.0
Oral Treatment Needs	SN (%)	86.1	86.0	85.8
	SP (%)	18.3	22.5	21.6
Dental Pain	SN (%)	27.6	26.2	26.0
	SP (%)	81.9	88.7	87.4
Tooth Decay	SN (%)	68.1	62.1	63.0
	SP (%)	65.4	86.8	86.2

SN = Sensitivity; SP = Specificity.

Table 2. Sensitivity and specificity for perceived dental caries according to PUFA score of 0.2.

Questions	SN (%)	SP (%)
Opinion Regarding Oral health Condition	91.7	57.0
Satisfaction with Oral health Condition	83.3	45.3
Oral Treatment Needs	90.1	18.1
Dental Pain	40.2	82.3
Tooth Decay	83.9	60.7

SN = Sensitivity; SP = Specificity.

Discussion

The pilot study was a representative population of children aged 12 to 15 years residing in Jakarta, the capital of Indonesia. The participating schools in this study were randomly chosen, a trained examiner collected the information and the data were accessed via the Jakarta Education Authorities website. Thus, the internal and external validity of these data is guaranteed.

The DMFT and PUFA indices were used as common methods for the assessment of oral health status [14,15]. The sensitivity and specificity of the clinical examination and self-perceived questionnaire were compared. In previous studies, self-perceived assessment of dental caries status was neither useful nor successful [4]. However, another study suggested that valid self-reported measures are an efficient alternative for large epidemiological studies [7]. It has been suggested that sensitivity and specificity should be considered together since adequate validity is established when both measures are high [16].

The present study results showed that the self-perceived needs of oral treatment had the highest sensitivity for the DFMT index, but low specificity. In contrast, the self-perceived dental pain had the highest specificity, but low sensitivity. Self-perceived dental pain reported in this study was higher than that was reported among adolescents in India [12]. In a previous study evaluating self-perceived oral health condition, a high sensitivity (0.85) and maximum specificity (1.00) were

found [7]. While in this study, the sensitivity and specificity of the self-perceived oral health condition had similar results as the self-perceived dental pain. These results were similar to those of another study where sensitivity was lower than specificity [4].

These differences were probably due to the incomparable oral health literacy level. Oral health literacy demonstrates the degree to which individuals have the capacity to comprehend basic oral health information and services needed to make oral health decisions and act on them. Lack of oral health literacy would lead to poor oral hygiene and high risk for oral diseases [8].

Results of this study showed that children seemed to be unable to recognize whether they were affected by dental diseases. Also, the perception of health was at a higher level and perception of disease at a lower level. Lack of awareness could influence oral health-seeking behavior, which is related to using dental care, a wide variety of psychosocial factors, and self-perception of illness [4,6]. Other socioeconomic background may contribute to the use of dental service among children as a previous study found that lower odds of dental visit were seen among children identifying with Māori, Pacific or Asian people (and those in the 'Other' ethnic category) than among European students, and among those residing in medium- or high-deprivation areas than those in low-deprivation areas [11].

For the PUFA index, only one cut-off point was analyzed. From the five questions compared with PUFA index, the question regarding oral health condition had the highest sensitivity with a moderate value of specificity. The question about dental pain had the highest specificity with a low value of sensitivity. For the PUFA index, the children's perception of disease was at a higher level than their perception of health. As a possible explanation, regarding the PUFA index, caries had progressed to pulp involvement, which could induce pain or other symptoms. PUFA index is suitable for assessing the consequences of severity of tooth decay and it is universally applicable in all settings [15]. The questionnaire was more sensitive for the PUFA index than the DMFT index. In the present study, there was a discrepancy with the clinical assessment. There was no self-perceived variable found to have both high value of specificity and sensitivity. However, the questionnaire has a significant value in explaining the perception and awareness of oral health conditions as clinical examination has some limitations in demonstrating psychosocial oral health problems. Self-perceived oral health assessment serves as a key element that has a greater effect on quality of life and can be utilized as an indicator for overall oral health status [8]. The combined clinical and subjective indicators define a multidimensional assessment of the oral health status in society [7].

Conclusion

The questionnaire was more sensitive to the PUFA index than the DMFT index. However, self-perceived information obtained from the questionnaire can not properly evaluate the clinical status of dental caries. This might be due to the children's lack of perception of health and illness.

Financial Support: This study was supported by Universitas Indonesia.

Conflict of Interest: The authors declare no conflicts of interest.

References

- [1] Bagramian RA, Garcia-Godoy F, Volpe AR. The global increase in dental caries. A pending public health crisis. *Am J Dent* 2009; 22(1):3-8.
- [2] Adiatman M, Yuvana AL, Nasia AA, Rahardjo A, Maharani DA. Dental and gingival status of 5 and 12-year-old children in Jakarta and its satellite cities. *J Dent Indones* 2016; 23(1):5-9. <https://doi.org/10.14693/jdi.v23i1.982>
- [3] Agustanti A, Rosalien R, Hutami DF, Septalita A, Rahardjo A, Maharani DA. Dental caries in 12-year-old school children living in Jakarta. *J Int Dent Med Res* 2018; 11(1):238-42.
- [4] Vered Y, Sgan-Cohen HD. Self-perceived and clinically diagnosed dental and periodontal health status among young adults and their implications for epidemiological surveys. *BMC Oral Health* 2003; 3:3. <https://doi.org/10.1186/1472-6831-3-3>
- [5] Balappanavar AY, Sardana V, Nagesh L, Ankola A V, Kakodkar P, Hebbal M. Questionnaire vs clinical surveys: The right choice? A cross-sectional comparative study. *Indian J Dent Res* 2011; 22(3):494. <https://doi.org/10.4103/0970-9290.87081>
- [6] Maharani DA. Perceived need for and utilization of dental care in Indonesia in 2006 and 2007: A secondary analysis. *J Oral Sci* 2009; 51(4):545-50. <https://doi.org/10.2334/josnusd.51.545>
- [7] Pinelli C, Loffredo LCM. Reproducibility and validity of self-perceived oral health conditions. *Clin Oral Investig* 2007; 11(4):431-7. <https://doi.org/10.1007/s00784-007-0133-0>
- [8] Kotha SB, Chaudary M, Terkawi S, Ahmed M, Ghabban SN, Fernandez RAA. Correlation of perceived self-rated oral health status with various dental health and awareness factors. *J Int Soc Prev Community Dent* 2017; 7: S119-S124. https://doi.org/10.4103/jispcd.JISPCD_304_17
- [9] Kojima A, Ekuni D, Mizutani S, Furuta M, Irie K, Azuma T, Tomofuji T, Iwasaki Y, Morita M. Relationships between self-rated oral health, subjective symptoms, oral health behavior and clinical conditions in Japanese university students: A cross-sectional survey at Okayama University. *BMC Oral Health* 2013; 13:62. <https://doi.org/10.1186/1472-6831-13-62>
- [10] Akobeng AK. Understanding diagnostic tests 1: Sensitivity, specificity and predictive values. *Acta Paediatr* 2007; 96(3):338-41. <https://doi.org/10.1111/j.1651-2227.2006.00180.x>
- [11] Areai DM, Thomson WM, Foster Page LA, Denny SJ, Crengle S, Clark TC, Ameratunga SN, Koopu PI. Self-reported oral health, dental self-care and dental service use among New Zealand secondary school students: Findings from the Youth 07 study. *N Z Dent J* 2011; 107(4):121-6.
- [12] Kumar YS, Acharya S, Pentapati KC. Prevalence of dental pain and its relationship to caries experience in school children of Udipi district. *Eur Arch Paediatr Dent* 2014; 15(6):371-5. <https://doi.org/10.1007/s40368-014-0124-1>
- [13] Kozmhinsky VMR, Heimer M, de Goes PSA. Sociodemographic factors and oral health conditions related to the impact on the quality of life of adolescents. *Braz Res Pediatr Dent Integr Clin* 2016; 16(1):35-42. <https://doi.org/10.4034/PBOCI.2016.161.04>
- [14] World Health Organization. *Oral Health Surveys: Basic Methods*. 5th. ed. Geneva: World Health Organization; 2013. 125p.
- [15] Monse B, Heinrich-Weltzien R, Benzian H, Holmgren C, van Palenstein HW. PUFA - An index of clinical consequences of untreated dental caries. *Community Dent Oral Epidemiol* 2010; 38(1):77-82. <https://doi.org/10.1111/j.1600-0528.2009.00514.x>
- [16] Habib A, Alalyani M, Hussain I, Almutheibi MS. Brief review on sensitivity, specificity and predictivities. *IOSR J Dent Med Sci* 2015; 14(4):64-8. <https://doi.org/10.9790/0853-14456468>