Reliability of Patient Surveys for Assessment of Dental Condition and Correlation to a Dental Health Examination

Abstract

Background: Traditional clinical dental examinations are resource intensive, creating a need for efficient screening tools, especially in large populations. This study retrospectively evaluates the reliability of a self assessment questionnaire aiming to identify individuals with high dental morbidity and assess the urgency of dental care.

Methods: As part of a limited time project, a questionnaire focusing on reported symptoms and medical history was administered to 121 female soldiers aged 18-21 via mobile devices. Based on their responses, participants were categorized into “low” or “high” severity risk groups. All individuals identified as high risk were invited for clinical dental examinations, along with low risk participants who requested a dental examination. In this study, we retrospectively analysed the data collected during the project by comparing the severity levels predicted by the questionnaire with the findings from the clinical assessments.

Results: We found a significant correlation between predicted and actual severity levels according to the Chi-Square Pearson test. While clinically 78.5% of the patients had a low severity dental condition, 73% of actual high severity cases were correctly predicted, enhancing the efficiency of prioritizing high risk patients. Also, examining patients with predicted high severity levels is shown to increase the chances of treating a patient with high severity conditions. Analysis of individual questions revealed varying effectiveness, with some questions showing higher predictive value for high severity conditions.

Conclusions: The questionnaire shows promise for initial triage in large-scale screenings, and it can effectively predict dental health severity, particularly in identifying high risk cases. Hence this tool can help improve treatment effectiveness and resource allocation in dental care. Combining self assessments with clinical evaluations remains crucial for accurate diagnosis and treatment planning.

Keywords: Dental Risk, Training, Preventing Medicine, Dental Examination.

Authors:

Noa Revivo Tuchner, DMD [1]
Alex Lvovsky, DMD [1] [2]
Sofia Pidman [3]
Avi Shemesh, DMD [1] [2]

[1] Medical Services Center, Israel Defense Forces Medical Corps, Tel Hashomer, Ramat Gan, Israel.
[2] Department of Endodontics, Israel Defense Forces Medical Corps, Tel Hashomer, Ramat Gan, Israel.
[3] “Bina” Program, Faculty of Dental Medicine, Hebrew University, Jerusalem, Israel.

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Corresponding Author:
Noa Revivo Tuchner
0524576209
revnoa@gmail.com

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Introduction

Oral health is crucial to overall well-being, significantly impacting quality of life. Dental diseases like caries and periodontal disease are globally prevalent and present major public health challenges. Edelstein[1], Marcenes[2] and Jürgensen[3] described dental caries as a global pandemic, highlighting its widespread prevalence and severe health impacts. Factors such as sugar consumption, lack of fluoride, and poor oral hygiene contribute to caries. Early detection and management are essential for preventing severe outcomes and maintaining oral health.[4]

Clinical examination is the gold standard for diagnosing dental diseases but is resource-intensive and impractical for large-scale screenings. [5][6] Methods based on patient-reported information offer efficient alternatives for identifying individuals at risk. These tools rely on patients' reports providing crucial preliminary data, for example on their overall oral health status, medical history, specific symptoms like bleeding on probing,[7] [8] socioeconomic status, dietary and smoking habits. These are used in different contexts of dentistry, for example in identifying conditions like periodontitis[9][10] or dental caries.[5] Several studies have validated the effectiveness of these tools, showing significant correlations between self-reported and clinically observed conditions.[7][9][11] However, self-assessment can be limited by biases such as dental anxiety and lack of knowledge.[12] [13]

The various studies indicate that self-assessment questionnaires and reported symptoms can be effective tools for predicting dental health conditions and identifying individuals at high risk for dental diseases. [14] [15] These self-assessment tools are particularly valuable in large-scale screenings and settings where clinical resources are limited. The consistent findings across different populations and contexts highlight the potential for integrating self-assessment methods into routine dental health surveillance and preventive strategies.

This study aims to evaluate the effectiveness and reliability of a self-assessment questionnaire based on reported symptoms and dental history, in predicting the urgency of dental care and the level of dental disease. This will be achieved by determining the correlation between predicted and actual oral health states, assessing whether such a questionnaire can reliably identify serious dental cases without clinical examinations, thereby improving dental care delivery efficiency.

Methods

This study is a retrospective case study, that was approved by IDF Ethics Committee – approval number 2446.

A questionnaire focused on patients' reported symptoms and medical history was composed for filtering out dental patients in a large screening setup **(see Figure 1)**. This questionnaire was administered as part of a temporary project aimed at improving dental triage efficiency, and data were later analysed retrospectively. It was completed by 121 noncombat female Israeli soldiers, aged 18 to 21, who were examined during their basic training at the Border Defense Corps training base. The questionnaire included seven prediction questions. Each question provides an indication for a different dental condition severity, with the patient's overall predicted level of disease determined by the most severe indication from the questionnaire. All patients were assigned a predicted level of dental condition severity, "low" or "high" severity, based on their answers to the questionnaire's questions. Questionnaire responses were re-coded to separate identificatory and medical information.

Then, all the participants were summoned for a clinical dental examination during which their actual dental severity level was determined according to their physical state. The actual levels of dental disease were determined based on the IDF's classification system, which is based on types of treatment needed. The general guidelines to classify a patient's state to a severity level are: Level 1 – need for calculus removal; Level 2 – up to six caries lesions; Level 3 – six to ten caries lesions, and/or the need for post and core treatment; Level 4 – deep caries lesions that are nearby the pulp, need for root canal treatment, need for extractions, and/or above ten caries lesions. Level 1 and level 2 are treated as "low" actual severity, while level 3 and level 4 are "high" severity levels.

After collecting all predicted and actual clinical severity

1) Have you had a dental check-up in the last 5 years?
   No indication
2) During a dental check-up, were you told that you need a tooth extraction (other than wisdom teeth), root canal treatment, or have a very deep cavity?
   High severity (3/4)
3) In the past few months, have you experienced severe pain from a tooth (other than wisdom teeth) that wakes you up at night?
   High severity (3/4)
4) Have you experienced recent tooth pain that you would rate 9 or 10 on a scale of 1 to 10?
   High severity (3/4)
5) In the past few months, have you experienced mild pain when eating sweet foods or drinking cold water that disappeared after stopping the stimulation?
   Low severity (1/2)
6) Are you aware of a few minor cavities (not deep and not numerous) that you have?
   Low severity (1/2)
7) Do you wish to be examined by a military dentist?
   (Consent for examination)

Figure 1 - Prediction questions and their associated levels of dental condition severities that can be deduced from them.

findings, the correlation between "low" predicted level to actual level 1 or 2, and between "high" predicted level to actual level 3 or 4, was evaluated by Pearson Chi-Square test using IBM SPSS software.

To further analyze the relationship between predicted and actual levels, we calculated the occurrence of actual severities out of various predicted severities, and the occurrence of predicted severities out of various actual severities.

We also assessed the usability of each question used in the prediction task, by checking which percentage of the patients who answered an answer indicative to a treatment-worthy condition (in most questions this answer is “yes”), were in a condition of clinical high severity.

Results

A significant correlation between predicted and actual severity levels was found according to the Chi-Square Pearson test (P-value<0.05)

Table 1 lays out occurrences of the levels detected in the clinical examinations, and the relationship between predicted and actual severities.

In the prediction stage, both severity levels were close to being equally common: 47% and 53% were predicted to have a high and low severity dental condition respectively. As clinically examined, low severity conditions were much more common - evident in 78.5% of the cases.

For both predicted levels, most of the cases were clinically low, but the occurrence of high severity cases is larger when the high levels are predicted: 12% and 30% of the predicted-low and predicted-high cases were actually high severity, respectively.

Out of the actual high severity cases, 73% of the cases were predicted high, and only 27% predicted low.

Actual severities				
Predicted severities		Low severity	High severity	Total
	Low severity	50 (88%)	7 (12%)	57
	High severity	45 (70%)	19 (30%)	64
	Total	95 (78.5%)	26 (21.5%)	121
Predicted severities				
Actual severities		Low severity	High severity	Total
	Low severity	50 (53%)	45 (47%)	95
	High severity	7 (27%)	19 (73%)	26
	Total	57 (47%)	64 (53%)	121

Table 1 - Occurrence of actual severities out of various predicted severities, and occurrence of predicted severities out of various actual severities. Predicted and actual levels are correlated with p-value 0.02.

Actual low severity cases were pretty evenly distributed between both predicted levels.

For the prediction questions, the mean percentage for high severity conditions among the patients answering a treatment-worthy indicative answer, was 31% for the various questions used, and the median was 29%. Some questions had a higher chance of indicating a high severity condition, specifically questions #6, #2 and #4, where 53%, 39% and 31% of those answering "yes" had high severity conditions respectively.

Discussion

Our study aimed to evaluate the effectiveness and reliability of a dental condition indicative questionnaire in predicting dental disease severity. The results of this study provide valuable insights into the effectiveness of using a self assessment questionnaire to predict the urgency of dental care. Our findings indicate a significant correlation between the predicted and actual severities of dental conditions, as evidenced by the Pearson Chi-Square test. The analysis demonstrated that while the questionnaire was generally effective in identifying patients with high severity conditions, there were some discrepancies that highlight the need for further refinement of the predictive tool.

A particularly important result is that a strong majority of the cases that were actually high severity (73%) were correctly predicted as high severity. This finding is crucial, as it suggests that the questionnaire is highly effective in identifying patients with the most urgent need for dental care. If the primary goal is to ensure that high severity cases are not missed, the questionnaire serves as a robust tool for this purpose.

Moreover, given that a sustainable majority of the cases were actually of low severity, our analysis shows that if we summon only patients predicted to have high

severity for treatment, we significantly enhance our chances of treating patients with actual high severity conditions. Specifically, there is a 30% chance of treating high severity patients among those predicted to have high severity, compared to only a 12% chance among those predicted to have low severity, or a 22% chance in the general patient population. This targeted approach can improve the efficiency of dental care delivery and ensure that resources are focused on the most urgent cases. Additionally, if the analysis is performed with more severity levels (4 levels), we also find a consistent result where progressing through the predicted levels increases the likelihood of the patient having the highest dental severity level. Although this detailed analysis is not included above, it supports the robustness of this finding.

Additionally, we assessed the effectiveness of the various prediction questions in identifying high severity cases. Our analysis showed that some questions were more indicative of high severity conditions than others, with an average of 31% and a median of 29% of patients who answered affirmatively being in a treatment worthy condition. Notably, certain questions had higher predictive value, highlighting the importance of refining these questions to improve the overall accuracy of the questionnaire.

Some of the results for the effectiveness of the prediction questions may seem non intuitive at first glance, for example question #6 is aimed to indicate lower levels of dental disease, but nevertheless it emerges as indicative of high severities. But we should keep in mind that the level of predicted severity is taken as the highest severity according to the prediction questions, so some of those answering “yes” to question #6 had other indicative answers as well.

In conclusion, the use of self-assessment questionnaires shows promise as a supplementary tool in the initial triage of dental patients, helping to prioritize clinical resources more efficiently. Naturally, the ability to identify the severity of dental conditions without a dentist's examination is somewhat limited, both due to the few findings that can be collected via a short questionnaire and due to the limited dental knowledge and familiarity of patients with their medical condition and history. On the other hand, the strong ability of the questionnaire to identify high severity cases underscores its potential as an effective screening tool to ensure urgent cases are addressed promptly. Combining clinical evaluations with self-reported assessment is still essential to enhance diagnostic accuracy and optimize patient care. Future work should focus on refining the questionnaire to improve its specificity and further validate its reliability across diverse patient populations.

REFERENCES

1. Edelstein BL. The dental caries pandemic and disparities problem. BMC Oral Health 2005; 6(Suppl 1):S2.
2. Marcenes W, Kassebaum NJ, Bernabé E et al. Global burden of oral conditions in 1990-2010: a systematic analysis. Journal of Dental Research 2013; 92(7):592-597.
3. Jürgensen N, Petersen PE. Oral health and the impact of socio-behavioural factors in a cross sectional survey of 12-year old school children in Laos. BMC Oral Health 2009; 9:1-11.
4. Mathur VP, Dhillon JK. Dental caries: A disease which needs attention. Indian Journal of Pediatrics 2017; 85:202-206.
5. Levin L, Shpigel I, Peretz B. The use of a self-report questionnaire for dental health status assessment: a preliminary study. British Dental Journal 2013; 214(5):E15-E15.
6. American Academy of Pediatric Dentistry. Guideline on caries-risk assessment and management for infants, children, and adolescents. Pediatric Dentistry 2013; 35(3):E157-E164.
7. Blizniuk A, Ueno M, Zaitsu T, Kawaguchi Y. Association between self-reported and clinical oral health status in Belarusian adults. Journal of Investigative and Clinical Dentistry 2016; 8(2):e12206.
8. Locker D. Self-esteem and socioeconomic disparities in self-perceived oral health. Journal of Public Health Dentistry 2016; 69(1):1-8.
9. Eke PI, Dye B. Assessment of self-report measures for predicting population prevalence of periodontitis. Journal of Periodontology 2009; 80(9):1371-1379.
10. Abbood HM, Hinz J, Cherukara G, Macfarlane TV. Validity of self-reported periodontal disease: A systematic review and meta-analysis. Journal of Periodontology 2016; 87(12):1474-1483.
11. Levin L, Shenkman A. The relationship between dental caries status and oral health attitudes and behavior in young Israeli adults. Journal of Dental Education 2004; 68(11):1185-1191.
12. Meera T. Self-assessed dental status, dental anxiety of the patient and their oral hygienic behaviour. Journal of Pharmaceutical Sciences and Research 2016; 8(6):575.
13. Atchison, KA, Linda FD. Understanding health behavior and perceptions. Dental Clinics 2003; 47(1):21-39.
14. Sekundo C, Stock C, Jürges H, Listl S. Patients' self-reported measures of oral health—A validation study on basis of oral health questions used in a large multi-country survey for populations aged 50+. Gerodontology 2019; 36(2):171-179.
15. Pitiphat W, Garcia RI, Douglas CW, Joshipura KJ. Validation of self-reported oral health measures. Journal of Public Health Dentistry 2002; 62(2):122-128.