An Assessment of Dental Treatment Need: An Overview of Available Methods and Suggestions for a New, Comparative Summative Index

Jolanta Aleksejūnienė, PhD; Vilma Brukienė, PhD

Abstract

Objective: *The aims were to give an overview and consider advantages and disadvantages of different approaches used to evaluate dental treatment need and to suggest an alternate Quantitative Summative Dental Treatment Need Index.* ***Methods:*** *The Medline Ovid database was searched for relevant articles published during the last three decades combining the terms "needs assessment," "dental care," "health services needs and demand."* ***Results:*** *There were substantial differences in methods used. Different modifications of the Decayed, Missing, Filled Teeth/Surfaces indices, complex quantitative summative indices, or simplified approaches were used to assess dental treatment need. Differing advantages and disadvantages of these methods can be identified. Previously used approaches have a common limitation for use in oral epidemiology.* ***Conclusions:*** *The suggested alternate Quantitative Summative Dental Treatment Needs Index focuses on an ability to compare both the total burden of treatment need as well as to make a distinction among specific treatment needs across populations. This new approach is an attempt to develop a comprehensive index for use in oral epidemiology with further revisions anticipated.*

Key Words: needs assessment, dental treatment need, epidemiological index

Introduction

Unmet need for health care is commonly used to describe the extent to which existing health problems go unaddressed (1). A national database of unmet dental treatment need would be of great value because it would provide a basis to estimate manpower requirements, effectively allocate resources for health care, estimate costs of oral health care programs, and identify the types of treatments necessary to meet those needs (2,3). An assessment of unmet dental treatment need is also important internationally in order to compare different populations and population subgroups or to estimate different levels of deprivation regarding dental treatment need. It has been recommended that limited resources for community-based oral health programs be targeted at populations or communities with greatest treatment need (4). Therefore, conducting an assessment of treatment need is a necessary first step in oral health care. However, it has been reported that there is no good comparative index that addresses the entire need of dental treatment (5). Additionally, it has been inferred that because of the complex multifactorial nature of dental care for children, it is not possible to construct a simple index of pediatric dental treatment need (6).

Contemporary therapeutic and preventive challenges, along with the changing dental disease patterns, have created a demand for alternate approaches to answer specific questions in caries research (7). Thus, further research is needed to develop a new quantitative dental treatment need index (TNI) (8).

The aims of this work are a) to give an overview and consider advantages and disadvantages of different approaches used to evaluate dental treatment need and b) to suggest an alternate quantitative summative dental TNI for comparisons across different populations.

An Overview of Different Assessments of Dental Treatment Need

The Medline Ovid database was searched for relevant articles published over the last three decades, combining the terms "needs assessment," "dental care," "health services needs and demand." The search was limited to publications in English. The relevant publications were identified, and the focus was to evaluate the measurements of dental treatment need.

Diverse methods were used to evaluate dental treatment needs in different studies. Some of these were simplified approaches to assess need for dental treatment, some were evaluations of past caries and treatment experience, and others used more specific assessments of treatment need. As there were substantial differences in methods used, they will be discussed separately.

The Decayed, Missing, Filled Teeth/Surfaces (DMFT/S) Indices. The World Health Organization (WHO) established guidelines for the DMFT/S indices (9). They were

Send correspondence and reprint requests to Dr. Jolanta Aleksejūnienė, 2199 Wesbrook Mall, Vancouver, BC V6T 1Z3, Canada. Tel.: 604-822-7800; Fax: 604-827-4448; e-mail: jolantaa@interchange.ubc.ca. Jolanta Aleksejūnienė is with the Department of Oral Health Sciences, Faculty of Dentistry, The University of British Columbia (www.dentistry.ubc.ca). Vilma Brukienė is with the Institute of Odontology, Faculty of Medicine, Vilnius University. Manuscript received: 1/17/08; accepted for publication: 6/3/08.

DOI: 10.1111/j.1752-7325.2008.00101.x

widely accepted throughout the world and have been extensively used for more than 60 years (10). It is important to make a distinction that these indices were used for two main purposes. The most common use was to evaluate the prevalence and incidence of dental caries experience. The second purpose was to assess the need for dental treatment, which was defined as either the number of teeth/surfaces with untreated caries, i.e., the D component, and/or the unmet dental treatment need evaluated as the proportion of D/DMF (5,11-15). The problem with the latter approach is that it is not useful for international comparisons because the aforementioned proportion is highly dependent on the population studied. For example, in developing countries, the DMFT/S is mainly composed of D and M components, whereas, in industrialized countries, the FT component is the dominant part of the DMFT/S index (16). An additional disadvantage of this approach is that it does not make a distinction among diverse treatment needs.

Focusing on the high-risk approach, the Significant Caries Index (SiC) was derived from the DMFT index (17). The SiC is the mean DMF of one-third of the highest caries-risk group (10). The SiC index has been shown to be more sensitive than the DMF index for preventive and prognostic goals (18). Although the SIC index can be useful for the comparison of the high-risk groups from different countries, it still does not enable comparisons of specific normative dental treatment needs and/or the total treatment burden among populations.

It is important to consider that the DMFT/S indices reflecting the summative caries experience are neither identical nor specific enough to describe treatment need (10). They neither adequately indicate treatment need pertinent to manpower and financial considerations nor are sufficient to evaluate the severity and potential complications of dental caries (7).

Simplified Quantitative Indices. The simplified approaches included both subjective (i.e., self-perceived) and objective (i.e., professionally assessed dental treatment need). These approaches usually robustly differentiated among the diverse treatment needs. For example, the need for the dental care was discriminated either among the need for emergency-oriented care, dental check-ups, and any other type of dental care, or between the two levels: 0-1 decayed tooth versus 2-22 decayed teeth (19). For the self-perceived oral treatment need in children, an even more simplified approach was used, i.e., asking the question "Do you feel you need any dental treatment now?" (answer: yes/no) (20).

Another simplified approach was to estimate the percent of people in need for the specific treatment, e.g., the percentage of people in need of an extraction or a conservative treatment (2,13,21). The problem with this approach is that people do not consider the extent of treatment needed, e.g., the need for one extraction is equally considered as the need for more extractions.

Dental Treatment Needs Assessment According to the WHO Criteria. The standard WHO methodology and criteria for the normative dental treatment needs assessment were developed and have been used (22). However, there has been inconsistency in how these criteria have been applied in different studies. For example, the need assessment included six types of basic needs: those relating to dental caries, traumatic dental injuries, enamel defects, periodontal, orthodontic, and prosthodontic problems (23). The study by Antunes et al. discriminated only roughly between the need for prevention and the need for restorative treatments (24). The problem with this discrimination is that different treatments were summed under one score, i.e., fillings, extractions, pulpal care, and crowns were treated as the same treatment modality. Similar approaches, i.e., to combine different treatment modalities under one code, were employed elsewhere (25).

A more accurate distinction among different treatment needs was attempted, i.e., to find out how many individuals needed a one-surface filling, a two-surfaces filling, or dental extraction (12,14,26). Although the last approach is more accurate and specific in regard to dental treatment needs, it still does not take into account the overall extent of the treatment needed, e.g., a need for one extraction is equally considered as the need for five extractions.

Another study discriminated among the basic levels of treatment such as no treatment needed, preventive treatment, fissure sealants, initial conservative restorations, advanced conservative restorations, and radical treatments (7). The inherent shortcoming of the last approach is that three different treatment modalities, i.e., pulp therapy, prosthetic restorations, and extractions, were included into one radical treatment level.

Similarly, in another study, treatments were classified as preventive (diet modification, prophylaxis, oral hygiene instructions, and sealants), restorative (restorations, pulp care, and crowns), and rehabilitative (tooth removal) where a person or a tooth could be assigned to a maximum of two treatment categories (25). This approach did not consider that the same person would need all three categories of treatment.

Other Approaches to Study Dental Treatment Needs. There were approaches to focus on urgency for treatment and on the self-perceived need for dental treatment. However, urgency criteria were not consistently applied in different studies (11,27,28). Objective assessments and self-reports were employed to determine or define the urgency. However, similar to aforementioned approaches, different problems were also clustered and robustly evaluated (29,30).

In a study of the older people, dental treatment need was ranked,

according to the guidelines of the American Dental Association, into five categories from "no need" to "an urgent need" (27). The problem with this ranking is that one category includes two different types of treatment, namely, periodontal treatment and denture reline or repair. This means that, despite the possibility of two different treatments, both fall under one category. A contrasting limitation is that some categories are not mutually exclusive, e.g., an urgent need for extractions may be allocated into two categories: a rank four (need for extraction) and a rank five (need for urgent dental treatment). This surely undermines the reliability and validity of this measurement.

A more specific approach to urgency measurement was defined as low (no visible disease or incipient disease), moderate (cavitated, asymptomatic decay, or moderate gingivitis), and high-urgency need (infection, tooth or jaw fracture, pulpitis, or severe periodontal condition with bleeding) (11). The authors emphasized that the presence of or lack of urgency did not mean there was no need for preventive and therapeutic dental services (11).

Although the urgency approach may be practical and efficient to identify the need for the immediate treatment, it still has a number of limitations as discussed earlier.

The self-perceived need for oral health care, a subjective indicator, has been suggested as a complimentary measure to the professionally defined need (31). This approach has been employed in a few studies (19,32-34). Only a weak association was found between the self-perceived need and the objectively assessed oral health (32,33). On the other hand, the perceived need for dental care was strongly associated with utilization of dental-care services (19). The latter association is more important in the context of the fulfillment of dental treatment need.

It has to be considered that, although self-assessment is practical and can give a quick overall picture of self-perceived treatment need in populations and population subgroups, it is still unclear how reliable and valid the method is for other purposes (34).

Complex, Quantitative, Summative Indices. There have been several attempts at comprehensively assessing dental treatment need (7,35,36).

The Oral Health Status Index (OHSI) combined a modified DMFS index, assessments of gingival inflammation, calculus and destructive periodontal disease (36). This index integrates the status of the teeth and the periodontium into one numeric score ranging from −55 to 100 (36). In a few studies this index showed a good discriminant validity to differentiate among the groups of different socioeconomic status (36-38). There is, however, an inherent limitation in the way this index was composed. The OHSI was derived by the paired preference technique from the opinions of general dentists. Thus, there is a possibility of an examiner bias.

A TNI categorized needs according to both the severity of damage to the tooth and the complexity of treatment required (7). Then, the tooth was assigned to one of seven categories (7). Although this index is more comprehensive in assessing treatment need than the aforementioned indices, there are still some limitations. First, a subject level category and the tooth level categories are integrated into the same index. This clearly creates problems when differences are statistically analyzed. Another problem is that categories are not mutually exclusive, e.g., a front tooth lesion, which covers less than half of surface (category four) could need a three-surface advanced restoration (category five). Moreover, thresholds among different categories are not distinct, and there is an inconsistency in their description. Furthermore, treatment modalities, such as endodontic, prosthodontic, and extractions, are too different to be included into one category (category six).

Possibly, the most comprehensive approach was employed in the study assessing sociodental treatment needs for children (39). This assessment consisted of three components: normative need (NN), impact-related need (IRN), which integrated NN and oral-health-related quality (OHRQoL), and a propensity-related need (PRN), which summed all three needs (PRN = NN + OHRQoL + behavioral propensity). The PRN approach resulted in a considerable decrease of the overall dental treatment need compared with NN, i.e., the need identified through the conventional clinical assessment. It has been reported that conventional clinical methods are unrealistic because they frequently result in a very high volume of need, which cannot be insured and treated even in wealthy countries (1). Although this method is valuable for one purpose, that being an efficient distribution of limited resources, it is not sufficient for other purposes, such as comparing overall treatment needs among different populations or population subgroups and planning for human resources to meet the needs of providing health-care services.

Suggestions for a New Quantitative Summative Dental Treatment Needs Index (QSDTNI)

An alternate index for evaluating summative dental treatment need is presented and subsequently discussed. This approach focuses on the ability to compare the total burden of treatment need in populations or subpopulations as well as to make a distinction between specific treatment needs across populations. It is important to emphasize that this index is developed for the epidemiological use only, i.e., it is not adequate for specific clinical purposes, e.g., allocation of a specific treatment.

A Basic Model for the Assessment of Dental Treatment Need. In this assessment, the normative dental treatment need is recorded according to the WHO criteria. Subsequently, a QSDTNI is calculated for each subject. The calculation is based on the relative differences in

monetary costs of diverse dental treatment services. To this end, the *Fee Guide for Dental Treatment Services*, published annually by the British Columbia Dental Association (Canada, 2007), was used. The cost for a sealant is arbitrarily chosen as the basis for all calculations and is equaled to unity. Then, the relative ratio for each specific treatment is obtained by dividing the cost of a specific dental treatment by the cost of the sealant. For example, the relative ratio for a one-surface filling (rrRF1) is calculated in the following way:

$$\text{rrRF1} = \frac{\text{Cost of one-surface filling}}{\text{Cost of a sealant}} \quad (1)$$

The relative ratios of basic treatment needs are presented in Table 1. The QSDTNI for each individual is calculated by summing relative ratios of all necessary specific treatment needs according to the following formula (n denotes the number of teeth requiring the specific treatment modality):

$$\begin{aligned}\text{QSDTNI} = {} & n(\text{rrPS}) + n(\text{rrRF1}) + \\ & n(\text{rrRF2}) + n(\text{rrRF3}) + n(\text{rrRE1}) + \\ & n(\text{rrRE2}) + n(\text{rrRE3}) + n(\text{rrPC}) + \\ & n(\text{rrPDmax}) + n(\text{rrPDman}) + \\ & n(\text{rrCDmax}) + n(\text{rrCDman}) + \\ & n(\text{rrSE}) \end{aligned} \quad (2)$$

For example, a subject needs sealants for teeth numbers 36 and 46, a two-surface filling for tooth 16, an endodontic treatment and a crown for tooth 26. The QSDTNI index for this patient will be calculated as follows by using the relative ratios for each treatment modality (refer to Table 1):

$$\begin{aligned}\text{QSDTNI} = {} & 2(1.00) + 1(4.97) + \\ & 1(31.23) + 1(26.71) = 64.91 \end{aligned} \quad (3)$$

Critical Considerations of the Suggested Approach. One of the advantages of the QSDTNI is that it is a comprehensive and not a simplified assessment of dental treatment need. Additionally, this index is based on the WHO guidelines that are already widely applied, and subsequent calculations can be performed in a standardized way. This clearly reduces the possibility of examiner bias.

Overall, the previous studies using the WHO criteria were not consistent in analyzing the acquired information. This makes comparisons among different studies at least difficult, if not possible. The suggested new index evaluates both individual specific treatment need and the total burden of treatment need. This enables comparisons of treatment needs across the studies and across populations. The latter option was clearly lacking in the previously used indices.

Another disadvantage of several previously employed indices was that different treatment modalities were collapsed under one treatment category. The suggested QSDTNI does not have this disadvantage. The aforementioned complex quantitative summative indices have an advantage of capturing variations in treatment needs among individuals; however, in contrast to the QSDTNI, they do not enable comparisons of specific dental treatment needs.

On the other hand, the limitations of the QSDTNI should be acknowledged. It is important to emphasize that this index was not developed for clinical use. Therefore, this index should be considered as an epidemiological index, whose primary use is to evaluate patterns of treatment needs across populations or subpopulations.

Another important consideration is that the suggested index includes assessments only of basic treatment needs. The future development of this index should include additions, where risk of oral disease and the complexity of the treatment are accounted for. The future development of the QSDTNI should also include adjustments for special treatment needs such as periodontal, orthodontic treatment or implants.

This new approach of evaluating the dental treatment need should be looked upon as an attempt to develop a comprehensive index for use in oral epidemiology. Further discussions for possible revisions of the suggested index are welcome.

Table 1
Relative Ratios for the Basic Dental Treatment Needs*

Treatment modalities	Relative ratios for the specific treatments**
Preventive	
Sealant (PS)	RrPS = 1
Restorative filling***	
One surface (RF1)	rrRF1 = 3.93
Two surfaces (RF2)	rrRF2 = 4.97
Three surfaces (RF3)	rrRF3 = 5.86
Restorative endo	
Single-rooted (RE1)	rrRE1 = 16.90
Two-rooted (RE2)	rrRE2 = 22.02
Multi-rooted (RE3)	rrRE3 = 31.23
Restorative prosthetic	
Crown (PC)	rrPC = 26.71
Partial denture-cast frame	
Maxillary (PD max)	rrPDmax = 35.22
Mandibular (PD man)	rrPDman = 38.39
Complete dentures	
Maxillary (CD max)	rrCDmax = 27.80
Mandibular (CD man)	rrCDman = 30.94
Surgery	
Extraction (SE)	rrSE = 4.58

* If a tooth needs several treatments, all treatments included, e.g., endodontic + restoration + crown.
** The relative ratio is the price of a specific dental treatment divided by the cost of a sealant.
*** Filling due to a primary, secondary caries or trauma.

References

1. Newacheck PW, Hughes DC, Hung YY, Wong S, Stoddard JJ. The unmet health needs of America's children. Pediatrics. 2000;105:989-97.
2. Dash JK, Sahoo PK, Bhuyan SK, Sahoo SK. Prevalence of dental caries and treatment needs among children of Cuttack (Orissa). J Indian Soc Pedod Prev Dent. 2002;20:139-43.
3. WHO. Intersectional action for health. The role of intersectoral cooperation in national strategies for health for all. Geneva: World Health Organization; 1986.
4. Council on Dental Research. Cost-effectiveness of sealants in private practice and standards for use in prepaid dental care. Council on Dental Research. J Am Dent Assoc. 1985;110:103-7.
5. Helminen SK, Vehkalahti MM. Dental indices and their impact on targeting of dental prevention, periodontal and filling therapy in young adults undergoing subsidised public dental care. Community Dent Health. 2003;20:100-5.
6. Parekh S, Goodman J, Barnard K. An index of paediatric dental treatment need (IPDTN). Int J Paediatr Dent. 2001;11:4.
7. Mann J, Sgan-Cohen HD, Asher RS, Amir E, Cohen S, Sarnat H. A treatment need index: a pilot study. Int J Paediatr Dent. 1993;3:129-34.
8. Ismail AI, Sohn W, Tellez M, Amaya A, Sen A, Hasson H, Pitts NB. The International Caries Detection and Assessment System (ICDAS): an integrated system for measuring dental caries. Community Dent Oral Epidemiol. 2007;35:170-8.
9. WHO. Oral Health Surveys. Basic methods. 4th ed. Geneva: WHO; 1997.
10. Campus G, Solinas G, Maida C, Castiglia P. The "Significant Caries Index" (SiC): a critical approach. Oral Health Prev Dent. 2003;1:171-8.
11. Bolin K, Jones D. Oral health needs of adolescents in a juvenile detention facility. J Adolesc Health. 2006;38:755-7.
12. Kulkarni SS, Deshpande SD, Dharwad SD. Caries prevalence and treatment needs in 11–15 year old children of Belgaum city. J Indian Soc Pedod Prev Dent. 2002;20:12-5.
13. Mitchell DA, Ahluwalia KP, Albert DA, Zabos GP, Findley SE, Trinh-Shevrin CB, Marshall SE, Lamster JB, Formicola AJ. Dental caries experience in northern Manhattan adolescents. J Public Health Dent. 2003;63:189-94.
14. Nalweyiso N, Busingye J, Whitworth J, Robinson PG. Dental treatment needs of children in a rural subcounty of Uganda. Int J Paediatr Dent. 2004;14:27-33.
15. Stubbs C, Riordan PJ. Dental screening of older adults living in residential aged care facilities in Perth. Aust Dent J. 2002;47:321-6.
16. Petersen PE. Continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme. World Oral Health Report. Geneva: WHO; 2003.
17. Bratthall D. Introducing the Significant Caries Index together with a proposal for a new global oral health goal for 12-year-olds. Int Dent J. 2000;50:378-84.
18. Marthaler T, Menghini G, Steiner M. Use of the Significant Caries Index in quantifying the changes in caries in Switzerland from 1964 to 2000. Community Dent Oral Epidemiol. 2005;33:159-66.
19. Astrom AN, Kida IA. Perceived dental treatment need among older Tanzanian adults – a cross-sectional study. BMC Oral Health. 2007;7-9.
20. Gherunpong S, Tsakos G, Sheiham A. Developing and evaluating an oral health-related quality of life index for children; the CHILD-OIDP. Community Dent Health. 2004;21:161-9.
21. Adegbembo AO, Adeyinka A, George MO, Aihveba N, Danfillo IS, Thorpe SJ, Enwonwu CO. National pathfinder survey of dental caries prevalence and treatment needs in The Gambia. SADJ. 2000;55:77-81.
22. Saravanan S, Anuradha KP, Bhaskar DJ. Prevalence of dental caries and treatment needs among school going children of Pondicherry, India. J Indian Soc Pedod Prev Dent. 2003;21:1-12.
23. Tsakos G, Gherunpong S, Sheiham A. Can oral health-related quality of life measures substitute for normative needs assessments in 11 to 12-year-old children? J Public Health Dent. 2006;66:263-8.
24. Antunes JL, Frazao P, Narvai PC, Bispo CM, Pegoretti T. Spatial analysis to identify differentials in dental needs by area-based measures. Community Dent Oral Epidemiol. 2002;30:133-42.
25. Adewakun AA, Amaechi BT. Caries-based treatment need assessment by clinical dental nurses in Anguilla, British West Indies. Community Dent Health. 2005;22:170-4.
26. Naidu R, Prevatt I, Simeon D. The oral health and treatment needs of schoolchildren in Trinidad and Tobago: findings of a national survey. Int J Paediatr Dent. 2006;16:412-8.
27. Adegbembo AO, Leake JL, Main PA, Lawrence HL, Chipman ML. The effect of dental insurance on the ranking of dental treatment needs in older residents of Durham Region's homes for the aged. J Can Dent Assoc. 2002;68:412.
28. Locker D, Frosina C, Murray H, Wiebe D, Wiebe P. Identifying children with dental care needs: evaluation of a targeted school-based dental screening program. J Public Health Dent. 2004;64:63-70.
29. Falcon HC, Richardson P, Shaw MJ, Bulman JS, Smith BG. Developing an index of restorative dental treatment need. Br Dent J. 2001;190:479-86.
30. Weyant RJ, Manz M, Corby P. Dental caries status and need for dental treatment of Pennsylvania public school children in grades 1, 3, 9, and 11. J Public Health Dent. 2004;64:136-44.
31. Locker D, Miller Y. Evaluation of subjective oral health status indicators. J Public Health Dent. 1994;54:167-76.
32. Lundegren N, Axtelius B, Hakansson J, Akerman S. Dental treatment need among 20 to 25-year-old Swedes: discrepancy between subjective and objective need. Acta Odontol Scand. 2004;62:91-6.
33. Ostberg AL, Eriksson B, Lindblad U, Halling A. Epidemiological dental indices and self-perceived oral health in adolescents: ecological aspects. Acta Odontol Scand. 2003;61:19-24.
34. Rozier RG, King RS. Defining the need for dental care in North Carolina: contributions of public health surveillance of dental diseases and conditions. N C Med J. 2005;66:438-44.
35. Atchison KA, Dolan TA. Development of the Geriatric Oral Health Assessment Index. J Dent Educ. 1990;54:680-7.
36. Spolsky VW, Marcus M, Coulter ID, DerMartirosian C, Atchison KA. An empirical test of the validity of the Oral Health Status Index (OHSI) on a minority population. J Dent Res. 2000;79:1983-8.
37. DePorter DJ, Marcus M, Jacobson JJ. A comparison of potential treatment costs for group capitation versus voluntary individual enrollment plans. J Dent Educ. 1988;52:605-8.
38. Marcus M, Koch AL, Gershen JA. A proposed index of oral health status: a practical application. J Am Dent Assoc. 1983;107:729-33.
39. Gherunpong S, Tsakos G, Sheiham A. A sociodental approach to assessing dental needs of children: concept and models. Int J Paediatr Dent. 2006;16:81-8.