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A sociodental approach to assessing dental needs of children: concept and models

S. GHERUNPONG, G. TSAKOS & A. SHEIHAM
Department of Epidemiology and Public Health, Royal Free and University College London Medical School, London, UK

Summary. *Objectives.* Traditional normative methods of assessing dental needs do not correspond to current concepts of 'health' and 'need'. Although there is dental research on quality of life, evidence-based practice, and oral behaviours, those concepts are rarely applied to dental needs estimation. Dental needs are usually calculated mainly from clinical data and are likely to be inaccurate. A structured comprehensive method for assessing dental needs is required. The objectives of this study are to develop and test a new sociodental system of needs assessment for overall dental needs of primary schoolchildren. Furthermore, normative and sociodental estimates of need are compared.
Design. The study developed a theoretical framework and pathway algorithms of sociodental needs assessment and applied them to assessing overall dental needs. Normative dental needs were assessed using standard normative criteria. The child oral impacts on daily performances (Child-OIDP) was used to assess oral impacts, and a self-administered questionnaire was used to obtain information on demographic variables and oral behaviours. Data were analysed according to the developed algorithms.
Setting. A cross-sectional survey in Suphanburi Province, Thailand.
Participants. All 1126 children aged 11–12 years in a town.
Main results. The sociodental approach was acceptable and not costly. In all, 54·4% had normative need under the dental needs model for life-threatening and progressive conditions, but only 16·6% had high propensity-related need; the remaining 37·8% would require dental health education or oral health promotion (DHE/OHP) or both and appropriately adjusted clinical interventions. Under the basic model of dental needs, 45·1% had normative need. Two-thirds of them (30·9%) had impact-related need and the remaining 14·2% did not have oral impacts and therefore should only receive dental health education. Only one-third of those with impact-related need had high propensity and were suitable for evidence-based conventional treatments; the remaining two-thirds should receive DHE/OHP and alternative clinical interventions.
Conclusions. A sociodental system of dental needs assessment was developed and tested on school children. It decreased the estimates of conventionally assessed dental treatment needs and introduced a broader approach to care.

Introduction

Assessing dental needs is the basis of planning dental services and treatment. Appropriately assessed population needs improve estimates of resources, rational allocation of dental services, and efficient dental care expenditure. Dental practitioners should be able to assess individual patient needs, based not only on normative assessment but on perceived needs and impacts, to make suitable treatment plans and obtain the best treatment outcomes. Therefore, rather than based almost entirely on normative needs, a broader perspective of 'health' and 'need' is recommended when assessing needs [1].

The cost of oral health care is high. In European Union countries, the estimated total oral health expenditures varies from 3% to 13% of total health expenditures [2], and in many countries oral health costs rank third or fourth as a percentage of overall health care costs. In children, the cost of dental treatment has further risen by the increased demand for orthodontic services. For example, in the UK, the annual expenditure on orthodontic treatment has

Correspondence: G. Tsakos, Department of Epidemiology and Public Health, Royal Free and University College London Medical School, 1-19 Torrington Place, London WC1E 6BT, UK.
E-mail: g.tsakos@ucl.ac.uk
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increased by 85·5% in a 10-year period [3]. In low-income nations, the cost of treating dental caries with the traditional method is beyond their financial capabilities; three-quarters of these countries lack sufficient resources to finance an essential health care package for their children [4]. In Thailand, the government's oral health care budget is inadequate to meet the increasing oral health needs of the population, particularly for treatment of dental caries, periodontal diseases, and dentures [5].

Apart from the impracticality and inappropriateness of the conventional methods of need assessment, there are further reasons for developing new methods of assessing dental needs [6]. First, contemporary concepts of health emphasize the importance of subjective well-being [7]. How patients feel is more important than how doctors think they ought to feel [8]. Second, the improvement of quality of life through better functioning and psychosocial well-being is the greatest benefit of dental care [9]. That perspective led to the development of oral health-related quality of life (OHRQoL) indicators [10], which are recommended to be combined with clinical measures for assessing dental health and evaluating treatment outcomes [11–13]. A third reason relates to evidence-based practice and definitions of need as the 'ability to benefit' [14–17]. Matthew suggested that treatment needs exist only when there is an effective intervention contributing to health gain [14]. Moreover, patient's behaviours affect treatment outcomes and therefore should be incorporated in needs assessment [6,17,18].

Despite their importance, OHRQoL, evidence-based practice and health behaviours have never been systematically used in dental needs assessment. Dental needs are simply calculated by converting clinical normative data into amounts of needs. Health behaviours and even OHRQoL have been measured in surveys, but they were neither integrated or merged with clinical data at an individual level, nor used in needs assessment [19,20]. Consequently, population needs and related resource estimates are likely to be inaccurate.

To improve the current dental needs systems, a new sociodental concept of needs assessment has been introduced for adult populations [21–23]. A comprehensive structured method for assessing dental needs of schoolchildren using the sociodental approach does not exist. The objectives of this study are to develop and test a new sociodental system of needs assessment for overall dental needs of primary schoolchildren. Furthermore, normative and sociodental estimates of need are compared.

Methods

Developing the theoretical framework

The framework of sociodental needs assessment consists of three levels (Table 1):

1 Normative need (NN), assessed by clinical measures. Dental diseases or impairments are detected here.

2 Impact-related need (IRN), assessed by integrating NN with OHRQoL. This level is used to identify and prioritize children in terms of need for dental care. However, early stages of progressive conditions (e.g. caries, cancer) do not impact on people's lives; consequently, NN is paramount in those cases. As a result, the aforementioned integration is performed only for conditions that are unlikely to progress and are not life threatening (e.g. malocclusion).

3 Propensity-related need (PRN), obtained by integrating NN with OHRQoL and behavioural propensity. At this level, treatment is prescribed in the light of probability of success, using the best available evidence on effectiveness of treatments and the individual's behavioural propensity. Behavioural factors that are likely to affect treatment outcomes (e.g. diet, fluoride use, oral hygiene, and dental attendance pattern) are assessed; each factor is categorized into good, moderate, and poor. Then, taking all relevant factors together, children are categorized into different levels of PRN, from high to low. The high-PRN group includes those with good behavioural propensity who will benefit from treatment, whereas those at lower levels of PRN have high risk of treatment failure or other negative outcomes if the normatively planned treatment is carried out. Thus, intermediate or palliative treatment is more appropriate

Table 1. Levels of dental needs and factors under consideration.

Dental need level	Factors under consideration
Normative need (NN)	Clinical impairment
Impact-related need (IRN)	Clinical impairment
	Oral health-related quality of life (OHRQoL)
Propensity-related need (PRN)	Clinical impairment
	Oral health-related quality of life (OHRQoL)
	Behavioural propensity for treatment

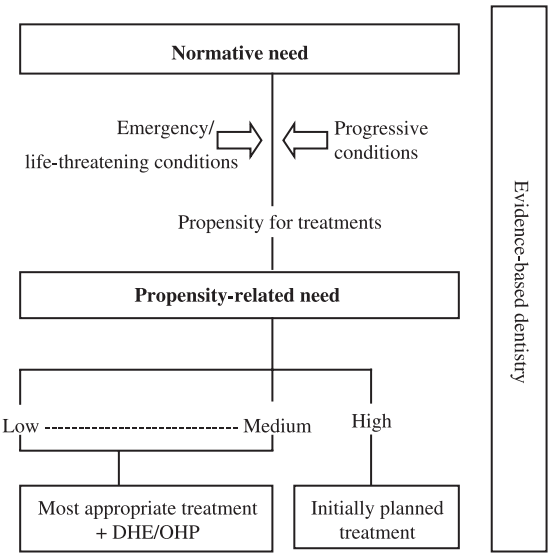
than the initially planned treatment. In addition to the clinical intervention, children should receive dental health education and/or oral health promotion (DHE/OHP) programs.

The assessment of PRN is comparable to a complete treatment plan for individual patients. Where patients have not yet adopted a particular behaviour, seen as a prerequisite for some treatments, the focus should be on improving their behavioural propensity and possibly also providing an alternative initial intervention. Thereafter, comprehensive treatment is reconsidered according to their changed behaviour in response to health education. On a population basis, the amount of initially planned treatment can be roughly estimated. But as changes in behavioural propensity cannot be measured at the examination, only an estimate of the DHE/OHP needs can be made, with guidelines to reassess for comprehensive clinical treatment after a period. Evidence-based guidelines are an important component of the socio-dental approach and the guidelines cover all levels of need. Planners should refer to published guidelines when deciding on appropriate treatments. Moreover, selection of treatments depends on the local setting, available resources, and extent of general needs in the community.

Developing algorithms of dental needs assessment

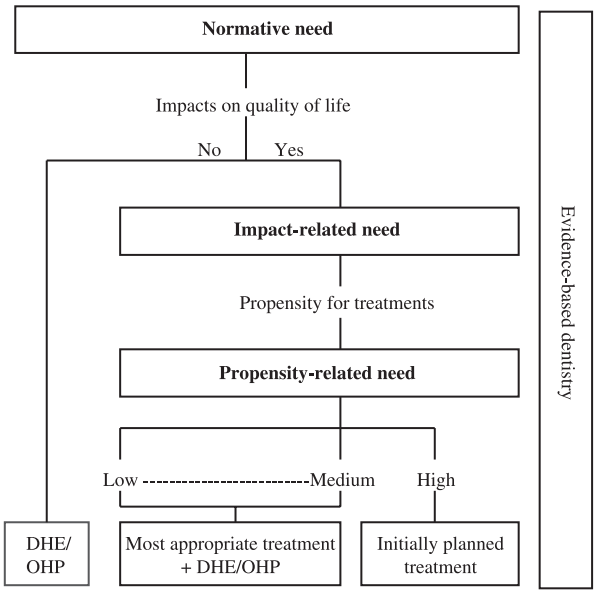
From the aforementioned broader framework, two models of dental needs assessment were developed: the dental needs for life-threatening and progressive oral conditions (DNLP) (Fig. 1) and the basic model of dental needs (BMDN) (Fig. 2). Each model applies to a different group of oral diseases, depending on concepts of their natural history.

The DNLP model (Fig. 1) is applicable for dental diseases that are highly likely to progress or need emergency treatment. They include dental caries, traumatic injuries involving dentine/pulp, and pre-cancerous lesions. The model starts with NN and goes straight to PRN; IRN is not assessed. In PRN, children are classified into different groups. The high-PRN group need treatment as normatively assessed; for the low PRN groups, treatment should be adjusted to suit their propensity and they should also receive DHE/OHP. Where there are no alternatives (e.g. for extractions or small fillings), treatment for the low PRN group should be the same as for the high PRN group, supplemented by DHE/OHP. If simpler alternatives (e.g. intermediate restorative materials) are available, they could be provided for children in low PRN, together with DHE/OHP. For example, when treating extensive caries in children at high risk of developing secondary caries, with poor oral hygiene and poor dental attendance, dental crowns are not recommended [24,25]. In such cases, alternatives (e.g. temporary crown or plastic restorations)



DHE/OHP, dental health education/oral health promotion

Fig. 1. Model of dental needs for life-threatening and progressive oral conditions (DNLP).



DHE/OHP, dental health education/oral health promotion

Fig. 2. Basic model of dental needs in children (BMDN).

can be carried out. Where reassessment is feasible, a permanent crown can be provided if and when the propensity improves.

The BMDN algorithm (Fig. 2) refers to diseases that are unlikely to progress or cause important adverse health consequences in the absence of treatment. They include missing teeth [26], malocclusion [27,28], enamel defects, traumatic dental injuries not involving the dentine/pulp, and gingivitis. In relation to gingivitis, the evidence on its progression to periodontitis is equivocal; most cases do not progress and current treatments do not significantly alter the life history, so health gain is unlikely [29,30].

The BMDN starts with NN and then assesses IRN, using an OHRQoL measure; thus, it identifies children with both normative need and oral impacts affecting quality of life. In the absence of impacts, children with NN are not considered to need treatment, except from DHE/OHP. Children with IRN are categorized according to PRN. The PRN assessment has already been described for the DNLP algorithm. However, prompt treatment may not be necessary in the BMDN model, because conditions are unlikely to progress. The high-PRN group will receive the treatment initially planned, whereas treatment for the lower PRN groups can be either adjusted or delayed in the light of responses to DHE/OHP. For example, fixed orthodontic treatment could be either delayed until children can maintain adequate oral hygiene or changed to other interventions [28].

Testing the sociodental need system

This process began with developing measures for three groups of data: (i) clinical impairments, (ii) OHRQoL, and (iii) behavioural propensity. A number of pilot studies were carried out to validate all questionnaires and improve the practicality of their application in fieldwork; the back-translation method was used to check the validity of translation from English to Thai.

Clinical normative assessments were based on the WHO survey manual and Thailand Clinical Practice Guidelines [31,32]. The criteria and guidelines were independently reviewed by 30 dentists working in public health or academia; after minor modifications, they were unanimously accepted.

The Child-OIDP index [33], a composite indicator that assesses the impacts of oral conditions on basic activities and behaviours of daily life, was chosen to assess OHRQoL because it, uniquely among such measures, attributes impacts to specific oral conditions, thus facilitating its use in needs assessment for the different conditions. Children were individually interviewed, except for the first screening question that was self-administered in a classroom setting. To reduce the interview time and improve the practicality of the instrument, 16 pictures illustrating 8 daily performances were developed and used as interview aids [33].

The behavioural propensity measures were developed through extensive review of the literature. Reports of expert committees and professional bodies were scrutinized [34–36], and senior public health dentists were consulted. The measures covered four main oral health behaviours suggested in a consensus document by the Health Education Authority [37]; sugars consumption, use of fluoridated toothpaste, pattern of toothbrushing, and dental attendance. Each was categorized into good, fair, or poor (Table 2). The assessment of dental attendance pattern was based on the local dental service system that provides school services to children. Children were classified by their responses to dental appointments given by school dental services; those who always, sometimes, and rarely visited dentists when they had appointments. For the use of fluoride toothpaste, children were asked to identify the brand of toothpaste they regularly used. This was coded by the researcher into regular user of fluoride toothpaste or not. All the children questioned knew the toothpaste brand they used. The questionnaire contained 11 ordered short questions; 2 for identification and

Table 2. Categorization of four behavioural propensities.

	Propensity levels		
Behavioural propensity	Poor	Moderate	Good
Frequency of sugary food/drink intakes per day	6 or more	4–5	0–3
Frequency of toothbrushing per day	Not every day	Once	Twice or more
Regular use of fluoridated toothpaste	Did not use	–	Use
Dental attendance pattern	Rarely	Sometimes	Always

demographic information, 4 for sugar consumption, 3 for dental attendance, and 1 each for the use of fluoridated toothpaste and toothbrushing [38].

Main survey

A cross-sectional survey was conducted including all 1126 final year primary schoolchildren aged 11–12 years in a municipal area of Suphanburi Province, Thailand. Data were collected through clinical examination and questionnaires. The clinical examinations, undertaken by four calibrated dentists, covered oral status and normative treatment needs for seven oral conditions: dental caries, gingivitis, enamel defects, traumatic dental injuries, malocclusion, prosthodontic and emergency conditions. An interviewer-administered questionnaire facilitated data collection on OHRQoL. One trained interviewer used the Child-OIDP index [33]. Finally, demographic and oral health behaviour data were collected through a self-administered questionnaire. Ten percent random duplication was conducted for reliability testing.

Data were analysed using the two aforementioned algorithms. The prevalence of NN, IRN, and high PRN was calculated. IRN referred to children with NN in the BMDN algorithm only who reported also oral impacts on their quality of life. High PRN referred to children either with IRN in the BMDN algorithm or those with NN in the DNLP algorithm, where all four behaviours were good. The McNemar test was used to compare estimates of NN with high PRN.

The Ethics Committee of the Thailand Ministry of Public Health approved the study protocol. Primary education, local health authorities, and all primary schools in study areas gave permission. Positive consent forms and information letters were sent to parents.

Results

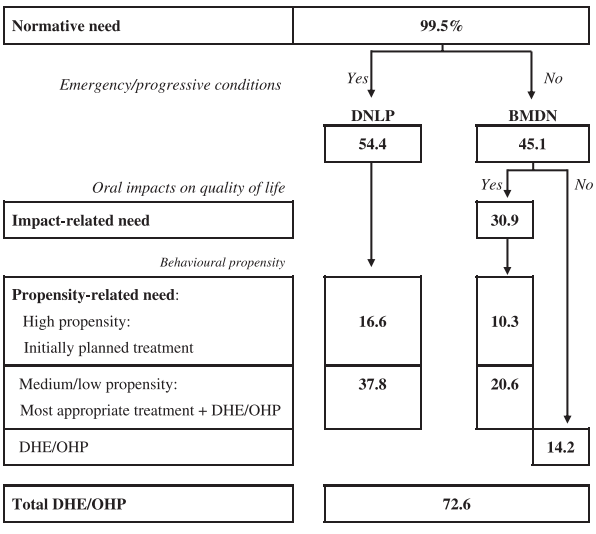
In all, 1101 of the 1126 children consented and 1034 (91·8%) completed all stages of the survey. Among them, 52·4% were male and 47·6% were female; the mean age was 11·3 years. In terms of test-retest reliability, the weighted kappa score for the Child-OIDP was 0·91, kappa scores for the self-administered questionnaires were 0·7–1·0, and for intra- and interexaminer variability in the clinical examination were 0·7–1·0 and 0·6–1·0, respectively, indicating good to excellent agreement.

In addition to the clinical examination, questionnaire procedures were practical in terms of children's response, time, and personnel costs. The behavioural questionnaire, adapted for local and age-specific use, was found to be very simple and could be self-administered easily by all children in a classroom. The Child-OIDP individual interview with picture aids by an interviewer was enjoyable and took 10 min per child [32].

Overall, 99·5% of children had at least one type of normative need; the most common being for periodontal scaling (84·4%). When issues of subjective well-being or quality of life and oral behaviours affecting treatment outcomes were considered along with normative need, the treatment needs are further analysed according to the two algorithms, in relation to each type of oral conditions.

Dental needs for life-threatening and progressive oral conditions

In the studied population, 54·4% had normative need under this model. However, only 16·6% had high propensity-related need and should be treated as initially planned because treatment would be effective for them. The remaining 37·8% did not have high propensity and would require DHE/OHP together with clinical treatment appropriately adjusted to their propensity (Fig. 3).



DHE/OHP = dental health education and/or oral health promotion.
DNLP = model of dental needs for life-threatening and progressive oral conditions.
BMDN = Basic model of dental needs in children.

Fig. 3. Overall sociodental needs of 1034 Thai primary school children.

The basic model of dental needs

In all, 45·1% of children had NN under this model, 30·9% had IRN, and the remaining 14·2% did not have oral impacts and therefore should receive DHE/OHP instead of clinical interventions (Fig. 3). The 30·9% of children with IRN had their quality of life affected by oral condition and, therefore, required dental care; 10·3% had high PRN and were suitable to receive treatment, whereas the remaining 20·6% did not have high propensity and would need either DHE/OHP to improve their behavioural propensity prior to the clinical intervention or DHE/OHP with less complicated interventions that would still benefit them.

In total, 26·9% of children (16·6% from DNLP and 10·3% from BMDN) had high PRN and would receive treatments as initially planned. This differs markedly from the 99·5% assessed normatively ($P < 0{\cdot}001$, McNemar test). The other 72·6% who did not have high propensity or oral impacts could receive DHE/OHP and relevant alternative interventions commensurate to their propensity.

Discussion

This study developed and tested a sociodental system of dental needs assessment on primary schoolchildren. Apart from the oral examination, which is comparable to the normative approach, the additional procedures of the sociodental approach were acceptable in terms of additional costs and children's response. The sociodental approach decreased the estimates of overall treatment needs markedly; from 99·5% (normative need) to 26·9% (high PRN). Although half (54·4%) of the children would definitely require treatment because of their progressive or emergency conditions (DNLP algorithm), less than one-third of them had high propensity and should receive treatments as initially planned. The other two-thirds require a broader approach of dental care, involving possible alternative treatments and DHE/OHP.

The other half of the population (45·1%) with NN was further assessed for their OHRQoL using the BMDN algorithm. Two-thirds of them had IRN. Only one-third of those with IRN had high propensity and were suitable for evidence-based conventional treatments; the needs of the remaining two-thirds should include DHE/OHP and alternative clinical interventions.

The findings suggest that the estimate of dental treatment needs obtained by the traditional normative approach is much higher than the more broadly based sociodental estimate. These findings are consistent with studies using the sociodental approach on adult populations [21,22]. Srisilapanan and coworkers assessed prosthodontic needs in an elderly population. Sixty percent of the dentate population had NN, whereas half of them had IRN and two-thirds of the latter had high PRN. In the edentulous, 80% had NN and 60% of them had IRN [22,23].

The large reduction of the needs estimate using the sociodental approach has implications for dental service planning. Conventional normative methods using only clinical indices are unrealistic, because they frequently result in very high volume of need, which cannot be covered, even in wealthy countries [39]. On the other hand, the sociodental approach not only results in more realistic estimates but also takes into account the ability to benefit from treatment in a fashion very similar to what good dentists would do, thus reflecting this best practices approach into the treatment plans for population groups. The integration of dental status, OHRQoL and oral behaviours for each child makes the estimates more meaningful, as the results reflect a more coherent picture of population's health and needs. In practice, this approach is similar to 'shared decision-making', where patients' opinions about their health and their relevant behaviours are included in treatment planning [40].

In the sociodental needs system, OHRQoL can also be used to prioritize dental needs. Children with more severe impacts would have a higher priority for dental care. The severity can be presented in terms of impact score or alternatively the intensity and extent of impacts. The approach proposed here suggests that a proper combination of clinical and OHRQoL measures relies on sound concepts of the natural history of diseases. OHRQoL is useful where diseases affect psychosocial well-being and treatment could improve quality of life. However, it is inappropriate and unethical to provide treatment based on OHRQoL measures for early stages of diseases that have not yet impacted on life quality, but will do so if prompt intervention is not carried out. Conversely, it is also inappropriate to carry out treatment for nonprogressive conditions that do not impact on life quality or whose impacts are not affected by treatment. Therefore, two separate models are proposed and OHRQL is used as a supplement, not a replacement to clinical measures, with the aim of

broadening concepts of oral health and needs [6,11]. A benefit of implementing the sociodental system is a more appropriate distribution of dental services and resources as treatment provision would be directed to children in need, for example, those having progressive lesions or oral impacts on quality of life.

This study presented the principles and general methods of assessing dental needs sociodentally. Although NN can be seen as a part of sociodental needs because the sociodental system is not developed from scratch but by complementing the normative system, the comparison between them was made on the basis that the normative and sociodental methods are two different instruments for assessing dental needs in the same population. Therefore, as the main aim of this study was to develop a new sociodental system, it is important to compare the new with the current normative system. If there were only small differences between them, there would be no point in introducing a new system. The findings of overall dental needs are indicative but not precise enough, because the integration of clinical, OHR-QoL, and oral behaviours data should be performed for each type of treatment separately, instead of the overall level. This requires the calculation of impacts scores specific to each oral condition [33] that will then be integrated with the relevant normative need and propensity measurements affecting outcomes related to them. Such more precise methods of specific dental needs assessment have been developed based on the two sociodental needs models presented here [38].

In conclusion, the study developed a new, appropriate, subject-centred sociodental needs assessment system and tested it on Thai primary school children. Additional measurements employed for the new system (oral impacts interview and oral behaviours self-administered questionnaire) were acceptable in terms of children's responses and study costs. The sociodental approach resulted in considerable decreases in the estimates of overall dental needs. Although the majority of children had needs for dental care, most needs should be met by a broader approach than conventional treatment plans, including appropriate alternative interventions and health education programmes.

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What this paper adds

- This study developed and presented the principles and a new method of assessing dental needs sociodentally.

Why this paper is important for paediatric dentists

- The sociodental method should enable paediatric dentists to assess individual patient needs, based not only on normative assessment but on perceived needs and impacts, to make suitable treatment plans and obtain the best treatment outcomes.
- A benefit of the sociodental method is a more appropriate distribution of dental services and resources as treatment provision would be directed to children in need.
- The sociodental approach resulted in considerable decreases in the estimates of overall dental needs.

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