Differences in Prosthodontic Treatment Needs Assessments Between the Standard Normative and Sociodental Approach

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Purpose: To assess and compare prosthodontic treatment needs and the related manpower requirements using the normative and sociodental needs approaches for adult Koreans aged 30 to 64 years. Materials and Methods: Data were obtained from 1,029 30- to 64-year-old adults who were a subsample of the 2003 Korean National Oral Health Survey. Subjects were clinically examined for normative needs and interviewed using an oral health-related guality of life (OHRQoL) measure, the Oral Impacts on Daily Performance. Their oral health behaviors were also assessed. The sociodental approach includes impact-related needs, in which normative needs are integrated with OHRQoL, and propensity-related needs, in which oral health behaviors are used to determine appropriate treatments. Prosthodontic treatment needs and number of clinicians needed to treat those needs were estimated using normative needs, impact-related needs, and propensity-related needs. *Results:* Compared to normative needs, significant decreases of 74.1% to 78.5% were found for prosthodontic treatment needs using impact-related needs and propensity-related needs, respectively. Differences in manpower requirements to deal with prosthodontic treatment were large; per 100,000 people, 86.5 dental clinicians would be needed using normative needs, compared to 22.4 clinicians using impact-related needs and 18.6 clinicians using propensity-related needs. Conclusions: The sociodental approach for assessing dental needs for prosthodontic treatment indicated much lower levels of treatment needs than the normative approach. The sociodental approach should be applied to dental workforce planning. Int J Prosthodont 2008;21:425-432.

Many countries have problems with unmet needs for dental treatment.¹ Grumbach² considered workforce planning to be "getting the right number of physicians in the right specialties in the right locations at the right time." This axiom also applies to dentistry.³⁻⁸ Many researchers have attempted to find appropriate methods for dental workforce planning.⁹⁻¹²

Manpower planning frequently uses needs as a basis for estimating the numbers and types of dental manpower required to meet those needs. Normative need is invariably used in this model, particularly the World Health Organization/Federation Dentaire Internationale (WHO/FDI) approach.¹³ Normative need, in the direct treatment planning approach recommended by the WHO/FDI, is defined as the quantity of dental health care that expert judges consider ought to be consumed over a relevant period for people to remain or become dentally healthy. However, there are several limitations of the WHO/FDI model. One is that it does not measure other factors influencing the whole system and its implementation.^{14,15} For example, the WHO/FDI model differs significantly from the behavioral model of health services utilization proposed by Andersen and Newman,^{16,17} who emphasized the importance of predisposing characteristics and variables such as dental disease, pain, or a person's perceived need for care, as well as health behaviors, when

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assessing need.^{16,17} Some of the concepts formulated by Andersen and Newman were incorporated into the sociodental approach suggested by Adulyanon¹⁸ and developed by Sheiham and Tsakos¹⁹ to assess dental needs. The sociodental approach is a needs assessment tool that combines normative needs with sociodental factors, such as perceived impacts and oral health-related behaviors.

The rationale of the sociodental approach stems from the conceptual and practical limitations of the normative approach.¹⁹ A major shortcoming of this standard normative approach is that it fails to take into account the way people perceive their health and therefore does not correspond to broader concepts of health and needs. As Locker²⁰ suggested, the conventional need assessments "tell us nothing about the functioning of either the oral cavity or the person as a whole and nothing about subjectively perceived symptoms such as pain and discomfort." Those subjective feelings are closely related to utilization.^{21,22} Normative need is also criticized as being unrealistic because it overestimates needed resources.^{14,15} A "realistic treatment need" was suggested as an attempt to estimate the true need for treatment.²³ It is a combination of the normative need, the self-perceived need, and the expressed demand for treatment, and it takes into account the mental and physical state of the individual as well as ethical considerations. Further, patients' attitudes and behaviors are known to have strong influences on the effectiveness of oral health treatments.²⁴ Effectiveness of treatment depends on clinicians but also on patients. Indeed, patient behaviors are relevant to the effectiveness of dental treatment in every field of dentistry.^{25,26}

These criticisms of the sole use of normative need led to the development of the sociodental approach to needs assessment, in which normative need is complemented by subjective measures of the impacts of oral conditions and behavioral factors that affect the decision to treat and the outcomes of treatment. According to the sociodental approach, the assessment of dental treatment need should include the following factors: (1) normative need defined by dental professionals, (2) subjective perceptions such as the oral impacts on daily life, and (3) attitudes of patients including propensity-related behavioral factors. Furthermore, this comprehensive approach should be founded on evidence-based dentistry for effective treatments.¹⁹

Studies using the sociodental approach to assess dental need have reported large differences between normative system estimates and those based on sociodental approaches. Half of the elderly Thai people considered to have a normative need for prosthodontic treatment did not need treatment based on the sociodental approach.²⁷ Similarly, Gherunpong et al²⁸ found a marked difference between the standard normative and sociodental approaches to need assessment in Thai children. The sociodental needs were 60% lower than those identified by the standard normative approach. These large differences between the 2 approaches suggest that there will be disparate estimates of workforce requirements.

Most dental planners use national survey data to estimate manpower needs. Therefore, this study aimed to compare the needs and related manpower estimates between the conventional normative method used by dental planners and the sociodental approach in a subsample of a national dental survey. The objective was to assess and compare prosthodontic treatment needs and the related manpower requirements using the normative and sociodental needs approaches on a sample of adult Koreans aged 30 to 64 years.

Materials and Methods

This study is a substudy within the 2003 Korean National Oral Health Survey.²⁹ This survey used 2-stage stratified sampling for the city selection. Six of 60 sites were chosen for this sociodental approach study. The research study sites were in Northeast South Korea in the Gangwon-Do and Gyeongsangbook-Do provinces. The sample consisted of subjects aged 30 to 64 years. The reasons for choosing this age group were that it covered the working population and also that most dental diseases, such as caries and periodontal disease, are well established by the age of 30. Therefore, this age group would be expected to have a considerable level of prosthodontic treatment need.

Members of the calibrated dental team of the Korean National Oral Health Survey²⁹ examined the selected participants of the survey using established clinical criteria. The National Survey did not use a random sample of the city population. A major proportion of the study population was from cities. Most of the participants were people who visited the health clinics for annual regular medical examinations and their family members. They were not dental patients. In the pilot study of the National Survey, there was no significant difference in oral conditions between the people who visited general hospitals or health centers and the people who did not.²⁹

The sample size for this sociodental study was based on an estimated prevalence of normative needs to be 55%, according to previous studies,^{30–32} and the related prevalence of sociodental needs to be 45%, with a significance level of 1% and a power of 90%. These significant differences were assumed as 10% in this study. This initial minimum sample size calculation (734 adults) was subsequently raised by 20% to 881 adults to account for nonresponse.

Sociodental Need for Prosthodontic Treatment: Normative Needs, Impact-Related Needs, and Propensity-Related Needs

The assessment of sociodental needs followed the stages of gradual incorporation of normative needs with oral health-related quality of life (OHRQoL) and behavioral propensity used in previous studies.^{19,27,28,31,33} These stages will now be presented in detail.

Normative Needs (NN). To assess prosthodontic treatment needs for prostheses in both arches, each arch was examined using the standard WHO criteria³⁴: (1) no prosthesis needed (PN0); (2) need for 1-unit prosthesis (1 tooth replacement) (PN1); (3) need for multiunit prosthesis (more than 1 tooth replacement) (PN2); and (4) need for a combination of 1- and/or multiunit prostheses (PN3). Need for full prostheses (PN4) was excluded from the data analysis because it referred to only a few cases. The data related to prosthodontic need only applied to people who had missing teeth.

Impact-Related Needs (IRN). IRN is the second stage in the process, in which NN estimates are integrated with OHRQoL using the Oral Impacts on Daily Performance (OIDP) index. People who have both NN and oral impacts are considered as having IRN. Most OHRQoL indices do not assess the specific dental conditions that are considered responsible for the impacts. When using such indices, it is not feasible to incorporate NN with OHRQoL for a specific oral condition such as missing teeth or with related specific dental treatments because the impacts are not linked to the specific clinical condition causing the impact. In contrast, the OIDP allows analysis of condition-specific oral impacts on daily performance (CS-OIDP) by attributing impacts to specific oral conditions or diseases (eg, missing tooth) based upon the respondent's perception. This special feature of the OIDP facilitates its use in needs assessment and for planning oral health services. Based on previous studies it was decided to use the following 3 conditions to indicate prosthodontic treatment needs: tooth loss, defective restoration or crown, and loose fitting dentures.^{27,30,31} The calculation of the CS-OIDP for prosthodontic treatment and the incorporation with NN facilitated the categorization of the subjects into the IRN group (NN with CS-OIDP > 0) or the no-IRN group (NN with CS-OIDP = 0).

Propensity-Related Needs (PRN). Finally, treatment is prescribed considering the probability of success, using the best available evidence on effectiveness of treatments from reports on evidence-based dentistry and the individual's behavioral propensity. Patient attitudes and behaviors are known to have strong influences on the effectiveness of treatment and improvement of oral health.²⁶ Effectiveness of treatment depends on clinicians but also on patients. In this study, frequency of toothbrushing per day was selected as a measure of behavior, since it affects the outcome of dental treatment.³⁵ The propensity levels were divided into good and poor based on published literature as follows: toothbrushing at least 2 times per day was considered a good propensity,³⁶ while lower frequency of brushing was indicative of poor oral hygiene.³⁷⁻³⁹ Thereafter, different treatment regimes and priorities may be established within a specific level of need according to the behavioral propensity of the subjects.

Workforce Planning

Based on the Resource Based Relative Value Scale (RBRVS)⁴⁰ and using the Ontario Dental Association's⁴¹ timings of dental treatment, the total time required for each type of prosthodontic treatment need is presented in Tables 1 and 2. While treatment needs are shown separately for the maxilla and mandible for the whole sample, the respective times were summed for each subject. To illustrate estimates of the workforce needed, these times were converted into number of dentists per 100,000 people. The calculation was based on the 3 different dental clinicians' yearly workload assumptions (2,000, 1,500, or 1,000 hours a year) suggested by the joint WHO/FDI working group.¹³

Data Analysis

The McNemar test for paired binary outcomes was used for the comparison between the NN, IRN, and PRN for each type of prosthodontic treatment per person. The total time requirement estimations of NN, IRN, and PRN were compared using the Wilcoxon signed rank test, which is used for paired continuous outcomes with a nonparametric distribution. SPSS version 13.0 for Windows (SPSS) was used for the analysis of data. Statistical significance was set at P < .05.

Results

A total of 1,220 people were asked to participate in the sociodental study, and 190 of those people refused. Thus, the final number of participants was 1,030 (response rate: 84.4%). Since there was only 1 edentulous person in the sample, the data were analyzed excluding this person, leaving a final sample of 1,029. The sociodemographic distribution of this sample is shown in Table 3. There was a slightly higher proportion of 35-to 44-year-olds than the other age groups. There were slightly more men than women. Most participants had finished high school (77.0%), and 77.6% earned 1,000,000 won or more, which equals or exceeds the minimum cost of living per month.

| Table 1 Time Required (min) for Different Types of Prosthodontic Treatme | 1 Time Required (min) for Different Types of Pr | rosthodontic Treatment |
|---------------------------------------------------------------------------------|-------------------------------------------------|------------------------|
|---------------------------------------------------------------------------------|-------------------------------------------------|------------------------|

| Treatment | Mean time |
|---------------------------------------------------------------------------|-----------|
| Crown: full, cast metal | 135.00 |
| Pontic: acrylic/composite/compomer, bonded to adjacent teeth | 30.00 |
| Dentures: partial, tooth-supported cast frame/connector, clasps and rests | 195.00 |
| | |

*Ontario Dental Association.41

Table 2Time Required (min) for ProsthodonticTreatments Used in This Study

| Treatment | Time |
|-----------|--------------------------------------------------------------------|
| PN1 | $(2 \times 135) + (1 \times 30) = 300$ |
| PN2 | $1 \times 195 = 195$ |
| PN3 | $1 \times 195 + (1 \times ((2 \times 135) + (1 \times 30))) = 495$ |

PN1 = need for 1-unit prosthesis (1 tooth replacement, ie 2 crowns and 1 pontic); PN2 = need for multiunit prosthesis (more than 1 tooth replacement); PN3 = need for a combination of 1- and/or multiunit prosthesis.

| Table 3 | Distribution | of Study | Sample I | by Age, Sex, |
|-----------|--------------|----------|----------|--------------|
| Education | , and Income | ; | | |

| | No. | % |
|----------------------|-------|-------|
| Age (y) | | |
| 30-34 | 263 | 25.6 |
| 35-44 | 335 | 32.5 |
| 45-54 | 254 | 24.7 |
| 55-64 | 177 | 17.2 |
| Gender | | |
| Male | 551 | 53.5 |
| Female | 478 | 46.5 |
| Education | | |
| No response | 6 | |
| Elementary school | 142 | 13.9 |
| Middle school | 195 | 19.1 |
| High school and over | 686 | 67.0 |
| Income | | |
| No response | 22 | |
| < 1,000,000 won | 226 | 22.4 |
| ≥ 1,000,000 won | 781 | 77.6 |
| Total | 1,029 | 100.0 |

Of the 1,029 people examined, 126 had an NN for prosthodontic treatment in the maxilla, and 198 had an NN in the mandible. The estimates for each type of prosthodontic treatment need in people with 1 or more missing teeth in the maxilla were as follows (Fig 1):

- PN1: 57 subjects had NN. Of those, 11 had IRN; 7 had a good level and 4 had a poor level of PRN.
- PN2: 32 subjects had NN. Of those, 9 had IRN; 6 had a good level and 3 had a poor level of PRN.
- PN3: 37 subjects had NN. Of those, 13 had IRN; 12 had a good level and 1 had a poor level of PRN.
- Total: 33 subjects had IRN for a maxillary prosthesis; 25 had a good level and 8 had a poor level of PRN.

The estimates for each type of prosthodontic treatment in people with 1 or more missing teeth in the mandible were as follows (Fig 2):

- PN1: 107 subjects had NN. Of those, 18 had IRN; 16 had a good level and 2 had a poor level of PRN.
- PN2: 40 subjects had NN. Of those, 12 had IRN; 8 had a good level and 4 had a poor level of PRN.
- PN3: 51 subjects had NN. Of those, 17 had IRN; 15 had a good level and 2 had a poor level of PRN.
- Total: 47 subjects had IRN for a mandibular prosthesis; 39 had a good level and 8 had a poor level of PRN.

The total difference between NN and IRN or PRN for prosthodontic treatment was statistically significant (P < .001). Both IRN and PRN estimates were significantly lower than the respective NN estimates for prostheses in both arches (Table 4). The decrease between NN and IRN or PRN was between 74% and 80%. For each type of prosthodontic need, there were significant differences for the comparison between NN and either IRN or PRN (P < .001). However, the comparison between IRN and PRN showed significant reductions only for the total prosthodontic needs (P=.008). None of the specific treatments showed a statistically significant difference between IRN and PRN.

There were significant differences in manpower estimates between the NN and sociodental approaches, measured either through IRN or PRN. Overall, there was a 74.1% decrease in the time needed for prosthodontic treatment when IRN was compared with NN, and a 78.5% decrease when PRN was compared with NN (Table 5). These differences are further highlighted by the number of dental clinicians required to treat 100,000 people using different assumptions for the annual working hours of a clinician. For example, if the mean annual hour worked per clinicians were 2.000. then 86.5 clinicians would be needed to treat the NN for prosthodontic conditions per 100,000 adults. This figure decreases to 22.4 clinicians per 100,000 adults for IRN and 18.6 clinicians per 100,000 adults for PRN (Table 6).



Fig 1 Model for sociodental needs of prosthodontic treatment for missing teeth in the maxilla.



Fig 2 Model for sociodental needs of prosthodontic treatment for missing teeth in the mandible.

Discussion and Conclusions

Despite its rationale and promising initial results, the sociodental approach has not been applied in large national dental surveys. This is the first study to compare the normative and sociodental need assessments using a subsample of a national survey population. This study aimed to assess the extent of the differences between normative and sociodental needs for prosthodontic treatment needs in adults. In addition, the consequences of the differences between the 2 different approaches were also calculated in terms of working hours of dental clinicians required for treatment.

The differences between NN and IRN or PRN for prosthodontic treatment were statistically significant.

This is in line with previous studies that showed significant and large differences between the approaches in adults.²⁷ Furthermore, a study of prosthodontic treatment needs in a representative German sample found that whereas 81% of the sample needed any kind of prosthesis based on normative assessment, this estimate decreased to 13% after subjective treatment needs were included.⁴²

The results of the present study highlight the differences between the conventional NN approach, which aims to replace almost every missing tooth to obtain a functional dentition, and the recent concepts that place more emphasis on the functional needs of a person and not necessarily on the retention of a complete dentition.^{43–46}

| Table 4 | Comparison of Impact-Related Needs (IRN) and |
|------------|----------------------------------------------|
| Propensity | y-Related Needs (PRN) with Normative Needs |
| (NN) for F | Prosthodontic Treatment (N $=$ 1,029) |

| | Need | % decre | ease from | F |)* |
|-----------------------|------|---------|-----------|--------|-------|
| Treatment | (n) | NN | IRN | NN | IRN |
| Total | | | | | |
| NN | | | | | |
| Maxilla | 126 | | | | |
| Mandible IRN | 198 | | | | |
| Maxilla | 33 | 73.8 | | <.001 | |
| Mandible PRN | 47 | 76.3 | | <.001 | |
| Maxilla | 25 | 80.2 | 24.2 | <.001 | .008 |
| Mandible PN1 | 39 | 80.3 | 17.0 | <.001 | .008 |
| NN | | | | | |
| Maxilla | 57 | | | | |
| Mandible IRN | 107 | | | | |
| Maxilla | 11 | 80.7 | | <.001 | |
| Mandible PRN | 18 | 83.2 | | <.001 | |
| Maxilla | 7 | 87.7 | 36.4 | <.001 | .125 |
| Mandible | 16 | 85.0 | 11.1 | <.001 | .500 |
| PN2 NN | | | | | |
| Maxilla | 32 | | | | |
| Mandible IRN | 40 | | | | |
| Maxilla | 9 | 71.9 | | <.001 | |
| Mandible PRN | 12 | 70.0 | | <.001 | |
| Maxilla | 6 | 81.3 | 33.3 | <.001 | .250 |
| Mandible PN3 NN | 8 | 80.0 | 33.3 | <.001 | .125 |
| Maxilla | 37 | | | | |
| Mandible | 51 | | | | |
| IKN | 10 | 04.0 | | < 0.01 | |
| IVIAXIIIA Mandibla | 13 | 64.9 | | < .001 | |
| PRN | 17 | 66.7 | _ | < .001 | |
| Maxilla | 12 | 67.6 | 7.7 | < .001 | 1.000 |
| Mandible | 15 | 70.6 | 11.8 | < .001 | .500 |

*McNemar test.

The decrease in estimates of need for prosthodontic treatment and the smaller number of clinicians needed when using the sociodental approach compared to the conventional normative model have considerable importance for oral health service planning. A systematic method, such as the sociodental approach, that includes normative considerations as well as subjective indicators of oral impacts and measures of behavioral propensity, is important for the planning of oral health. It overcomes the limitation of conventional dental workforce planning, which relies only on professional opinions for assessment of needs.^{13,47-50} The patient, the provider, and their relationship have **Table 5**Comparison of Impact-Related Needs (IRN) andPropensity-Related Needs (PRN) with Normative Needs(NN) for Prosthodontic Treatment by Total Time Required(N = 1,029)

| Time | | % decrease from | | <i>P</i> * | |
|-----------|---------|-----------------|------|------------|------|
| Treatment | (min) | NN | IRN | NN | IRN |
| NN | 106,800 | _ | - | _ | _ |
| IRN | 27,645 | 74.1 | - | <.001 | - |
| PRN | 22,995 | 78.5 | 16.8 | <.001 | .001 |

*Wilcoxon signed rank test.

Table 6Number of Dental Clinicians Needed Per100,000 Adults Based on Varying Assumptions of theMean Annual Working Hours Needed

| | Wor | Working hours per year | | | |
|------------|-------|------------------------|-------|--|--|
| Assessment | 2,000 | 1,500 | 1,200 | | |
| NN | 86.5 | 115.3 | 144.2 | | |
| IRN | 22.4 | 29.9 | 37.3 | | |
| PRN | 18.6 | 24.8 | 31.0 | | |

NN = normative needs; IRN = impact-related needs; PRN = propensity-related needs.

emerged as one of the important elements of treatment decisions.^{51–56} Rich and Goldstein⁵⁷ noted that "treatment planning is no longer simply a result of diagnosis. It is a complex process that involves a combination of diagnostic information, patient desires, evidence-based outcome data, and a thorough review of the treatment alternatives." The sociodental approach to assessing dental needs encapsulates all pertinent factors, in essence dictating which treatment is needed and should be performed.

The sociodental treatment needs assessment has many implications for planning and provision of dental services.^{19,28,58} First, the sociodental approach sup-

PN1 = need for 1-unit prosthesis (1 tooth replacement); PN2 = need for multiunit prosthesis (more than 1 tooth replacement); PN3 = need for a combination of 1- and/or multiunit prosthesis.

ports the development of a health-oriented model of care in preference to the normative treatment model that dominates current dental services. Second, it encourages a shift of emphasis from the purely mechanical to the behavioral aspects of treatment. Finally, it increases the likelihood of effectiveness of treatment and a greater degree of long-term success by conforming to evidence-based dentistry.

Although NN was determined by the well-established WHO criteria, it is worth pointing out that the standardization of the interpretation of these criteria in relation to the need for complete dentures may be considered challenging. This may have influenced the estimates of NN. In addition, there may indeed be concerns about timing estimates rendered by dental associations. However, the possible effect of the choice of timing estimates on the results of this study is limited, if any, as the focus was on the comparison of needs estimates between 2 different approaches, and the RBRVS and Ontario Dental Association timings were merely used to illustrate the dental manpower dimension of the needs assessment comparisons.

On a separate methodologic point, frequency of toothbrushing per day was used as a measure of the propensity factor, which affects outcomes of dental treatment, especially for prosthodontic treatments. Previously, a combination of several propensity factors was used.³² This approach was quite complicated and therefore only 1 propensity factor was incorporated in the current study. Toothbrushing is the best-known behavioral factor related to oral health and it is convenient to illustrate the application of the sociodental need approach.

In the present study, subjects that had either no impacts or poor behaviors were grouped in the nontreatment category. This may be appropriate for a cross-sectional study. However, treatment needs assessment is a dynamic and circular process. Longitudinal studies are needed to test the validity of the estimates of need from cross-sectional studies using sociodental approaches.

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