เปรียบเทียบประมาณการกำลังคนทันตแพทย์ที่จำเป็นสำหรับ
การดูแลทันตสุขภาพของนักเรียนไทยอายุ 6-12 ปี
โดยใช้วิธีมาตรฐานและวิธีประเมินทางทันตสังคม

A comparison for Estimates of Dental Manpower Needs
to Treat All Thai Schoolchildren aged 6 to 12 years old
Using Two Approaches: Normative
and Sociodental Approaches

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บทคัดย่อ

วัตถุประสงค์: การศึกษานี้มีวัตถุประสงค์เพื่อ
เปรียบเทียบจำนวนทันตแพทย์ที่จำเป็น เพื่อดูแลทันต
สุขภาพของนักเรียนในระบบโรงเรียนของไทยในปี
2573 โดยใช้วิธีปกติซึ่งประเมินความต้องการการรักษา
โดยมุมมองทางการแพทย์เพียงอย่างเดียว และวิธีที่
เสนอใหม่ซึ่งนำวิธีเดิมมาปรับโดยเพิ่มการประเมินทาง
ทันตสังคม และการใช้ปริมาณโรคที่เพิ่มขึ้นในแต่ละปี
เป็นข้อมูลนำเข้าในการคำนวณ

Abstract

Objective: The objective of this study was
to compare the number of dentists needed by the
year 2030 to treat dental diseases in the Thai
schoolchildren population, estimated by the
traditional normative dental health need method
and the number estimated using two adjusted
health need models, based on the sociodental
approach and the annual estimated increment of
dental caries

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วัสดุและวิธีการ: ทำการตรวจสุขภาพช่องปากของนักเรียนอายุ 6 และ 12 ปี จำนวน 1,211 คน ใน 5 จังหวัด โดยวิธีการขององค์การอนามัยโลก ทำการประเมินความจำเป็นต้องได้รับการรักษาพยาบาลตามวิธีปกติโดยทันตแพทย์ และประเมินทางทันตสังคมโดยใช้ดัชนี Oral Impact on Daily Performance (OIDP) ร่วมกับการสัมภาษณ์ การคาดประมาณจำนวนทันตแพทย์ในปี 2573 ดำเนินการโดยใช้ข้อมูลจากการตรวจสุขภาพช่องปากดังกล่าว ร่วมกับจำนวนนักเรียนในระบบโรงเรียนที่คาดประมาณสำหรับปี 2573 โดยวิธีการต่างๆ 3 แบบ คือ (1) ใช้ความต้องการการรักษาที่ประเมินด้วยวิธีการทางการแพทย์อย่างเดียว (2) ใช้ความต้องการการรักษาโดยใช้การประเมินทางการแพทย์ร่วมกับการประเมินทางทันตสังคม และ (3) การใช้ความต้องการทางการแพทย์ที่เพิ่มขึ้นในแต่ละปี ร่วมกับการประเมินทางทันตสังคม

ผลการศึกษา: การใช้วิธีที่ 1 คาดประมาณจำนวนทันตแพทย์ได้ 5,874 คน วิธีที่ 2 คาดประมาณกำลังคนได้ 4,994 คน, 5,521 คน และ 5,950 คน ตามลำดับ ขึ้นกับสถานการณ์สมมุติของความชุกในการเกิดฟันผุ ทั้งนี้ กำหนดให้ความชุกในการเกิดฟันผุ ซึ่งวัดโดยดัชนีฟันผุ ถอน อุด อยู่ระหว่าง 0.2-1.8, 0.5-2.2 และ 0.8-3.1 ตามลำดับ สำหรับวิธีที่ 3 ซึ่งใช้ปริมาณโรคที่เพิ่มขึ้นในแต่ละปีร่วมกับการประเมินทางทันตสังคม พบว่าคาดประมาณจำนวนทันตแพทย์ที่จำเป็นได้ 1,418 คน ผลการศึกษาชี้ว่าการคาดประมาณโดยวิธีที่ 1 ให้ผลการคาดประมาณสูงที่สุด เมื่อเพิ่มการประเมินทางทันตสังคมเข้าไปในการคาดประมาณทำให้จำนวนทันตแพทย์ที่คาดประมาณลดลง วิธีการคาดประมาณวิธีที่ 3 ได้ผลการคาดประมาณเพียง 1 ใน 4 ของการคาดประมาณวิธีแรกเท่านั้น

สรุป: การศึกษานี้เสนอให้ปรับวิธีการคาดประมาณกำลังคนทางทันตกรรม โดยนำการประเมินทางทันตสังคมและจำนวนโรคที่เพิ่มขึ้นในแต่ละปี มาร่วมในการคำนวณ

Materials and Methods: The oral health status of 1,211 students aged 6 and 12 years from five selected provinces were examined using dental survey methods recommended by the WHO. Normative treatment needs were assessed by dentists who conducted the examinations. In addition, a sociodental approach comprising impact-related need and propensity-related need of students was used, incorporating the Oral Impact on Daily Performance (OIDP) index and interviews. Estimation of the number of dentists required in the year 2030 was carried out using the examination data, the predicted number of schoolchildren in the year 2030 and models based on (1) the entire normative need alone, (2) the entire normative need incorporated with the sociodental approach, and (3) the annual incremental normative need incorporated with the sociodental approach.

Results: The manpower need in Model 1, the model based on the entire normative need alone was 5,874 dentists. The three scenarios based on the entire normative need incorporated with the sociodental approach produced requirements of 4,994, for Scenario 1 (areas with a DMFT 0.2 to 1.8), 5,521 for Scenario 2 (areas with a DMFT 0.5 to 2.2) and 5,950 dentists for Scenario 3 (areas with a DMFT 0.8 to 3.1), respectively. The Model 3 incorporating incremental need and not normative need with the sociodental approach produced a manpower requirement of 1,418 dentists.

The calculation based on normative needs alone yielded the highest estimates. Incorporating the sociodental approach with the entire normative need decreased the estimates for areas with a low and medium DMFT. Estimating

dentist requirements by using the yearly incremental increase in normative needs incorporated with the sociodental approach estimated the number of dentists required to deal with new increments of caries was one fourth of those calculated by using normative need alone.

Conclusions: As proposed by this study, adjusted dental treatment needs method should be used to calculate dental manpower needs based on the annual incremental increase in dental disease instead of using overall dental disease in the manpower calculation process.

Introduction

Human resources play an important role in the dental public health system. Sufficient numbers and types of appropriate dental personnel are essential to operate a good oral health care system for the population. The World Health Organization (WHO) has urged its member countries to estimate the optimal number of dental personnel during the past two decades[1]. Several methods for estimating human resources for health have been proposed. The most popular methods are (1) the Population Ratio Method, (2) the Health Need Method, (3) the Health Demand Method and (4) the Service Target Method[2]. In the Population Ratio Method, the required manpower is fixed as a ratio to the country's population. In 1985, the WHO recommended the ratio of 1 dentist per 5,000 population[3]. The Health Need Method aims to answer what kinds, amounts, and quality of services are required to maintain a given health status. The procedure converts prevalence and severity of disease in a population into time and then into number of health care personnel[4]. In the Health Demand Method, services are planned to meet what will be demanded[5]. The Service Target Method focuses on setting targets for the production and delivery of health services[5]. These four different methods require different input information and use different approaches for the estimations.

In Thailand, there have been at least three national studies on dental personnel needs[6-8]. These studies displayed variations in the dentist to population ratios, ranging from 1:4,033 to 1:15,727[6-11]. The most recent report by the Ministry of Public Health suggested that at least 17,999 dentists would be needed by the year 2017[8]. In that report the dental health workforce calculated by the Health Need Method was compared to those estimated by other methods. The report concluded that the most appropriate figure for the Thai population was the one estimated from adjusted

need for dental service. The adjustment was done by reducing the target proportion of people needing dental treatment. The major reason for the reduction was that too many dentists would be required to serve the total normative oral health needs of the whole population.

The Health Need method is the most frequently used method to estimate dental man-power at the national level[6-8]. However, it usually produces extremely high estimates of numbers of dentists required. In the Health Need method, all the diseases in the population at a certain period of time are transformed to manpower requirements. However, in reality, most oral diseases, especially dental caries, is irreversible. Therefore, converting all dental caries in the oral cavity into manpower needs implies that the dental workforce is calculated based on the assumption that all accumulated dental caries in the oral cavity of the population should be eliminated. This method yields a very high figure for dental manpower. If that large number of dentists were produced, that dental manpower cohort could eliminate all of the country's dental caries in one year. Thereafter there would be few tasks related to dental caries for them to perform in subsequent years. They would only have to deal with new increments in caries and complications of their earlier treatments. To overcome this limitation, it is more reasonable to estimate the dental manpower based on the new dental caries increment per year.

The number of dentists required to control the yearly increases in dental disease is the minimum number required to stabilize dental disease over time. This number is more valuable in health planning than the number needed to eradicate all dental disease of every member of the population in the country. Health planners can identify the critical dental workforce needs, and thus can more easily identify how long it will take to achieve a particular, targeted oral health goal. That will provide estimates of how many dentists will be needed in various situations.

Additional limitations of the Health Need Model have been observed. The Health Need Model is based only on the normative need of the population assessed by professionals. Numerous studies have illustrated shortcomings of using only normative need to predict the health need of the population. Sheiham and Tsakos[12] concluded that normative need assessment lacks objectivity and reliability, neglects psychological aspects and quality of life, lacks consideration of health behaviours and of patient compliance, neglects consumer rights, and provides unrealistic estimates for treatment planning. The normative need approach tends to overestimate health workforce requirements[13-15]. Additionally, it has been found that patients' attitudes might influence care seeking behavior[16]. Therefore it is vital to include perceived needs and patients' attitudes and behaviours as well as the impacts of dental status with normative needs to estimate dental needs and manpower. That has been done in the sociodental approach[12,17]. Srisilapanan and Sheiham[18] found that only half the older people who were assessed as having normative needs for dental care, actually perceived a need for dental treatment. Several studies reached the same conclusion, namely, that normative need severely overestimates patients' perceived needs for dental treatment[15,18,19,20]. As the sociodental approach has not been systema-tically applied to estimate manpower needs for a child population it was considered worth com-paring manpower estimates based on the con-ventional normative method with those from the sociodental approach.

The objective of this study was to compare the number of dentists needed by the year 2030 to treat dental diseases in the Thai schoolchildren

population, estimated by the traditional normative dental health need method and the number estimated using two adjusted health need models, based on the sociodental approach and the annual estimated increment of dental caries.

Material and Methods

Subjects and study sites. Five provinces were purposively selected as study sites to represent all regions of Thailand. They were Lampang, Udonthani, Phuket, Chonburi, and Bangkok, to represent the northern, northeastern, southern and eastern regions, and one metropolitan area, respectively. Schools located in these five provinces were selected randomly. Schoolchildren age 6 and 12 in these schools were considered as subjects of the study. Study subjects consisted of 1211 schoolchildren aged 6 and 12 years from these five selected provinces.

Normative Need. The dental status and treatment needs of each subject were assessed by two dentists (NK, PS), following WHO guidelines on basic surveys and methods[21]. Possible treatment needs for each tooth were: no treatment, one-surface filling, two-or-more-surface filling, crown, pulp care, extraction, sealant, and scaling. Treatment needs were specified for primary or permanent teeth, as different dentitions needed different times to treat.

The Sociodental approach. The socio-dental approach includes Impact-Related Needs (IRN), where normative needs are integrated with Oral-health-related quality of life (OHRQoL), and propensity-related Needs (PRN), where oral health behaviors are used to determine appropriate treatments[12, 17].

Impact-related Needs (IRN). Impact-related need is assessed by integrating normative need into the OHRQoL, measured by the Oral Impact on Daily Performance for Children index (Child-OIDP index)[22,23]. The Child-OIDP index consists of questions about the impact of oral health on respondents' daily life. If the impacts were expressed by the subjects, the subjects were further asked for the specific conditions that caused the specific oral impact. The Condition Specific OIDP (CS-OIDP) score was derived at this stage[22,23]. The purpose of identifying the CS-OIDP score was to relate the OHRQoL impacts to the specific dental treatment. CS-OIDP scores were interpreted as the patients' perception of the effect of the specific condition on their daily life. Subjects who had a normative need with a CS-OIDP score greater than 0 were considered as subjects in the Impact-Related Need "IRN" group. Subjects who had a normative need but no CS-OIDP score were categorised as the "no-IRN" group. So, the IRN group consisted of subjects who perceived their oral impacts. The number of subjects in the IRN group was assessed to calculate dental manpower needs in the next step. For subjects in the no-IRN group, those with conditions that were not likely to progress and not life-threatening, were not included in the next step. On the other hand, those with early stages of progressing conditions, such as caries, but whose daily life was not affected at the time of examination were included into the manpower calculation.

Propensity-Related Needs (PRN). In this step, normative need and OHRQoL were integrated into behavioural propensity. It is well accepted that the health behaviour of patients strongly influences the effectiveness of dental treatment[24]. Children with good health behaviours are classified as being ready to receive treatment. On the other hand, children with undesired behaviours should modify their daily activities before receiving treatment to maximize the effectiveness of the treatment outcome. In this study, children with good propensity were those who brushed their teeth

twice or more daily. Only children with good propensity were included in the manpower estimations as they would normally be provided with restorative treatments.

As some treatment requirements are considered to be compulsory by national insurance schemes, this study incorporated the sociodental approach with the normative need for some dental treatments only.

Time for Dental Treatment. The time for each type of dental treatment was evaluated using a self-reported questionnaire. Content validity of the questionnaire was verified by three experts, each of whom had worked on dental manpower planning in Thailand for more than 30 years. Reliability of the questionnaire was established by a test-retest method. The correlation coefficient of the two questionnaire responses in the reliability test was 0.99 (p<0.001). The questionnaire was divided into several parts: general information about the respondents, time spent per day on dental and non-dental assignments, duration of and the reason for absence from work, and time in minutes used per type of dental treatment. The questionnaire was sent to 750 dentists in the country, approximately 8.1 percent of the total number of Thai dentist, selected randomly from the Thai Dental Council dentist database. Two hundred and ninety six of them (34.5%) replied.

Calculation of Manpower Need. Three models for manpower calculation were applied in this study: Model 1; a model based on normative need alone without incorporating impact-related or propensity-related need, Model 2; a model based on normative need incorporated with the socio-dental approach that included IRN and PRN, and Model 3; a model based on annual incremental normative need incorporated with the sociodental approach.

The calculation of the three models can be briefly summarized as following:

***Model 1:** Number of dentist need*

$$= \frac{\text{Estimated 2030 DMFT}}{\text{This study DMFT}} \; \text{x} \; \frac{\text{Time used per treatment}}{\text{Time dentist spend per year on dental}}$$

x   Number of teeth with entire normative need

x $\dfrac{\text{Estimate number of schoolchildren in 2030}}{\text{Number of schoolchildren in this study}}$

***Model 2:** Number of dentist need*

$$= \frac{\text{Estimated 2030 DMFT}}{\text{This study DMFT}} \; \text{x} \; \frac{\text{Time used per treatment}}{\text{Time dentist spend per year on dental}}$$

x   Number of teeth with entire normative need, IRN, PRN

x $\dfrac{\text{Estimate number of schoolchildren in 2030}}{\text{Number of schoolchildren in this study}}$

***Model 3:** Number of dentist need*

$$= \frac{\text{Estimated 2030 DMFT}}{\text{This study DMFT}} \; \text{x} \; \frac{\text{Time used per treatment}}{\text{Time dentist spend per year on dental}}$$

x   Number of teeth with incremental normative need, IRN, PRN

x $\dfrac{\text{Estimate number of schoolchildren in 2030}}{\text{Number of schoolchildren in this study}}$

Because this study aimed to answer the "if-then" question rather than to specify only one optimal dental manpower figure, three scenarios of different dental caries prevalence were created in the second model. Appropriate numbers of personnel for each scenario were calculated to avoid specific prediction of future disease.

It has been shown in previous national oral health surveys that different regions of the country had different levels of dental caries[25]. In this study, three scenarios were developed, based on the different caries prevalences of different regions of Thailand.

- Scenario 1: This low prevalence scenario assumed that there was a very low DMF prevalence in the Metropolitan and the Central regions. The low prevalence in the remaining three regions was made based on a prediction of DMFT by the year 2030.

- Scenario 2: This moderate DMFT scenario was based on the prediction of DMFT by the year 2030 if the rate of change in DMFT from 1984-2007 were to be constant until 2030.

- Scenario 3: This scenario assumed the highest DMFT prevalence situation of the three. The scenario assumes a moderate DMFT prevalence in the metropolitan and central regions, and a high prevalence in the northern, northeastern and southern regions.

The process of manpower calculation was based on the number of children aged 6-12 in the year 2030, projected by the Office of Economic and Social Development Board. Data from examination of the 6-year-old children were applied to children aged 6-10 in the models. Data from 12-year-old children from the examination were applied to the 11-12-year-old children in the models. The number of teeth needing to be treated was extrapolated from figures derived from the oral examination of schoolchildren residing in the five selected provinces. Different manpower calculation methods were used, as described above. Because the estimation model based on the entire normative need alone is not relevant in concept it

was applied in the moderate scenario for comparison purposes only. Because the annual disease increment is very small compared to the overall disease prevalence, the estimation of incremental need incorporated with the OIDP index was performed only in the scenario in which dental caries prevalence of primary and permanent teeth was 1.0 and 0.1, respectively. The assumption of incremental caries increase per year was based on a series of previous national and regional surveys conducted in Thailand during the previous 30 years[25-27].

Results

Time per dental treatment (minutes). Time in minutes per dental treatment reported by dentists is presented in Table 1. These time figures represent the average time used per treatment to treat particular dental diseases of children aged 6-12 reported by dentists who completed the questionnaire.

There were very large differences in the calculated numbers of dentists required to treat the total child population aged below 12 years using the two main approaches. Using the normative

Table 1 Average time to treat a patient used by Thai dentists for specific treatments.

Treatment	Mean time used per patient or per treatment, in minutes	S.D.
Diagnosis	13.2	9.7
One-surface filling (primary tooth)	20.9	16.5
Two-surface filling (Primary tooth)	30.7	21.5
One-surface filling (Permanent tooth)	22.3	17.6
Two-surface filling (permanent tooth)	36.8	34.6
Stainless steel crown (Primary tooth)	52.9	27.8
Crown (Permanent tooth)	163.3	96.7
Pulp care (Primary tooth)	66.3	38.4
Root canal treatment (Permanent tooth)	163.8	113.1
Extraction (Primary tooth)	13.7	8.2
Extraction (Permanent tooth)	19.4	12.2
Scaling	22.8	12.0
Removable orthodontic treatment	59.5	48.9

Table 2 *Estimated numbers of dentists needed for treatment of caries and periodontal disease of children in the Thai school system in the year 2030, according to scenarios.*

Treatment	Estimated Dentist Requirement (persons)				
	MODEL 1 Calculated from entire normative needs alone	MODEL 2			MODEL 3 Calculated from annual incremental normative needs with sociodental approach
		Scenario 1 DMFT 0.2 to 1.8 Calculated from entire normative needs with sociodental approach	Scenario 2 DMFT 0.5 to 2.2 Calculated from entire normative needs with sociodental approach	Scenario 3 DMFT 0.8 to 3.1 Calculated from entire normative needs with sociodental approach	
6-10-year-old schoolchildren					
Primary teeth uncomplicated filling	363	290	363	413	75
Primary teeth complicated filling	1282	1025	1282	1457	265
Primary teeth crown	488	390	488	555	101
Primary teeth pulp care	244	195	244	277	50
Primary teeth extraction	356	285	356	405	74
Primary teeth sealant	891	952	891	849	284
Permanent teeth uncomplicated filling	13	11	13	36	3
Permanent teeth complicated filling	4	3	4	10	1
Permanent teeth extraction	8	6	8	21	2
Permanent teeth sealant	891	952	891	849	143
Total	**4,540**	**4,109**	**4,540**	**4,872**	**998**
11-12-year-old schoolchildren					
Uncomplicated filling	69	43	69	95	4
Complicated filling	62	39	62	85	4
Crown	183	61	97	134	6
Pulp care	236	68	109	150	7
Extraction	26	5	8	11	0
Sealant	565	612	565	518	342
Scaling	193	57	71	85	57
Total	**1,334**	**885**	**981**	**1,078**	**420**
Overall Total 6 to 12 year olds	**5,874**	**4,994**	**5,521**	**5,950**	**1,418**

approach would need 5,793 dentists whereas only 1,416 would be needed using the sociodental approach.

Three models and three scenarios for estimating dental manpower. The three models for estimating dental manpower needs to treat schoolchildren in the year 2030 are shown in Table 2. For the Model 2, three scenarios were applied according to various levels of dental caries prevalence. The summary of the three scenarios are presented in Table 3. The scenario with a low dental caries trajectory assumes that the level of DMFT in 12-year-old children ranged from 0.2 to 1.8 DMFT. The moderate and high DMFT scenarios assumed values of 0.5 to 2.2 and 0.8 to 3.1, respectively.

The manpower need in Model 1, the model based on the entire normative need alone was 5,874 dentists. The three scenarios based on the entire normative need incorporated with the sociodental approach produced requirements of 4,994, for Scenario 1 (areas with a DMFT 0.2 to 1.8), 5,521 for Scenario 2 (areas with a DMFT 0.5 to 2.2) and 5,950 dentists for Scenario 3 (areas with a DMFT 0.8 to 3.1), respectively. The Model 3 incorporating incremental need and not normative need with the sociodental approach produced a manpower requirement of 1,418 dentists.

Discussion

Dental manpower estimation is very important for national health planning. The Ministry of Public Health of Thailand has used only the health need model that uses normative need as a basis for every manpower calculation for the last 30 years[6, 8]. The latest estimation, conducted in 2009 using the same method, estimated that 140,651 dentists would be required by the year 2017 to treat dental disease in the total Thai population[8]. At present, there are only approximately 10,000 dentists in the workforce for the whole country. The present supply of new dental graduates is only about 700 per year[28]. It is therefore impossible to achieve the target number of 140,651 by 2017. As a result, the estimation of dental manpower performed by the Ministry of Public Health is unrealistic. However, in order to have a more realistic estimation, the Ministry of Public Health altered the target population. Instead of aiming to treat the whole population, only 20 to 50 percent of the population was set as the target to receive a particular treatment. The reduction in the target population resulted in a lower estimate of dentist needs as well. After adjusting the target population, the estimation of the number of dentists needed has been changed from 140,651 to 17,999[8].

Despite adjusting the target population to make the estimates more pragmatic, there are still some other limitations of the Ministry of Public Health manpower estimation model. They are: (1) the reduction in the number of the population receiving dental treatment was achieved by using expert opinion only, (2) the number of dentists resulting from the traditional health need calculation is the number of dentists required to eradicate all the disease in one year. As outlined earlier in this paper, this approach is not rational

Table 3 *Scenario for calculation of manpower need to treat 6-10-year-old schoolchildren*

	Mean dmft in primary teeth (6-y-old group) /Mean DMFT in permanent teeth (12-y-old group)				
	Metro	Central	North	NE	South
Scenario 1 Low DMF trajectory	1/0.2	4/0.8	3/1.8	4/1.3	5/0.5
Scenario 2 Medium DMF trajectory	2/0.5	4/1.4	4/2.1	5/2.2	7/1.0
Scenario 3 High DMF trajectory	3/0.8	6/2.0	5/2.4	5/3.1	7/1.5

for dental manpower production planning.

Many studies have found large differences between normative dental needs and perceived needs (Gherunpong et al., 2006 a; Ryu et al., 2008; Srisilapanan and Sheiham, 2001; Tsakos et al., 2006). Calculating manpower needs from normative dental health need alone produces large overestimates, because it is known that not all people with normative needs seek dental care. Using the sociodental approach in manpower modeling generates more rational results. This study showed differences between the entire normative need model and the model incorporating normative need with the sociodental approach. Because of some compulsory treatment requirements by national insurance schemes, this study incorporated the sociodental approach with the normative need for some dental treatments only. The manpower requirement resulting from the model that combined normative need with the perceived need produced half or even less than half the manpower requirements compared to that calculated from the entire normative need approach alone for certain dental procedures. That is well illustrated in the reduced numbers of dentists required to provide crowns, pulp care, tooth extractions, and scaling for the 12-year-old group in this study. This study confirms the results of several previous studies, that differences in manpower need derived solely from normative need models are about twice those derived from a sociodental approach that includes perceived needs and impacts on daily life[15, 18-20, 29].

If health planners input the health need model with only the entire normative need without considering the perceived needs of patients and aim to eliminate all the disease existing in a population it might generate incorrect estimates for the country's manpower needs. The approach used by the Ministry of Public Health implies that if it is possible to produce many dentists to eliminate those diseases, no more dental tasks would remain after one year. The results of this study suggest that the annual incremental increase in dental disease would require about 1,500 dentists compared to about 6,000 using the normative approach that is normally used based on national dental surveys. That is approximately one fourth of the manpower estimated by the original normative model. Our findings suggest that by using a sociodental approach and the annual incremental rate of increase in oral diseases the Ministry of Public Health's manpower need estimation of 140,651 can be greatly reduced. Such a reduction should lead to a change in oral health policy to expand the goals and scope of the dental care system.

From the estimates reported in this study, it is apparent that after replacing dentists who leave the system for any reason with newly graduated dentists coming into the system, the number of active dentists treating schoolchildren would be equal to the numbers needed to control the annual incremental increase in dental diseases, the prevalence of diseases will not change. This study shows that the minimum number of dentists to stabilize dental disease in the child population of Thailand is not excessive. It might be more realistic to use the numbers reported in this study for national oral health planning. The number of dentists in excess of that needed to stabilize disease can be considered as the number of dentists needed to reduce the remaining untreated diseases in other age groups. On the other hand, as there is a trend for a decrease in the young-age population of Thailand and caries rates are declining[25, 27], the number of dentists needed to stabilize dental disease will also decrease. From this proposed method of calculation the dental manpower need can be predicted and manpower planning of the nation can be managed without overproduction of dentists.

Conclusions

As proposed by this study, a adjusted dental treatment needs method should be used to calculate dental manpower needs based on the annual incremental increase in dental disease instead of using overall dental disease in the manpower calculation process.

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