Chapter 5

Discussion

5.1 Concept

5.1.1 Need assessment as a basis for manpower calculation

As the purposes of need assessment are to find differences between health need and health services in order to plan health care, the definition of need has a great influence on the design of health and workforce schemes. Bradshaw (1972) classified four types of need, namely, normative need, comparison need, perceived need, and expressed need. Although the most commonly used type of health status and need assessment in oral health care is through clinical indices and normative or professionally defined need, normative need, assessing health need through professional judgment is highly criticized because of its limitations. These limitations include lack of objectivity and reliability, neglects psychological aspects and quality of life, lacks consideration of health behaviors and of patient compliance, neglects consumer rights, and provides unrealistic estimates for treatment planning (Sheiham and Tsakos, 2007).

Incorporating sociodental approach into normative need was introduced to overcome the limitations of normative need (Gherunpong et al, 2006a; Sheiham and Tsakos, 2007). Sociodental approach is composed of three types of assessment; normative need, impact-related need and propensity-related need. Impacted-related need

concerns on perception of patients on quality of life impacted by their dental condition. Propensity-related need concerns behavioural background of people as that is known to be related to treatment effectiveness. Integrating sociodental aspects with normative need makes estimation of need for dental treatment more realistic. This is because need assessment based on professional judgments should take into consideration patients' perception and their past behavioural patterns. Need assessed by this new approach is therefore usually different from that judged by professional decisions alone. As a consequence, when the need definition of the population changes, the numbers of workforce calculated based on need also change. Because many methods of dental manpower estimation are partially or totally based on population needs and the sociodental approach has not been systematically applied to estimate manpower needs for a child population, it was considered worth comparing manpower estimates based on the conventional normative method with those using the sociodental approach.

Many studies compared need assessed by professional alone to the sociodental approach. Srisilapanan and Sheiham (2001) found that only half the older people who were assessed as having normative needs for dental care, actually perceived a need for dental treatment. de Oliveira and colleagues (2008) found about 49% of children with orthodontic normative need reported impact on daily life from malcocclusion condition. Several studies reached the same conclusion, namely, that normative need severely overestimates patients' perceived needs for dental treatment (Gherunpong et al, 2006b; Tsakos et al, 2006; Ryu et al, 2008). In adults, it is more likely to find differences between the number of persons with need assessed by professionals only and persons

with need assessed by professionals and the sociodental approach. Conditions usually of concern to dentists but which may or may not impact on the personal daily life of patients are periodontal disease and dental caries. Active dental caries is considered as a progressive condition. This condition should be treated whether or not it has an impact on the daily life of schoolchildren. In this study, orthodontic treatment was excluded from the assessment because the treatment is not commonly available in Thailand. Moreover, the Child-OIDP index is designed for older schoolchildren, thus this study used normative need alone during assessing the oral health need of the 6-year-old schoolchildren. These points are reasons that the needs assessed by the two methods in this study do not differ very much from each other.

5.1.2 Concept of using entire normative need and annual incremental normative need in calculating dental manpower

Dental caries is usually 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. This is because entire normative need present in oral cavity of patients are accumulated experience of their oral disease since the time their teeth have erupted. In the process of manpower calculation the entire need was converted into time for treating the disease, then converting that to number of manpower needed. If the time calculated from need are converted into equivalent number of manpower that be able to treat all the disease within

one year, that is we expect to eliminate all the disease accumulated from past in a single year. As a result, using this entire normative need for calculation manpower always produces very high figures of workforce requirement. This large number of manpower is unlikely to be available in practice. 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 stabilise 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 is likely to take to achieve a particular, targeted, oral health goal. That can provide estimates of how many dentists are needed in various situations.

Using the entire normative need is useful for a disease with a recurrent nature as the disease could recur in consecutive years to that in which it was treated. This study considered periodontal disease as a disease with a reversible nature. So the overall prevalence of periodontal disease observed in samples was used in Model 3. On the other

hand, dental caries does not fit this concept. Hence only the yearly incremental increase in dental caries was included in Model 3.

5.2 Issue considering on dental manpower estimation

5.2.1 Epidemiology of oral health of Thai schoolchildren

The dental caries status of the permanent teeth of Thai schoolchildren has continuously improved during the last 30 years. According to the report of the 6th national oral health survey, although the mean DMFT of 12-year-old students seems to be constant at about 1.5 to 1.6 from 1984 to 2007, the D component of the DMFT is very different from the earlier report. Mean decayed teeth per person in 12-year-old child was 0.84 in the year 2007. In the 1984 report it was 1.4. The M component was steady at 0.0-0.07 for the all six National Oral Health Surveys. Contrarily the F component increased from 0.1 in 1984 to 0.64 in 2007. It is worth noting that DMFT changed differently across the region. In the Bangkok metropolitan region the DMFT that was once as high as 3.0 it has been reduced to 1.28 at present. Meanwhile, the DMFT figures in more rural areas such as the Northern and North-eastern regions have increased from 1.4 to 1.78 and from 0.5 to 1.27, respectively (Department of Health, 2008).

The periodontal disease status of 12-year-old-schoolchildren in Thailand has improved recently. It is demonstrated from the National Survey that average healthy gingival sextant of 12 year-old-group was 1.4, 1.4, 1.9, and 2.8 in the survey years 1989, 1994, 2001, and 2007 respectively. The percentage of 12-year-old subjects by maximum CPI score in oral cavity from the latest four National Surveys showed a similar trend. In

the 1989 survey only 5.9% of subjects aged 12 had a maximum CPI score of 0, meaning they demonstrated a healthy periodontal status. This percentage has changed to 6.2, 2.3, 9.5, and 18.0 in the later surveys. It can be concluded that the periodontal status of this age-group has improved over time (Department of Health, 2008).

We can see from the results of this study that the status of both dental caries and periodontal disease in the schoolchildren examined is different from that reported in the latest National Surveys. The prevalence of dental caries in this study was relatively low compared to that in the 2007 National Oral Health Survey. The dmft of 6-year-old schoolchildren in this study was 3.6, whereas that in the National Survey was 5.4. Also the DMFT in 12-year-old schoolchildren of 1.0 was lower than the corresponding 1.5 of the National Survey. As a result of lower dental caries level, the treatment need indicated for dental caries in this study was lower than that of the national statistics too. The percentage of 6-year-old schoolchildren who needed treatment of caries for primary teeth were: one surface filling, 24.1%; two-or-more surface filling, 47.4%; stainless steel crown, 12.4%; pulp care, 4.9%; and extraction, 29.7%. The corresponding numbers from the latest National Survey were 56.9%, 58.8%, 9.4%, 27.3%, and 32.7%, respectively.

The main possible reason of this difference might be the decreasing trend of dental caries in Thailand. Another source of difference possibly came from sample selection. This study sampling did not separate the rural and urban area for collecting data. The study was conducted in public provincial schools of the selected provinces that were considered as the place for study of both urban and rural originated students. It turns

out that the mean numbers of dmft and DMFT of this study tended to be lower than the national figures.

Even though there is some difference between the National Survey statistics and the epidemiological data observed in this study, it does not lead to severe limitation in the data analyzing process. This is because this study uses disease status as an input for comparing normative need and perceived need of subjects only. After converting the different need assessments into full-time equivalent manpower requirement, the imaginary situation of disease status will be hypothesized. The difference in disease prevalence hence influences the estimations minimally.

Another point worth mentioning here is the different trends of disease prevalence. Both dental caries and periodontal disease in 6 and 12-year–old Thai children showed different trends across the regions. As described above, in order to formulate scenarios in this study, the character of each region was used as a basis for each scenario formulation. The first scenario assumed that there was a very low DMF prevalence in the Metropolitan and Central regions. In this first scenario the low prevalence in the Northern, Northeastern and Southern regions was based on the prediction that the DMFT by the year 2030 would be equal to the present DMFT for those regions. The moderate DMFT scenario was made based on the prediction of the DMFT by the year 2030 if the rate of change in DMFT from the year 1984-2007 was constant until 2030. The high prevalence scenario assumed moderate DMF prevalence in the Metropolitan and Central regions, and a high prevalence in the Northern, Northeastern and Southern regions. The prevalence of periodontal disease was grouped into the three scenarios in the same manner. These three

area-based scenarios were expected to be more reliable than a single, whole-country prevalence assumption.

5.2.2 Application of universal pattern of dental caries in manpower estimation model

Sheiham and Sabbah (2010) reported that there are six universal patterns of dental caries. The patterns are true regardless of fluoride exposure, country, or time. They are (1) the relationship between current and future population mean DMFT; (2) the relationship between the prevalence and distribution of dental caries in a population; (3) the relationship between mean DMFT and mean DMFS; (4) the variability of caries susceptibility among tooth types and sites; (5) changes in mean DMFT scores for individuals and groups are 'stepped'; and (6) the relationship between the mean DMFT and the rate of dental caries progression. Following these patterns, the numbers in a population affected by levels of dental caries at a particular mean DMFT are predictable. In other words, there are some specific percentages of a population with a DMFT of 0, 1, 2, 3, and so on, for any given mean DMFT. The relationship between caries prevalence and mean DMFT of the population can be defined by the specific mathematical equation, namely, prevalence = 41.8 * $DMFT^{0.64}$ (Bachelor and Sheiham, 2002). For example, this equation suggests that the prevalence of dental caries in a population with a DMFT of 1 is about 42%. The equation suggests that only 42% of people would be affected by caries in a population with a mean DMFT of 1. Further calculation would present percentages of the population with mean DMFTs of 1, 2, 3, and so on. Applying the universal patterns of dental caries to this study, it can be assumed that there would be a specific percentage of

the population with DMFTs of 0, 1, 2, and so on for any given mean DMFT scenarios. It may be said that there would be only a particular percentage of schoolchildren affected by dental caries regardless of the assumed mean DMFT scenarios. However, data collected in this study were collected on a treatment time per tooth basis; therefore, applying a universal caries pattern to this study did not provide any difference from not doing so. On the other hand, there would certainly have been a difference if data were collected on a per person basis. In the example of schoolchildren with a mean DMFT of 1, without applying the universal caries pattern to the model, it could be implied that every schoolchild has dental decay. The dental workload in this population would be one cavity in each individual. By applying a universal caries pattern to the model, only 42% of the population would be affected by dental caries. Each of the affected children would have a DMFT of about 2.4. The workload in this case would be to treat only 42% of the schoolchildren, but to treat 2.4 cavities per affected child. The total number of cavities to be treated in the two models is the same. Differences in chair time for treating every schoolchild with one cavity each and 42% of schoolchildren with 2.4 cavities each could be significant on a scale of millions of schoolchildren. It is suggested by this study that collecting data on treatment time in children with different numbers of dental cavities, as these data would be useful for more realistic manpower estimations in the future.

5.2.3 Incremental normative need in manpower estimation model

As mentioned earlier in this chapter, the incremental normative need was significant in manpower estimation model. Manpower equivalent to annual incremental normative needs of the population was considered as minimum critical requirement

workforce. This workforce requirement was defined as minimum number of manpower need to stabilise dental caries in the population over time. The incremental normative need in this study was assumed to be 0.1 and 1.0 in permanent and primary teeth respectively. This study assumed incremental normative need using data from a longitudinal study conducted in Thailand few years ago. Although there are several cross sectional surveys conducted in Thailand, the average DMFT and dmft from those cross sectional surveys are not suitable to use for estimate incremental normative need in this study (Dental Public Health Division, 2000; 2008). Theoretically, DMFT and dmft is prevalence of dental caries. The prevalence of dental caries from several surveys are average numbers of dental decay in different persons. These dental cavities may or may not develop at the same rate. To identify the number of newly developed dental caries per year, there is a need for a longitudinal study that follows the same individuals. Unfortunately, longitudinal studies are rare in Thailand, especially in this age group. A study in Iceland, where the DMFT is high, showed that 1.5 lesions increase per year in study subjects of age 14-16 years (Arnadóttir et al., 2010). Study conducted in Hong Kong demonstrated 0.9 incremental dental cavities in 2 years (Wong et al., 2011). Other studies showed variations of annual incremental caries. These literatures are different in results because of their different background. In this study we assumed incremental normative need, mainly based on unpublished longitudinal data from Thailand, as this set of data is the best available with a similar background to that of the target population (Korwanich et al. 2010). The data were collected in Karen Hill Tribe schoolchildren aged 6-12 who had resided for three consecutive years in remote rural areas of the west of

Thailand. Other series of cross sectional studies held in separated provinces of Thailand during the last 30 years were also used for minor adjustments of the data (Department of Health, 2000). Both the longitudinal and series of cross sectional data are presented in Appendix VI.

5.2.4 Sex of Dentists and its effect on time spent on dental tasks

The effect of sex trends on dental productivity was included in this study as the trend of change in the sex proportion of dentists may influence manpower production plans dramatically in the future. A number of studies supported and argued this concern (Ahlberg, 1990; Brennan et al, 1992; van Dam and van Rossum, 1994; Newton et al, 2000; Katrova, 2004, Spencer and Lewis, 1988; Beazoglou et al, 2001; Blasius and Pae, 2005).

The data from the questionnaire show some important points worthy of note. Even though the number of female respondents in this study was higher than that of males, the proportion of the two sexes was more equal than the true proportion obtained from the Thai dental personnel database. In addition, there was a significant lack of response to some questions, such as marital status. Therefore, this factor should be considered when interpreting the results.

Despite the concordance of several reports, this study could not find a statistical difference in time spent on dental practice among male and female dentists in Thailand. It can be seen clearly from this study that female dentists had a lower average number of hours of work per year than their male counterparts. However, the difference between the two sexes was not high enough to provide statistical significance. Previous studies have

suggested that female dentists had lower dental productivity as they were more likely to be expected to take care of the family than were their male counterparts. Moreover, they were reported to have spent more time on family matters, for example, career breaks, child delivery, working in part time sessions, and early retirement (Mathew and Scully, 1994; Newton et al, 2000, Ayers et al, 2008). This study found that taking career breaks due to child delivery was the third most frequent cause of absence in the female respondents group.

An additional factor that might influence the interpretation of the results of this study is the dental care delivery system of the country. In Thailand, public health sector dentists, who constituted the majority of respondents in this study, also work part time in private practice. This combination of work type may compromise the reported working time and absent-from-work time of the respondents. Administrative responsibility, on the other hand, could be one important reason that senior-level male dentists spend less time in clinical practice than do their female counterparts. In Thailand, males still dominate the higher administrative positions. As stated previously in the literature reviews, most of the studies were conducted in highly developed countries, such as the United Kingdom, the United States of America, Australia and New Zealand. In those countries the combination of work in the private and public sectors is not common. Dentists work either in the private or public sector. Therefore, it is possible to find a significant difference between times spent in dental practice among genders in those countries.

It is important to point out that the trend of sex shift among Thai dentists is in the same direction as reported in other countries (Brown and Lazar, 1999; Zillen and

Mindak, 2000; Laloo et al, 2005). It is strongly recommended that manpower planners at the national level should be aware of this trend and incorporate this factor into the future dental workforce planning system.

5.3 Methods of Manpower Requirement for Dental Health

5.3.1 Manpower estimation models

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 (Kahn and Sithole, 1991). 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 (Holler and Machans, 1989). 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 (Hornby et al, 1980). In the Health Demand Method, services are planned to meet what will be demanded (Hall, 1978). The Service Target Method focuses on setting targets for the production and delivery of health services (Hall, 1978). These four different methods require different input information and use different approaches for the estimations. Most studies in Thailand used one of the four aforementioned methods in estimating the country workforce requirement (Department of Health, 1986; Dental Faculty Consortium of Thailand, 1993; Ministry of Public Health, 2009). Anyway, some studies proposed different methods of

dental manpower estimation. For example, Udompanich (1990) introduced manpower estimation for dental public health at district level by using the System Dynamic Model.

To predict a country's manpower needs, it is important to consider and balance several domains to produce practical and realistic estimates, namely, need, supply, demand, and resources (Wirick, 1966; Hall and Meja, 1978; Joint FDI/WHO Working Group, 1984; Wright et al, 1998). Factors possibly influencing Thai dental manpower estimation were discussed recently, including incentives for dental personnel, government free trade area policy, new dental school establishment, and so on (The Dental Council of Thailand, 2009). Some studies included these concerns into their models (Udompanich, 1990; Ministry of Public Health, 2009). However, this study aimed to compare different needs assessed using distinct concepts. Thus, factors not related directly to health need were beyond the scope of this study. By concerning on difference on health needs alone, it may influence several models of manpower estimation as health needs are major inputs for these models.

5.3.2 Estimation of manpower using different models

At the national level in Thailand, dental workforce estimation has been done only on the health need model that uses normative need as a basis for every manpower calculation for the last 30 years (Department of Health, 1986; Dental Faculty Board, 1993; Ministry of Public Health 2009). The estimations in 1986 and 1993 were conducted following guidelines developed by World Health Organisation (WHO) and World Dental Federation (FDI) (WHO, 1985; Joint FDI/WHO working group, 1989). Both estimations used prevalence of disease from previous National Oral Health Surveys as basic input for

the calculation. Workload for treatment was calculated using difference between average DMFTs of two age cohorts. Basic assumption of this FDI/WHO model was the progressing rates of dental diseases in population are equal and increase steadily overtime for every age group. For example, number of restorative workload for the cohort 15-29 years was calculated using DMFT of this cohort minus DMFT of the younger cohort, the cohort 0-14 years, and then adjusted by some factors. The 1986 estimates suggested 7,809 dentists and 6,185 dental nurses were required for taking care dental health of the population by the year 2000. In the 1993 estimations, 8,644 dentists and 6,128 dental nurses were suggested as minimum requirement workforce to take care dental health of the population by the year 2006. Both estimates were assumed to provide different population coverage proportion depended on age group. Although the both estimates were conducted meticulously as directed by guidelines from WHO and FDI there might be some shortcoming. Critical comments to this WHO/FDI model were introduced by some authors (Bronkhorst et al. 1991). Major shortcoming of this model was from neglecting cohort and period effect in the estimates of oral care needs. According to recommendations from Bronkhost and colleagues, the model was suggested to use "if-then" questions and exploring the viability of alternative future systems. By using FDI/WHO manual as guideline for estimation, both of the 1986 and 1993 Thai estimates also faced limitations as same as those found in the original model.

The latest estimation, conducted in 2009 using the Health Need method, estimated that 140,651 dentists would be required by the year 2017 to treat dental disease in the total Thai population (Ministry of Public health, 2009). 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 (Vichawut et al, 2005). It is therefore impossible to achieve the target number of 140,651 by 2017. It is obvious that 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% 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 (Ministry of Public Health, 2009).

Despite adjusting the target population to make the estimates more achievable, there are still some other limitations in 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 thesis, this approach is not rational 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 the 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 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, which differences in manpower needs derived solely from normative need models are about twice those derived from a sociodental approach that includes perceived needs and impacts on daily life (Gherunpong et al, 2006b; Adulyanon, 1992; Srisilapanan et al, 2001; Srisilapanan et al, 2003; Tsakos et al 200618-20, 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. These findings suggest that by using the 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 and thus 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 as caries rates are declining (Department of Health, 2002; 2008), the number of dentists needed to stabilize dental disease can also be expected to decrease. From this proposed method of calculation, the dental manpower need can be predicted and manpower planning of the nation can be managed without the overproduction of dentists.

Another concern on reducing number of Thai population should be addressed here. As reported by Office of National Economic and Social Developmental Board,

number of schoolchildren tends to decreasing until the year 2030. Thus the number of dental manpower need to treat this group of children would decrease over time as well. If series of estimates of dental manpower need to treat schoolchildren from the year 2010 to 2030 are produced we might see decreasing trend of manpower need. It is possible that the number of manpower estimated for any year between 2010 to 2030 is higher than that of the year later. All the three Models in this study are affected in the same way from this decreasing trend. Although there is evidence of dental manpower deficiency in the present year the degree of severity of deficiency is gradually better in the future. It is recommended by this study to balance between increasing dental manpower production to reduce the manpower shortage problem and decreasing trend of dental treatment need in the future.

5.3.3 Workload on sealant, preventive care, and oral health promotion

Geoffrey Rose (1993), in his notable book "The Strategy of Preventive Medicine," classified two kinds of risk approach: high-risk approach and population approach. The high-risk approach aims to focus attention on individuals at high risk. This approach assumes that there are few in a population exposed to risk factors. This approach also assumes that only these few account for the majority of disease in the community. Therefore, measures for disease prevention in this high-risk approach are concentrated on offering preventive support to modify the causes of conditions in high-risk individuals. The population approach focuses differently on a large number of people in the center of the disease distribution. Preventive measures based on the population approach pay attention to the reduction of risk factors in the large numbers of those with

moderate risk. Preventive measures might not be appropriate in the high-risk approach when a small increase in risk in a large number of individuals generates more cases than does a large increase in a few individuals. Batchelor and Sheiham (2002)postulated that in cases of dental caries, high-risk approach prevention is based on the assumptions that (1) individuals with the highest level of caries account for the majority of future caries lesions, and (2) high risk interventions will be effective. It is highly possible that if there is some degree of violation of these assumptions the high-risk approach to dental caries would be ineffective. There are other criticisms of the high-risk approach (Fejerskov, 1995; Sheiham and Watt, 2002; Watt, 2002; Batchelor and Sheiham, 2006).

In Thailand, dental sealant application, a high-risk approach, is used as a major dental prevention scheme for primary schoolchildren. The Ministry of Public Health aims to provide dental sealants for at least half of Thai primary schoolchildren (Dental Public Health Bureau, 2011). From an economic point of view, using high-risk approach dental sealants on a population scale may not be cost effective. Therefore, this study estimated manpower for the sealant workload separately from other workloads to illustrate the manpower requirement in accordance with Thai health scheme policy. In keeping with the dental sealant scheme, this study assigned all sound permanent molar teeth to receive sealant application.

When the scenario involving the lowest dental caries prevalence was used, the percentage of caries free schoolchildren increased. The number of teeth without caries in each scenario was roughly predicted using a regression equation generated from the relationship of caries prevalence and the number of teeth without caries observed in study

subjects. It can be seen from the study results that the scenarios of lower caries prevalence provided higher manpower estimates for dental sealant task.

The manpower requirement estimated for sealant application was about half of the overall manpower requirement estimates. The requirement for this treatment did not vary after incorporating the sociodental approach into the normative need. This is because sealant application in this study was assumed to be applied to all sound molar teeth. The estimation of manpower from the workload that included sealants thus showed only small differences between Model 1 and Model 2. Without including the sealant workload, the manpower calculated by Model 2 required only 54 percent of the workforce calculated by Model 1.

One more issue worth pointing here is the dental health promotion workload. As aforementioned, individuals with normative need but poor behavioural propensity should modify their behaviour to improve the effectiveness of treatment before they actually receive the treatment. Modifying the behaviour of the population is considered as a necessary intervention in health promotion. Although this task was not included in the manpower need estimated by this study should be considered by health care planners. The FDI/WHO Model of dental health manpower estimation (1989) included this workload in their model. The 1986 and 1993 Thai dental manpower estimation thus included this workload as guided by the WHO manual. Both studies assumed that the population received 30 minutes of health education twice a year and manpower requirement was then estimated on that basis. Moreover, a concept related to behaviour modification has recently been discussed (Sheiham and Watt, 2000; Watt, 2002; Newton

and Bower, 2005; Watt, 2007). Several authors agree that behaviour of individuals is not freely chosen but depends on social conditions. Behaviour is a more likely indicator of other factors related to sociocultural environment than the cause of oral disease itself. As a result, behavioural modification through a lifestyle approach is ineffective and costly. The population approach and common risk factors approach were introduced as more effective ways to modify individuals' behaviours (Sheiham and Watt, 2000; Watt, 2002). From the questionnaire, this study found that dentists and dental nurses spend about half an hour and one hour, respectively, per day for non-treatment dental tasks, such as health education. The time they spend on these kinds of tasks is appropriate for oral health promotion. Because of high support in the literature for the population approach in health promotion, this study did not estimate manpower specifically for individual patient health education. This study supported health promotion through the population approach and the common risk factor approach. Time and manpower need for the population and common risk factor approaches should be arranged from the times related to dental treatment even if the treatment and non-treatment tasks are performed by the same individuals.

5.3.4 Using a skill mix concept in the model.

Health needs can be presented in several forms, for example, numbers of people, numbers of procedures, hours of work, and division of labour or costs. This study introduced two types of dental personnel requirements to achieve the same amount of dental tasks. It was demonstrated that more dental nurses would be required to perform same dental productivity than do dentists. However, the costs of producing dental nurses

are lower than those of producing dentists. To distribute dental assignments between dentists and dental nurses needs consideration in detail from both economic and public health aspects. It is suggested by this study that both production number of and assignment delivery to both types of dental personals should be planned closely together. Possible waste of time and resources may occur if planning for the different dental personnel is performed separately.

5.4 Implication for policy

A balance between demand and supply is a key concern for manpower planning policy. After estimation of manpower need, the health planner is advised to balance the estimates with the capacity of manpower production (Joint FDI/WHO, 1989; Dreesch et al, 2005). Assessing health need through the sociodental approach provides more realistic and reasonable manpower estimations (Sheiham and Tsakos, 2007). It is suggested by this study that health planners should consider some additioanl factors related to manpower in the process of manpower estimation. In brief, health planners should achieve these following points to yield more realistic estimates:

1. The sociodental approach should be incorporated into need assessment in future manpower estimation to make the estimates more reasonable and realistic.
2. National longitudinal studies on dental caries should be carried out in order to identify schoolchildren's incremental need.

3. Assignments of sealant application in schoolchildren should be revised from an economic point of view to answer whether or not it is sufficiently cost-effective.
4. The productivity of male and female dentists should be monitored periodically in order to assist health planners in making manpower estimates in the future.
5. The development of curricula for dental students and dental nurse students as well as dental assignments for dentists and dental nurses should be carried out with close coordination to improve efficiency of the oral health care system as a whole.

5.5 Limitations of the Study

5.5.1 Sample representativeness

In the epidemiologic study part of this study, 1,211 schoolchildren were selected as study subjects. Five provinces were selected randomly to be representative for each region across Thailand. Except Bangkok metropolitan, the provincial schools of the selected provinces were purposively selected. All schoolchildren aged 6 and 12 in the selected schools were assigned as subjects of the study. In Bangkok metropolitan, purposively selection of school sample was carried out. Schoolchildren studied in these schools were from various economic classes. However, all schools in this study located in urban area. In this study it was found that diseases prevalence of schoolchildren were lower than those reported in the latest national survey (Dental Public Health Division,

2008). It is possible that the unrepresentative of the subject selection process might be responsible for this difference.

5.5.2 Response rate of the questionnaire and self –reported in time spending for dental tasks

In the part of questionnaire survey finding time spend for dental task of dentists and dental nurses there were less than 50 percent response rate. This lower rate affected result of the study as it could be seen from wide standard deviations of the response. Another point that should be mention here is accuracy of the replies. As the replies were about practice of dental personnel, these replies were possible to deviate from actual time participants practice in their dental office. Also with the low response rate of the questionnaire, the interpretation of the questionnaire should be done with caution.

5.6 Summary

The need assessment using (1) sociodental approach incorporated with normative need and (2) incremental normative need in diseases of irreversible nature were introduced in this study. By incorporating sociodnetal approach into normative need number of manpower requirement was reduced by 50% compare to the estimates calculated by using normative need alone. Examples of manpower production using a skill mix concept were also demonstrated. It is suggested by this study to combine the scociodental approach and incremental normative need into future manpower predictions to produce more reliable and pragmatic estimates.