Chapter 3

Research Design, Scope and Methods

In this study, different materials and methods were used to derive basic information for the estimated model.

3.1 Epidemiology of Dental Disease in Schoolchildren

3.1.1 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 aged 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.

Sample size was calculated by the formula

$$N = deff * (z^2pq) / d^2$$

By using the same parameters as in the sample size estimation protocol of the 6th Thailand National Oral Health Survey, this study defined values of parameters as follows: Deff (design effects) = 1.5, Z (standard score of normal distribution at 95% confidence interval level) = 1.96, p (proportion of schoolchildren with dental caries) = 0.80 in the 6-year-old group, and 0.56 in the 12-year-old group, q

(proportion of caries free schoolchildren) = 0.20 in the 6-year-old group, and 0.44 in the 12-year-old group, d (relative error from the measurement) = 0.05.

The sample sizes needed in each region were proportional to the relative size of schoolchildren in those areas to the overall number of children in Thailand. Results of the calculation are shown in Table 11.

Table 11 Sample sizes needed for epidemiological study of dental disease in schoolchildren aged 6 and 12

Area	Number of samples need (n)	
	6-year-old group	12-year-old group
North	74	141
Northeast	104	106
Central	74	114
South	56	88
Metropolitan	53	117
Total	**361**	**566**

3.1.2 Oral Examination

The dental status and treatment needs of each subject were assessed by dentists following WHO guidelines on basic surveys and methods (WHO, 1997). Examinations were performed in selected schools under blue-white spectrum artificial light. Plain mouth mirrors, examination probe number 621, and tweezers were considered as basic instruments for the examination. Oral health status and treatment need of subjects were assessed as those suggested in the WHO guidelines. 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.

3.2 Need Assessment of Schoolchildren

3.2.1 Normative Needs

Treatment needs of subjects judged by dentists in the oral examination session described above were considered as the normative need of those subjects.

3.2.2 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.

3.2.3 Impact-related Needs (IRN)

Impacted–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) (Gherunpong et al. 2004). 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 (Gherunpong et al. 2004). 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 categorized 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 in the manpower calculation.

3.2.4 Propensity-Related Needs (PRN)

In this step, normative need and OHRQoL were integrated into behavioral propensity. It is well accepted that the health behaviour of patients strongly influences the effectiveness of dental treatment (Maizels et al., 1993). 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.

Orthodontic treatment need was excluded from this study as time use in this kind of treatment could vary greatly depending on the orthodontist who would design the treatment plan.

3.3 Assessment of time dentists use for treatment

3.3.1 Assessment of time required for Dental Treatment by dentists.

The time required 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, selected randomly from the Thai Dental Council dentist database. Two hundred and ninety six of them replied.

3.3.2 Assessment of time required for Dental Treatment by dental nurses

The time required for each type of dental treatment by dental nurses was evaluated using a self-reported questionnaire corresponding to the dentist questionnaire. Content validity and reliability of the questionnaire were assessed by the same manner as used for the dentists' questionnaire. The correlation coefficient

of the two questionnaire responses in the reliability test was 0.90 ($p<0.05$). The questionnaire was divided into several parts similar to the dentists' one. The questionnaire was sent to 750 dental nurses from the name list of dental nurses from the Thailand Dental Nurse Society, selected randomly.

3.3.3 Sample size estimation

Sample size estimation for the dentist and dental nurse questionnaires used Yamane's formula. Details are shown in Table 12.

Table 12 Sample size estimation for assessing dentist and dental nurse time spending on dental treatment

Yamane's formula $n = N/1+Ne^2$	Dentist	Dental nurse
N (Number of dentist / dental nurse	9,646	4,164
e (error from measurement)	0.1	0.1
n (Sample size)	196	191

3.4 Calculation of Manpower Need

3.4.1 Model of Calculation based on different approaches

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 sociodental approach that included IRN and PRN, and Model 3; a model based on annual incremental normative need incorporated with the sociodental approach.

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.

3.4.2 Scenarios of dental caries prevalence for Model 2

It has been shown in previous national oral health surveys that different regions of the country had different levels of dental caries (Dental Public Health Division, 2008). In this study, three scenarios were developed, based on the different caries prevalence in different regions of Thailand.

Scenarios

1. 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 northern, northeastern and southern regions was made based on a prediction of DMFT by the year 2030.
2. 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.
3. Scenario 3: This scenario assumed the highest DMFT prevalence situation of the three. The scenario assumed a moderate DMFT

prevalence in the metropolitan and central regions, and a high prevalence in the remaining three 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).

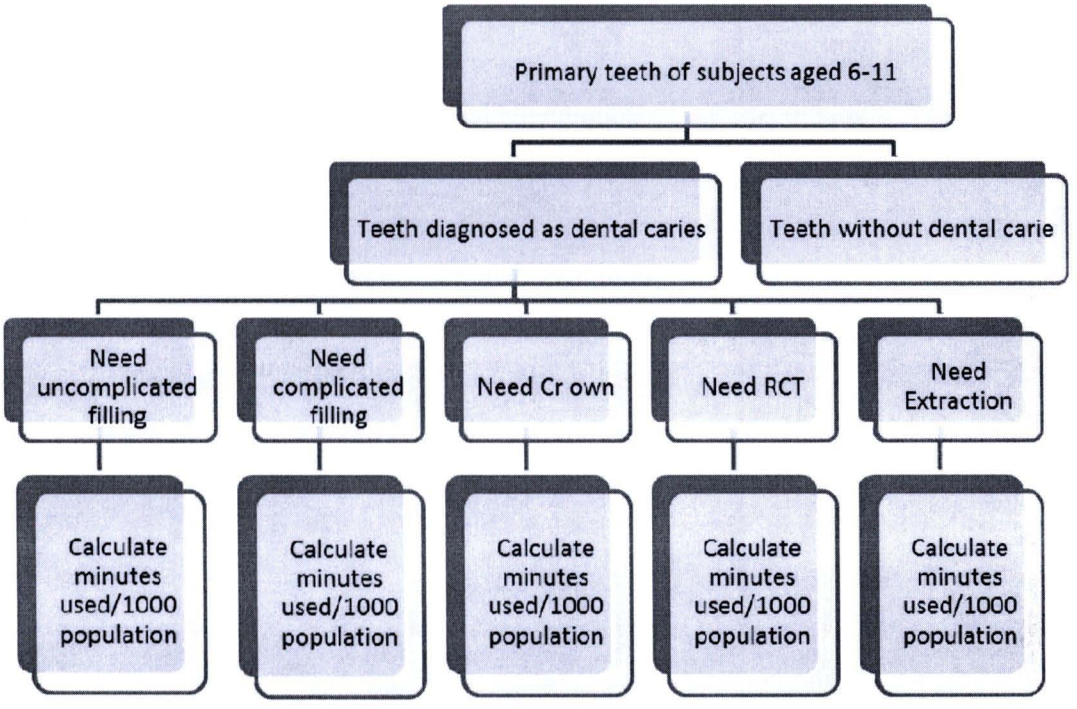
The three scenarios of Model 2 are presented in Table 13.

Table 13 Scenarios of mean dmft and DMFT for different regions for manpower calculation

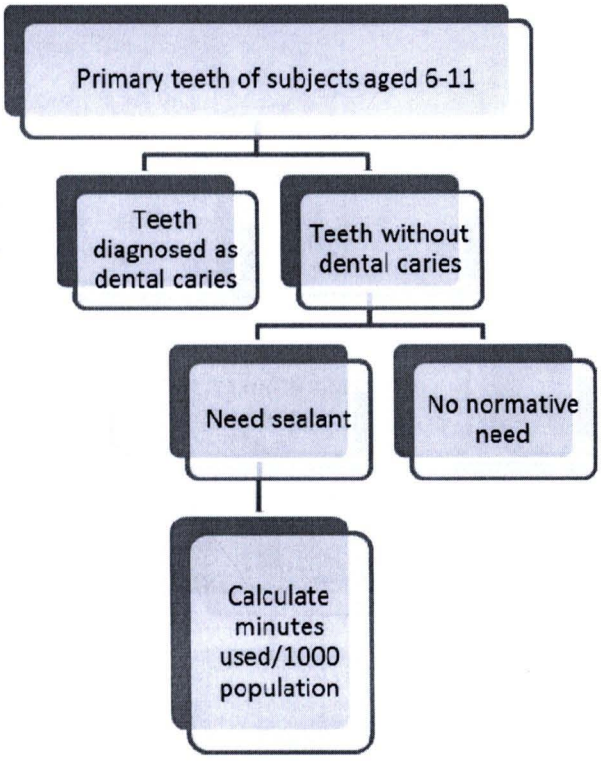
	Mean dmft in primary teeth (6-y-old group) /Mean DMFT in permanent teeth (12-y-old group)				
	Metro	**Central**	**North**	**NE**	**South**
Scenario 1 Low DMF trajectory	1/0.2	4/0.8	3/1.8	4/1.3	5/0.5
Scenario 2 Medium DMF trajectory	2/0.5	4 /1.4	4/2.1	5/2.2	7/1.0
Scenario 3 High DMF trajectory	3/0.8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

3.4.3 Algorithm for the calculation

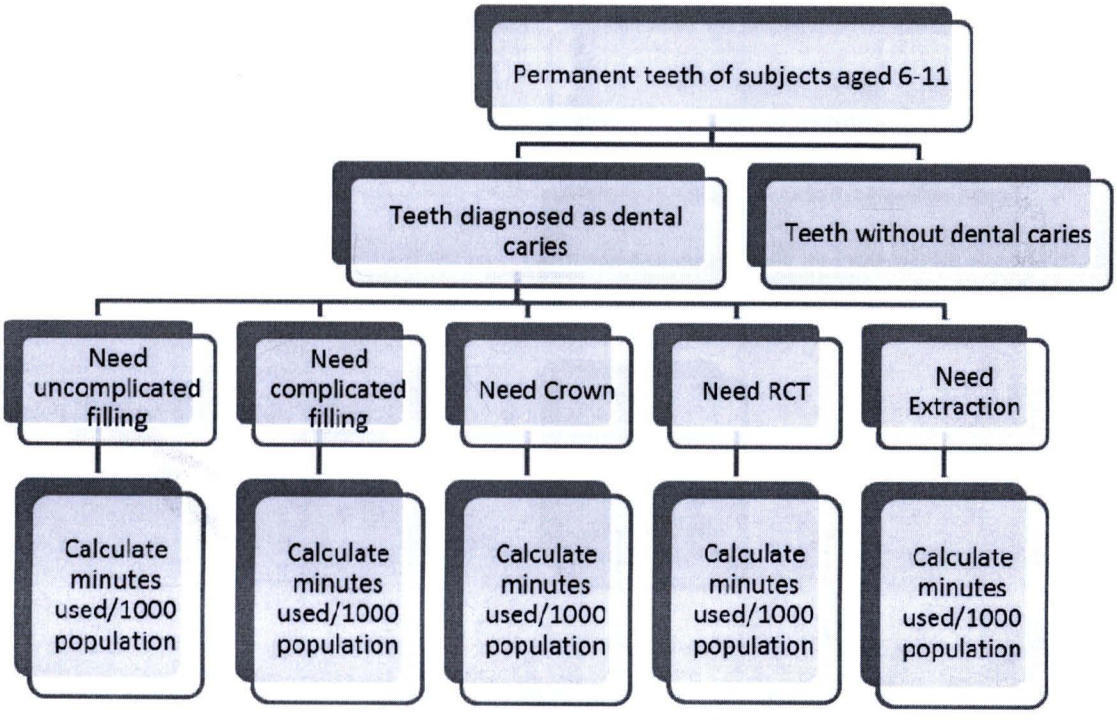
3.4.3.1 Primary teeth of subjects aged 6-11 years diagnosed with dental caries



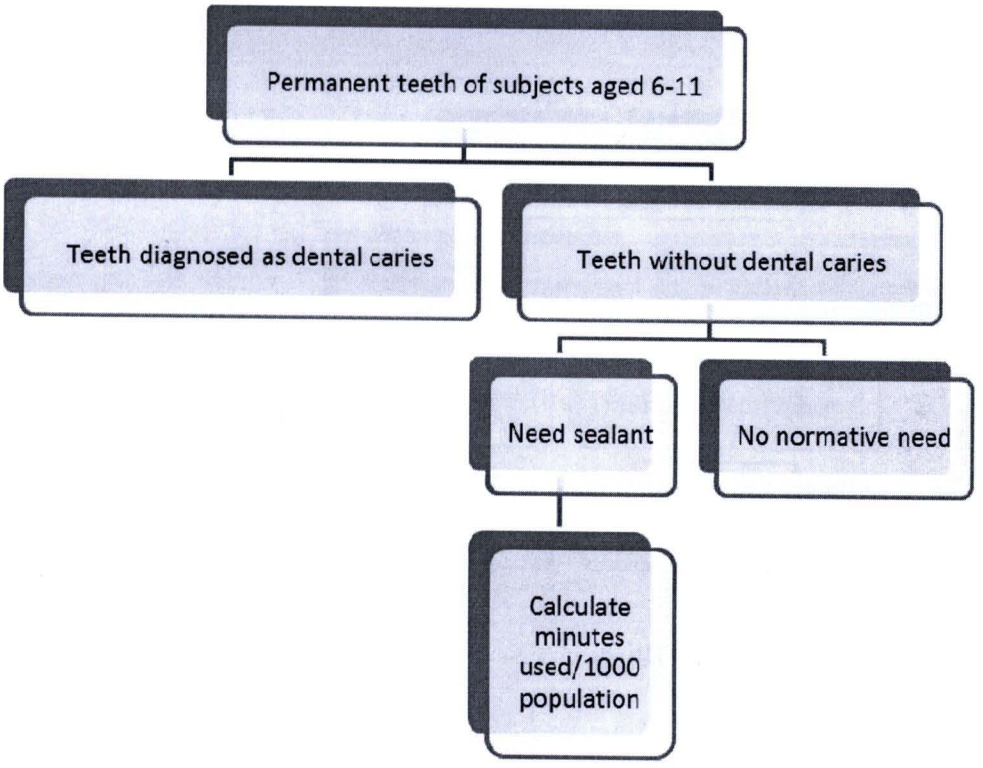
3.4.3.2 Primary teeth of subjects age 6-11 without dental caries.



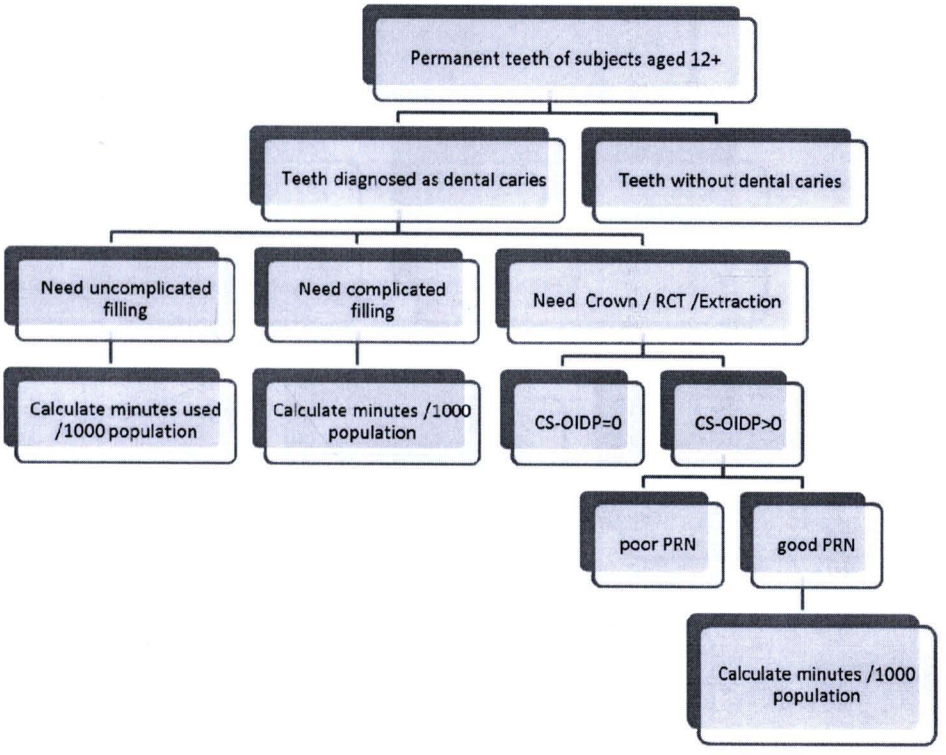
3.4.3.3 Permanent teeth of subjects aged 6-11 diagnosed with dental caries



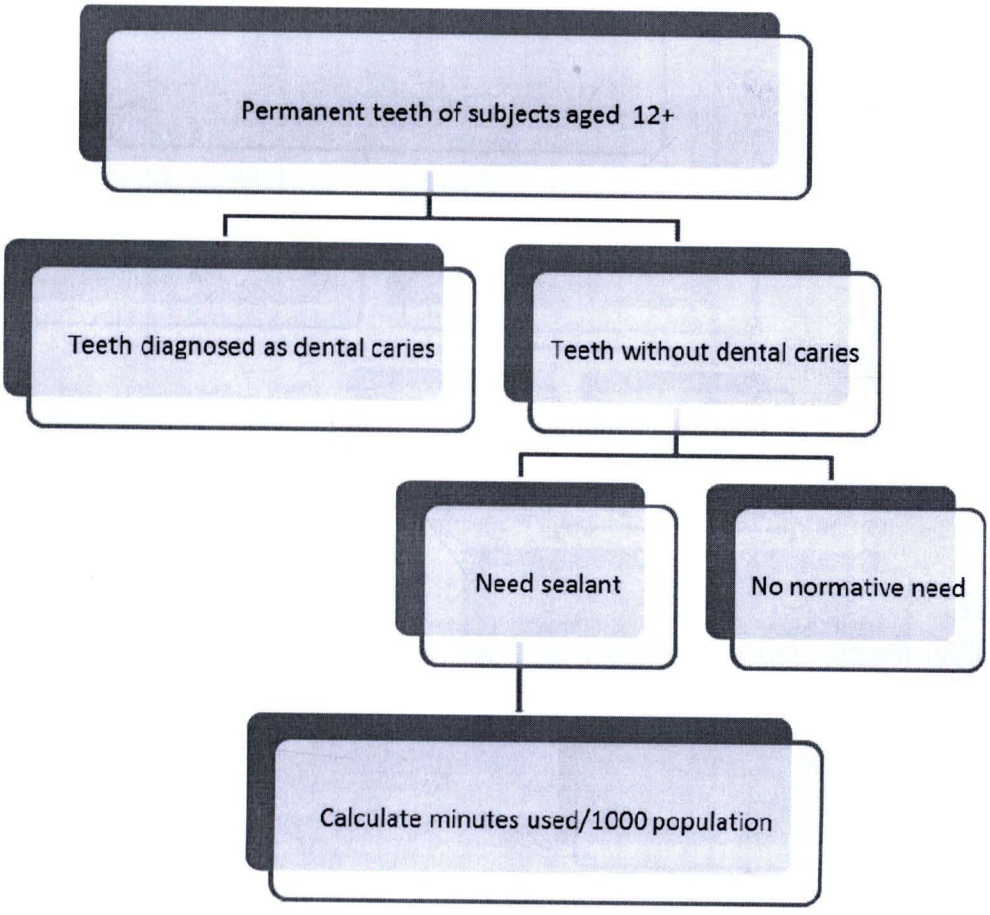
3.4.3.4 Permanent teeth of subjects aged 6-11 without dental caries



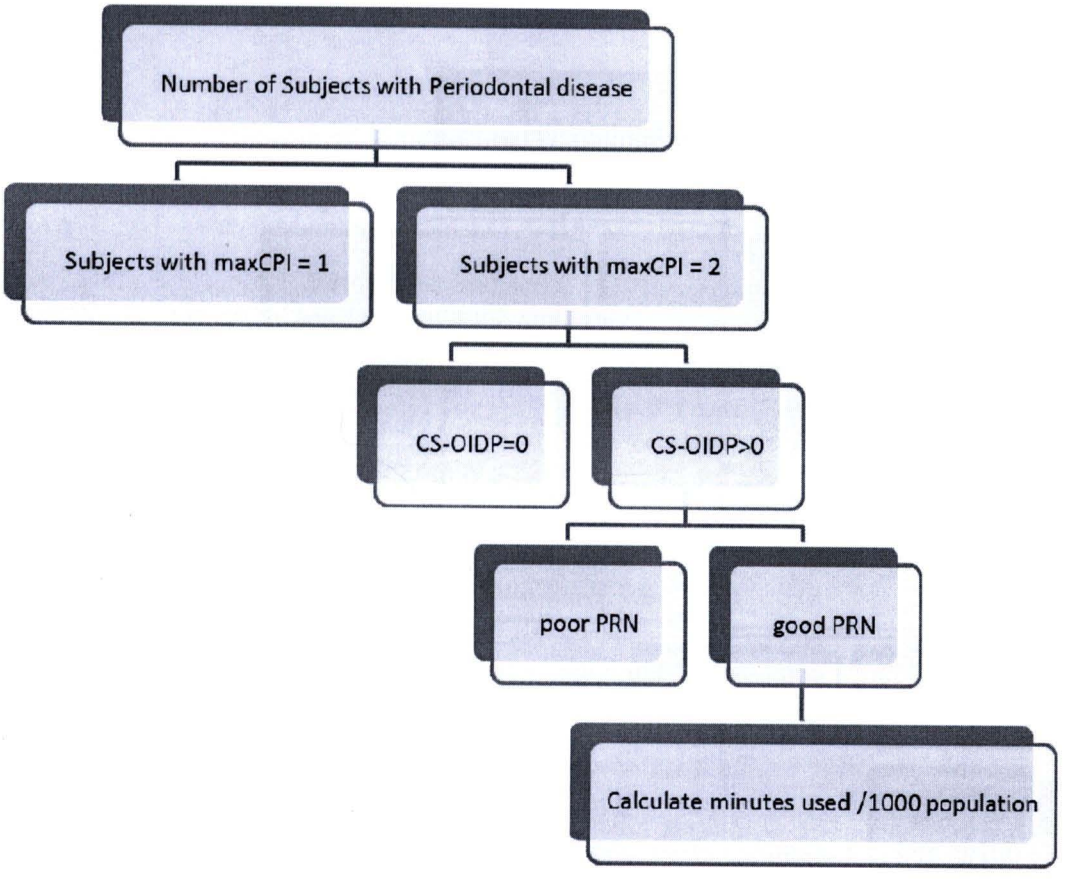
3.4.3.5 Permanent teeth of subjects aged 12 and over diagnosed with dental caries



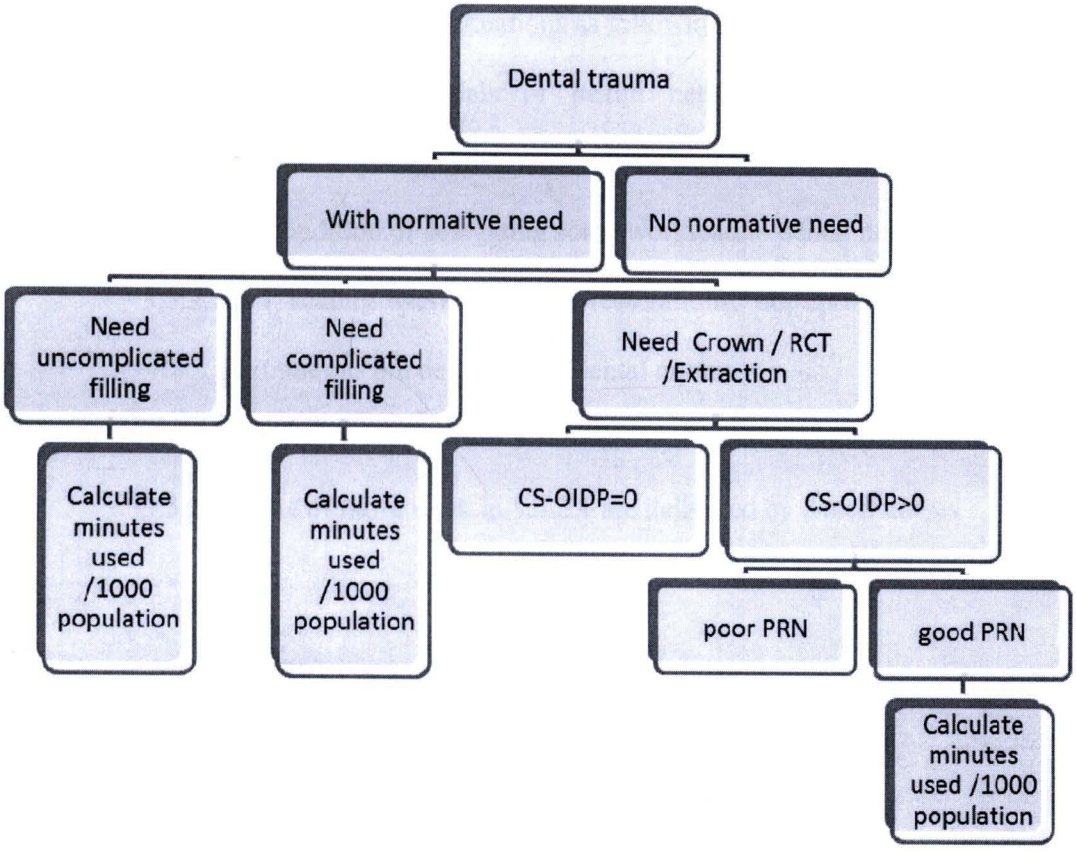
3.4.3.6 Permanent teeth of subjects aged 12 and over without dental caries



3.4.3.7 Periodontal disease in subjects aged 12 or over



3.4.3.8 Dental Trauma



3.5 Compare manpower need among different models and scenarios

Full Time Equivalent (FTE) dental manpower need per 1,000 population were compared need under different situations as following;

3.5.1 Under different models of health need approach and disease prevalence scenarios

3.5.2 Under condition of delegating some workload to dental nurses

3.5.2.1 All scaling work, Class I restorations, and primary dentition extractions are delivered by dental nurses

3.5.2.2 Half of those works in 3.5.2.1 are delivered by dental nurses

3.5.2.3 None of those work in 3.5.2.1 are delivered by dental nurses