# Chapter 2

# Methodology

In this chapter we describe methods used in the study. The methodology comprises information of study design, participants, inclusion criteria, questionnaire and data collection, variables of interest and conceptual framework, data management and statistical methods.

## 2.1 Study design

A cross sectional study on dental nurse' working practice was carried out by postal questionnaire survey in the three southernmost provinces of Thailand.

## 2.2 Participants

Subjects comprised 168 dental nurses in general hospital, community hospital, health center, primary care unit, municipality and provincial health office from 11 districts in Pattani, 7 districts in Yala and 12 districts in Narathiwat.

Table 2.1 shows the numbers of dental nurses for each working section. Most of them worked in community hospital followed by health center. Since 2012 Thai government has changed health center to be the Tambon health promoting hospital. Noted that no dental nurse worked in health center in Pattani. Pattani health office policy does not allow dental nurses work in health center because of no dental unit and equipments for them to work.

| Work place | Number of dental nurses | | |
|---|---|---|---|
| | Pattani | Yala | Narathiwat |
| General hospital | 6 | 3 | 7 |
| Community hospital | 33 | 16 | 30 |
| Health center | - | 40 | 15 |
| Primary care unit | 2 | 2 | 2 |
| Municipality health office | 1 | 2 | 1 |
| Provincial health office | 3 | 3 | 2 |
| Total | 45 | 66 | 57 |

*Table 2.1: The number of dental nurses for each province*



**2.3 Inclusion criteria**

All dental nurses who have worked in the three southernmost provinces at least six months were included in this study.

**2.4 Questionnaire and data collection**

*Questionnaire*

A Questionnaire constructed by the researcher was carried by three steps as follows:

**Step 1**: A questionnaire was used in order to get information about working practices. The questionnaire developed for this study was based upon dental nurse' role from Ministry of Public Health, Thailand and dental nurse curriculum. The questionnaire was divided into three parts as follows:

Part 1 is about demographic characteristics of the participants including gender, age, marital status, education background, place of graduation as dental nurse, year of

graduation as dental nurse, the ability to use Malayu language for communication, working experience, work position, work place, having dentist, number of dental nurse and having dental assistant.

Part 2 is about the current working practices including 21 items divided into two areas of dental nurses working practice such curative activities (12 items), and oral prevention activities (9 items). A five-point scale (Linkert Scale) will be employed in order to determine the variables ranging from 0 to 4, the following criteria are 4= I do this work very frequently, 3= I do this work frequently, 2= I do this work occasionally, 1= I rarely do this work, 0= I never done this work.

Part 3 is open ended question consisting of working problems and their suggestions.

**Step 2:** The questionnaire had been checked for accuracy by three experts from Prince of Songkla University and Sirindhorn College of Public Health.

**Step 3:** The questionnaire was tried out with 25 dental nurses who work in Satun and Songkla province. Internal consistency reliability estimates for the curative activities and preventive activities were measured by Cronbach's alpha coefficient. Alphas of 0.86 (curative activities) and 0.82 (preventive activities) were obtained for the two activities, indicating a relatively high level of internal consistency for both activities.

*Data Collection*

The questionnaire was send to the provincial health office for distribution to dental nurses in its province in May 2012. The researcher has given them one month for returning the data. Follow-up telephone were planned when the response rate below 80 %.

The data was entered into computer by using an EpiData programme. R programme was used for statistical analysis (R development core team, 2010).

**2.5 Variables of interest and conceptual framework**

*Variables*

Variables of interest comprised 13 determinants and 21 outcomes. The descriptions of determinant variables are as follow:

| Variables | Definition |
|---|---|
| Gender | Male and female |
| Age | Age in year |
| Marital status | Single, marriage and divorce |
| Education background | Certificate, bachelor and Master's degree |
| Place of graduation | Place of graduation as dental nurse: Sirindhorn College of Public Health in Yala, Trang, Chonburi,Supanburi, Pidsanulok, Khonkaen and Ubonradchathani province |
| Year of graduation | Year of graduation as dental nurse |
| Malayu language | The ability to use Malayu language for communication Yes or no |
| Working experience | Experience in year |
| Work position | Dental nurse practitioner**,** dental nurse professional and non government |
| Work place | General hospital, community hospital, health center, primary care unit (PCU), municipality and provincial health office |
| Having dentist | Yes or no |
| Number of dental nurses | Number of dental nurses |

| | |
|---|---|
| Having dental assistant | Yes or no |

*Table 2.2: Description of determinants*

*Outcome variables*

The outcome variables are the levels of workin *Outcome variables*

The outcome variables are the levels of working practice  practice comprise twenty one items. They are Q1 (oral examination), Q2 (preventive resin restoration), Q3 (simple filling), Q4 (complex filling), Q5 (polishing amalgams), Q6 (taking radiograph), Q7 (simple extraction), Q8 (complex extraction), Q9 (suture), Q10 (tooth drainage), Q11 (supra gingival scaling), Q12 (sub gingival scaling), Q13 (pit and fissure sealant), Q14 (fluoride application), Q15 (oral healthcare in dental room), Q16 (oral health program for antenatal), Q17 (oral healthcare for preschool children), Q18 (school dental service), Q19 (oral healthcare at home), Q20 (preparation dental work plan) and Q21 (conduct the oral health care plan base on the community's problem)

The questionnaire is shown in the appendix. Figure 2.1 shows a conceptual framework for the variable of interest.

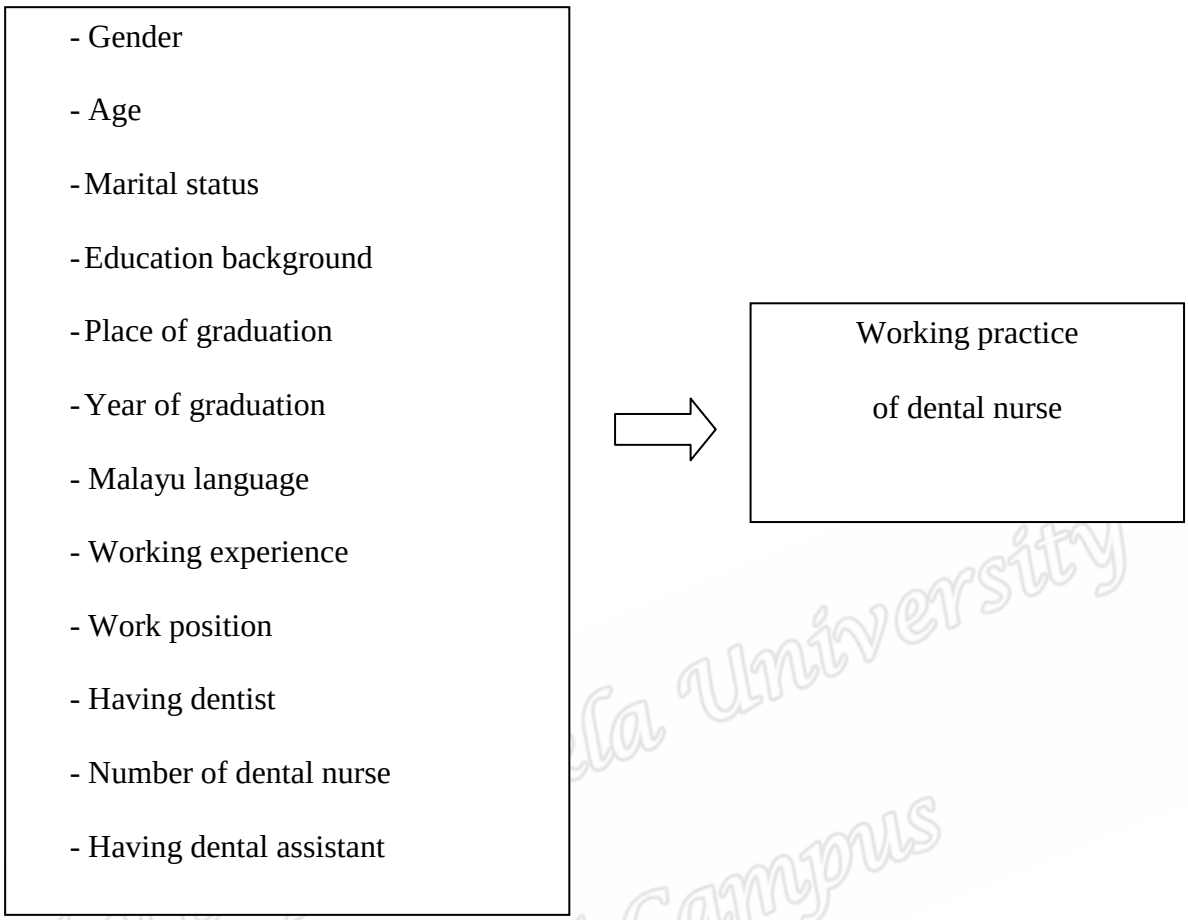


*Figure 2.1: Conceptual framework showing variable in the study.*



**2.6 Statistical methods**

*Descriptive statistics*

Characteristics of participants were described using frequency and percentage for categorical variables, mean and standard deviation for continuous variables.

The distributions of working practices were summarized by frequency and percentage.

*Cronbach's alpha*

Cronbach's alpha is a measure of internal consistency, which developed by Lee Cronbach in 1951. Internal consistency expressed as a number between 0 and 1, which describes how closely related a set of items are as a group. There are different reports about the acceptable values of alpha, ranging from 0.70 to 0.95 (Tavakol and Dennick, 2011). The formula for the standardized Chronbach's alpha ($\alpha$) is

$$\alpha = \frac{N.\bar{c}}{\bar{v}+(N-1).\bar{c}} \qquad (2.1)$$

where *N* is equal to the number of items, $\bar{c}$ is the average inter-item covariance among the items and $\bar{v}$ equals to the average variance.

*Pearson's Correlation*

Since we have several outcomes, factor analysis is used to reduce the dimensionality of these outcomes. Before the factor analysis was performed, Pearson's correlation test was used to calculate item subscale, item total correlation coefficients for assessing internal consistency. The correlation coefficient for a sample of bivariate pairs (*x*, *y*) is defined as (McNeil *et al*, 2006)

$$r = \frac{\sum(x_i-\bar{x})(y_i-\hat{y})^2}{\sqrt{\sum(x_i-\bar{x})^2}\sum(y_i-\bar{y})^2} \qquad (2.2)$$

where *r* is correlation coefficient, *x* is a value in first set of data, *y* is a value in second set of data and *n* is a total number of values. It may be shown that *r* ranges from a minimum of -1 to maximum level of 1. A correlation coefficient equal to 0 indicates no linear relationship between the two variables. The magnitude of the correlation

coefficient determines the strength of the correlation. Although there are no rules for describe correlation strength. In this study we used these guidelines:

$0 < r < 0.3$ means weak correlation, $0.3 < r < 0.5$ means moderate correlation and $r > 0.5$ means strong correlation .

*Factor analysis*

Factor analysis is a multivariate method used for data reduction purposes. It is designed for interval data. The factor analysis model can be written as follows. If we have $p$ variables $X_1, X_2, \ldots, X_p$ measured on a sample of $n$ subjects, then variable $i$ can be written as a linear combination of $m$ factor $F_1, F_2, \ldots, F_m$ where, as explained above $m<p$. Thus,

$$X_i = a_{i1}F_1 + a_{i2}F_2 + \ldots\ldots\ldots\ldots\ldots + a_{im}F_m + e_i \qquad (2.3)$$

Where the $a_i$s are the factor loadings or score for variable $i$ and $e_i$ is the part of variable $X_i$ that cannot be explained by the factors.

There are three main steps in a factor analysis including calculate initial factor loadings, factor rotation and calculation of factor score (Cornish, 2007)

In this study we investigate the matrix of correlation coefficient between 21 variables. We used factor analysis to reduce the number of outcome variables. There are 140 observations corresponding to the 21 questionnaire items in these data. Each factor must contain at least two working practices to contribute to the factor analysis. Working practices which has large correlation with each other and small correlation with working practice in other groups. Working practices that are not correlated with any other working practices are said to have high uniqueness and are conventionally omitted from the factor analysis. The factors comprised weighted linear combinations

of the working practice and may be rotated to maximize the weight within each group and minimize the weight outside each group. The resulting weights are called "loadings". "Promax" rotation was used in preference to "varimax" which requires the rotations to be orthogonal (Browne, 2001).

Promax rotation is one of many types of rotation and is regarded as the standard approach. This approach places more emphasis on the simplification of the factors. It tends to avoid a general factor.

*The two sample t- test*

The two sample *t*-test was used to compare the mean of the determinant is of the binary type and the outcome variable is continuous. The null hypothesis that two population means are equal may be expressed as

$$H_0: \mu_1 = \mu_2$$

if samples of size $n_1$ and $n_2$ are taken from the two populations, giving sample means $\bar{y}_1$ and $\bar{y}_2$. The two sample *t* statistic takes the form

$$t = \frac{\bar{y}_1 - \bar{y}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \qquad (2.4)$$

in this formula, *s* is equal to the pooled sample standard deviation. If $s_1$ and $s_2$ denote the standard deviations of the two samples, respectively. The pooled sample standard deviation is given by the formula

$$s = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

A *p*-value is obtained from the table of the two tailed *t* distribution with $n_1 + n_2 - 2$ degree of freedom (McNeil *et al*, 2006).

*One Way Analysis of Variance (ANOVA)*

In this thesis we are considering methods for the analysis of data in which the outcome is continuous and the determinant more than two categories. The null hypothesis is that the population means of the outcome variable corresponding to the different categories of the determinant are the same, and this hypothesis is tested by computing a statistical called the *F*-statistic and comparing it with an appropriate distribution to get a *p*-value. Suppose that there $n_j$ observations in sample *j*, denoted by $y_{ij}$ for *i*= 1, 2, ……$n_j$. The *F*-statistic is defined as (McNeil, 1996)

$$F = \frac{(s_0 - s_1)/(c-1)}{s_1/(n-c)} \qquad (2.5)$$

where $s_0 = \sum_{j=1}^{c} \sum_{i=1}^{n_j} (y_{ij} - \bar{y})^2$, $s_1 = \sum_{j=1}^{c} \sum_{i=1}^{n_j} (y_{ij} - \bar{y}_j)^2$

and $\bar{y}_j = \frac{1}{n} \sum_{i=1}^{n_j} y_{ij}$, $\bar{y} = \frac{1}{n} \sum_{j=1}^{c} \sum_{i=1}^{n_j} y_{ij}$, $n = \sum_{j=1}^{c} n_j$

while $S_0$ is equal to sum of squares between group, $S_1$ is sum of squares within group or error, *c* is the number of groups. If the population means are the same or the null hypothesis is true, *F* value closes to 1 most of the time. A large *F* value means that there has different outcome among group or the effect of the treatment is relevant.

*Multiple linear regression*

Multiple linear regression was used to model the association between the outcomes and the determinants. Regression is used to analyze data in which the outcome is

continuous variable. When there is a single determinant, it can summarize the data in the scatter plot by fitting a straight line. In conventional statistical analysis, the line fitted is the least squares line, which minimizes the distances of the points to the line, measured in the vertical direction. If there is more than one determinant, the method generalizes to multiple linear regression, in which the regression line extends to the multiple linear relation represent as

$$Y = \beta_0 + +\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k \qquad (2.6)$$

where $Y$ is the outcome variable, in this study $Y$ is working practice of dental nurses $\beta_0$ is a constant, $\beta_1, \beta_2, \ldots, \beta_k$ is a set of parameter and $x_1, x_2, \ldots, x_k$ is a set of *k* determinants, there are 13 determinants in this study.

There are three assumptions that have to be checked when using multiple linear regression analysis. First, the association between outcome and determinant variable is linear. Second, the variability of the error (in the outcome variable) is uniform and these errors are normally distributed. If these assumptions are not met, a transformation of the data may be appropriate. Linear regression analysis may also use when one or more of the determinants are categorical variables. In this case the categorical determinant is broken down into *c*-1 seperate binary determinants, where *c* is the number of categories. The omitted category is taken as the baseline or referent category (McNeil, 1996).

A regression analysis may have two different goals: to predict the dependent variable using a set of independent variables and to quantify the relationship of one or more independent variables to a dependent variable. The first of these goals focuses on finding a model that fits the observed data and predicts future data as well as possible,

whereas the second pertain to producing accurate estimates of one or more regression coefficients in the model. The second goal is of the particular interest when the research question concerns disease etiology, such as trying to identify one or more determinants of a disease or other health related outcome.