Chapter 1

Introduction

First we describe the overview of this thesis. Secondly we introduce the background of road traffic accident mortality. After that we describe objectives of this study and review of the literature.

1.1 Overview

This study examined patterns of road traffic accident mortality and also carried out the statistical modeling to estimate mortality rates in southern Thailand. The outcome variable for this study is death rates (or mortality rates) which are calculated as number of deaths divided by the corresponding population. The datasets that were used were based on death certificates from mortality databases for southern Thailand from 1996 – 2006. Another dataset is the number of population for southern Thailand.

Chapter 2 describes the methodology used. It details the study design, source of the data, data management, and the statistical and graphical methods used.

Chapter 3 shows the results from the preliminary data analyses. In this chapter, number of road traffic accident death in southern Thailand is presented graphically, classified by determinants as well as mortality rates.

Chapter 4 covers the further analysis and statistical modeling performed.

Chapter 5 discusses the results reported in previous chapters; limitations and ideas for future study are included.

1.2 Background

Road traffic accidents are a major problem for public health globally. The World Health Organization reported that about 1.2 million people are killed from road traffic accidents every year and it was estimated that approximately 3000 people die by road traffic accidents around the world on any given day. A projection of global leading causes the death from 2004 to 2030 by World Health Organization revealed that, if current trends continue, road traffic accidents will rise from the ninth to fifth of world leading cause of death with 3.6 % of global deaths, up from 2.2 % in 2004 (World Health Organization, 2008). While disability-adjusted life years (DALYs) will rise from ninth with 2.7 % of total DALYs in 2004 to third and 4.9 % of total DALYs in 2030 (World Health Organization, 2004b).

Road traffic accidents caused mortality and disability that lead to public health and social problems such as economic loss, particularly for males of working age. It impacts the family income and national economy directly and indirectly. The cost of medical care, funeral and loss of income due to mortality or disability can push a family into poverty (Nantulya and Reich, 2003).

Road traffic accidents are a major cause of death for middle and lower-income countries which bear disproportional shape of deaths, with 85 % of world total road crash mortality and 90% of the annual DALYs lost due to road traffic injury (World Health Organization, 2004a). Factors that contribute to this problem are increasing of motor vehicle numbers, poor enforcement of traffic safety, and poor public heath infrastructure and services (Nantulya and Reich, 2002).

Much of it is preventable and predictable. It is important to understand the nature of road traffic accidents to help policy-makers implement optimal interventions and make the general public's awareness of consequences of road traffic accidents. This lead to increased effectiveness of road safety interventions and was the way that high-income countries reduced road traffic accidents. This is supported by "The world report on road traffic injury prevention" a document published by World Health Organization (World Health Organization, 2004a) which contains the guidelines for developing counties to issue road safety interventions.

In Thailand, there were 23.9 million recorded motor vehicles in 2006 (Ministry of Transport, 2008) and approximately 66,300 deaths from road traffic accidents from 2002 to 2006 and an average of 13,000 deaths per year (Mahaisavariya, 2008). This has become one of the top ten leading causes of death in Thailand (Ministry of Public Health, 2007). Deaths from road traffic accidents per 100,000 population were 21.4, 20.8, 21.5, 20.4, 19.8, 17.8 and 16.7 in 2000 to 2006, respectively (Ministry of Public Health, 2007). The high income countries in Europe and western Pacific had an average mortality rate of 11.0 and 12.0 per 100,000 population in 2002 (World Health Organization, 2004a).

A study reported that the economic loss due to road traffic accidents for Thailand in 2004 was approximately 204 billion Baht or 3.9 - 4.7 million Baht per a death (Ministry of Transport, 2007). Moreover trauma care systems in Thailand are still poor. In road crash scenes, there is no trained emergency service person for pre-hospital care. Most patients have to access the hospitals by themselves without

pre-hospital care which often cause of them to die before reaching hospital (Bavonratanavech, 2003).

Although the Thai government made an effort to reduce road traffic accidents by issued road safety interventions and law enforcements such as traffic safety education program, sporadic road safety campaign in specific long-holiday periods (i.e., Songkran festival, end of year and new year celebration), campaign against drinking and driving, blood alcohol concentration law, road safety laws (helmet and seat belt laws), etc. However, there were many barriers that lead all road safety measures and law enforcements in Thailand beyond from its goals such as lacking of policy implementation, gap of appropriate in law enforcements and unable of monitoring and evaluation the effectiveness of road safety measures (Suriyawongpaisal and Kanchanasut, 2003).

One of the most steps in prevention and control of traffic accident death is having the information about demographic characters of its victims and risk areas. Thus to demonstrate the methodology for estimating the mortality rates from road traffic accidents, we used statistical modeling to performed this research.

1.3 Objectives

The specific objectives of this study are as follow.

1.3.1 To identify patterns road traffic accident mortality in southern Thailand over the period of 1996-2006.

1.3.2 To develop statistical model for estimating road traffic accident mortality rates in southern Thailand.

1.4 Expected advantages

1.4.1 Description of pattern of road traffic accident mortality in southern Thailand is performed.

1.4.2 Statistical model for estimating road traffic accident mortality rates in southern Thailand is obtained.

1.4.3 The results of this study will be useful for road safety planning in southern Thailand.

1.5 Literature reviews

1.5.1 Statistical methods for modeling mortality rates

Many studies have used various statistical methods for modeling demographical, geographical and time effects for mortality in general, road traffic accidents mortality. The multiple regression and Poisson regression are commonly used for modeling the mortality rates and number of deaths in a specific population. However Pocock *et al.* (1981) pointed out that unweighted multiple regression is not appropriate for modeling mortality rates in different areas which vary in population size. In addition fully weighted regression is usually too extreme. Thus they introduced an intermediate solution via maximum likelihood for modeling death rates.

Tsauo *et al.* (1996) examined the effect of age, period of death and birth cohort in motor vehicle mortality in Taiwan from 1974 – 1992, used data from vital statistic. Log-linear regression was used for fitting the model to perform the effects of variables. Kardara and Kondakis (1997) identified trends of road traffic accident

deaths and injuries rates in Greece from 1981-1991 by using linear regression with logarithmic transformation.

LaScala *et al.* (2000) examined correlations between demographic and environmental versus pedestrian injury rates by using a spatial autocorrelation corrected regression model with applying the logarithmic transformation for the injuries rates. Evans (2003) conducted statistical modeling for estimating road traffics and railways accident fatal rates based on past accident data in Great Britain during 1967-2000.

In addition Lix *et al.* (2004) used Poisson regression to investigate the relation of demographic, geographical, and temporal explanatory variables with mortality in difference regions of Manitoba, Canada between 1985 and 1999, used data from Vital Statistics records and the provincial health registry. Yang *et al.* (2005) used Poisson regression modeling to examine and compare age- and sex-specific mortality rates due to injuries in the Guangxi Province in South Western China in 2002, based on death certificates data. However this study focused only on small areas. Congdon (2006) described a method for modeling mortality over area, age and time dimensions that takes account of spatial correlation, interactions between dimension, and cohort as well as age effects by applying Poisson regression.

Although Poisson regression is commonly use for modeling mortality due to road traffic accident death, but it cannot be used for modeling when many of observed are zeros due to having small sample size. Lee *et al.* (2002) suggested that when many of observed are zeros, the zero-inflated Poisson and the negative binomial are more appropriate than standard Poisson model. In addition, a study of Lord (2006) exposed that low sample mean combined with a small sample size of crash database can affect

the goodness of fit of the negative binomial model. The probability the dispersion parameter becomes unreliably estimated increases significantly as the sample mean and sample size decrease.

1.5.2 Road traffic accident mortality

There were several studies of the mortality from road traffic accidents. A review of Nantulya and Reich (2003) reported that the poor countries bear a disproportionate burden of mortality due to road traffic accident. The distribution of road traffic accidents is related by socioeconomic factors. Mortality rates for age group 0-14 in low- and middle-income regions were six times the rates for high-income regions. Hazen and Ehiri (2006) reported that most of "vulnerable road users" in developing counties that accounted for road traffic accidents, including pedestrians, bicyclists and motorcyclists. A review of Odero *et al.* (1997) showed that, road traffic deaths in developing countries were predominance of males over females. Males were over-represented in every "road user", especially amongst drivers.

Montazeri (2004) examined road traffic accident mortality in Iran, using mortality data on road traffic accidents between March 1999 and 2000. The study revealed that, most of deaths were males, aged 40 years or less, pedestrians or car occupants. Road traffic accident death of 57% occurred pre-hospital. In addition, Zadeh *et al.* (2002) surveyed characteristic of road traffic accident death's victims in one year from March 20th, 2000 to March 24th, 2001 in Iran. The results showed that, most of deaths were aged between 21 and 31 years old, male to female ratio was 4.1 to 1. Twenty seven percent of cases were died at the crashing scene and 72.7% in hospital.

Wong *et al.* (2002) identified factors that contribute to road traffic accident mortality in Singapore. The study exposed that, 82.3% of the victims were males. Relative risk of mortality between motorcyclists and motorcar drivers was 18.8:1. Ghaffar *et al.* (2004) described the frequency and distribution of injuries and mortality due to road traffic accident by age, sex, residence and profession in Pakistan, using a retrospective injury survey. The results showed that, road traffic injuries and mortality was found to be higher in males, those 16–45 years old, having residence in urban, and those in the professional category of laborers and vendors.

Zhou *et al.* (2008) identified characteristics of road traffic mortality in China from 2003 to 2005. The study revealed that, most of road traffic accident deaths were driver, especially those with driving experience less than 3 years. Traffic accident deaths occurred on suburban roads accounted for 60%. Menon *et al.* (2008) conducted a retrospective analysis of victims of road traffic accidents who died due to injuries sustained to the head in Mangalore, India over a period of 5 years between January 1999 and December 2003. Data were collected from police, relatives, hospital and post mortem records. The study showed that, most of victims were males (84.6%), age group between 21 and 30 years and two wheeler occupants.