

A Study of Risk Factors Leading to Road Accidents: Chachoengsao Province, Thailand

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Abstract

The objectives of this research were to study: 1) personal factors of automobile drivers in Chachoengsao Province, Thailand in the target population; 2) their driving behavior; 3) risk factors influencing the chance of having an accident; 4) measures used to avoid or reduce the impact of an accident; and 5) their attitudes towards both controllable and uncontrollable driving risks based upon their personal factors. The sample consisted of 400 drivers; statistics used included both descriptive and inferential statistics.

The majority of respondents were female, married, 36-40 years of age, bachelor degree graduates, and worked for private enterprises. They had non-permanent driver licenses in their possession for 3-5 years and had 10-20 years driving experience. Their overall attitudes towards controllable risk factors showed high scores on a given rating scale. Among controllable risk factors influencing the chance of having an accident, in descending order of magnitude, were violation of a traffic light, violation of a speed limit, texting while driving, and no signal given to other drivers. Uncontrollable risk factors influencing the chance of having an accident, in descending order of magnitude, were drunk driving, driving on damaged roads, driving when the rate of traffic is high, and driving on narrow roads.

Keywords: *Risk factors, road accidents*

Introduction

Sivak and Schoettle (2014) studied mortality from road crashes in 193 countries, and found that Thailand ranked #2 in the world in terms of the number of people killed (44 deaths per 100,000 persons) in road accidents after Namibia (45 deaths per 100,000 persons). Road accidents caused premature deaths, injuries, and other social and economic problems after the incidents. According to a study conducted by the ThaiRoads Foundation and Thailand Accident Research Center, Asian Institute of Technology (2013), the average number of deaths from road accidents from 2012-2013 was 22,052 annually. That translated into an average of 60 deaths per day. The number of persons injured in accidents was several times as many. Translated into economic terms, the human and workforce losses, as well as medical expenses paid to cure the injured, yields a formidable cost to society.

Toyota, the largest car manufacturer in the world and in Thailand, is concerned about the number of road accidents in Thailand. It aims to seek for guidelines that will help reduce road accidents, and has initiated a pilot study in Chachoengsao Province, east of Bangkok. The outcome of this pilot study will be used to develop a framework for a study that covers a larger area of the country.

Research Objectives

1. To study personal factors of automobile drivers in Chachoengsao Province who were part of the target population being studied.
2. To study the driving behavior of this group.
3. To study risk factors leading to road accidents.
4. To study measures used to avoid or reduce the severity of accidents.
5. To study attitudes toward both controllable and uncontrollable risk factors based upon personal factors.

Literature Review

Accident Causation Theory

The study is based on Heinrich's Domino Theory (Heinrich, 1931). According to him, 88 percent of all accidents are caused by unsafe acts of people, 10 percent by unsafe mechanical or physical conditions, and 2 percent by "acts of God" which are unpreventable. He proposed a "five-factor accident sequence" in which each factor would actuate the next step, in the manner of toppling dominoes lined up in a row. The sequence of accident factors is as follows:

1. Ancestry and social environment
2. Human error
3. Unsafe acts, together with mechanical and physical hazards
4. Accidents
5. Damage or injury

In the same way that the removal of a single domino in the row would interrupt the sequence of toppling, Heinrich suggested that removal of one of the factors would prevent accidents and resultant injuries, with the key domino to be removed from the sequence being number 3 (unsafe acts). However, unsafe acts are purely controllable factors, and many accidents may arise from uncontrollable factors. Multiple causation theory (Peterson, 1978), which is an outgrowth of Domino Theory, states that a single accident may arise from many contributory factors, causes, and sub-causes. According to this theory, contributory factors can be grouped into the following two categories:

1. Behavioral: includes factors pertaining to the driver, such as improper attitudes, lack of knowledge, lack of skills, and inadequate physical and mental condition.
2. Environmental: includes improper guarding of other hazardous road elements, and degradation of vehicles through use and unsafe procedures.

Other Related Articles

An early study carried out by Knipling and Wang (1994) in the United States related to driver drowsiness/fatigue. The research attempted to summarize national statistics on the incidence and characteristics of crashes involving driver fatigue, drowsiness, or "asleep-at-the-wheel" situations during the five-year period from 1989 to 1993. During this period, an average of 40,000 non-fatal injuries annually were associated with police-reported driver drowsiness crashes, while drowsiness or fatigue were cited as a factor in an annual average of 1,357 passenger vehicle fatalities, and combination-crashes resulting in 1,544 fatalities. The statistics also indicated that drowsy driver crashes peaked in the early a.m. hours, with a second smaller peak in the afternoon. Fifty-five (55) percent occurred between midnight and 7:59 am, and another 18 percent occurred between 13:00 and 16:59 pm. Furthermore, male drivers had a drowsiness crash-involvement rate that was 1.8 times greater than that of females. The study also showed that the drowsiness crash-involvement rate for drivers under 30 was more than four times higher than that for drivers 30 or over. This statistical profile of U.S. police-cited drowsiness-related crashes is remarkably similar to the same category of crashes occurring in New South Wales, Australia (Fell, 1994).

Thanadulburin (2011) conducted a study on awareness of accident occurrence on the part of youngsters' parents and drivers in Chiang Mai Province, Thailand and identified two factors most influential to the rate of road accidents – carelessness and casualness. From the driver's point of view, controllable factors were responsible for road accidents. From the parents' point of view, uncontrollable factors were responsible for road accidents. A related study was carried out in China by Wang, Rau, and Salvendy (2011). The research indicated that drivers who were likely to engage in driving risks were also likely to take risks in the domains of ethics, gambling, investment, recreation, and abuse of/or ignoring health.

Tongtua (2012) studied the process of instilling road safety culture in Thailand among Ubolrajthani University students and in surrounding communities. The study concluded that the two

major factors which could reduce the rate of road accidents were the behavior of drivers within the community themselves, and environmental factors such as road conditions that needed to be urgently reviewed. A further study in Thailand carried out by Karnjanaphen, Luethep, and Thaneerananont (2013), showed that major causes of road accidents, in descending order of magnitude, were driver errors (speeding, drowsy driving), bad road conditions (wet and slippery roads), poor visibility and unsafe vehicle. Some similar factors were found to apply to Russian drivers by Kudryavtsev (2012), who identified three major causes of road accidents: lack of safe driving skills, environmental conditions and bad traffic engineering, and lack of law reinforcement.

The National Institutes of Health (2013) in Maryland, U.S.A., conducted a nationwide study of the risks that drivers faced. The research results revealed that inexperience was the most influential factor that caused crashes and deaths. Other risk factors included distractions while driving (using cell phones and texting), driving at excessive speeds, close following (“tailgating”), drinking and driving, and driving at night. The research also indicated that the estimated cost of injuries and fatalities from car crashes was \$300 billion in 2009. Every year, more than 5.5 million car crashes are reported to police in the United States, with more than 30,000 fatalities and 2 million injuries.

The Center for Statistics and Analysis (2016) reported that 9 percent of all drivers involved in fatal crashes were 15 to 20 years old. The rate of young male drivers involved in fatal crashes was about 2.3 times that of young female drivers. Twenty-six percent of young drivers 15 to 20 years old who were killed in crashes had blood alcohol concentrations (BACs) of 0.01 gram/decilitre or higher; 81 percent of those young drivers had BACs of 0.08 gram/deciliter or higher. The data also showed that for those young drivers who survived the fatal crash, 84 percent were restrained, compared to 90 percent of all drivers who survived. A study by the same agency in 2015 on road accidents indicated that a male driver’s risk of having a road accident was twice that faced by a female driver. This was due to the fact that men drove longer distances than women (an average man drives 24,000 kilometers annually, while an average woman drives 16,000 kilometers) and the tendency that men might drive while drunk.

Finally, Stephens and Ohtsuka (2014) conducted a study on the cognitive biases shown by aggressive drivers, and tried to answer the question: does an illusion of control drive us off the road? The research findings revealed that road rage and illusion of control beliefs (feelings of control over the situation) accounted for 37 percent of the variance in hostile driving behavior scores.

Thus, the literature review attempted to identify both controllable and uncontrollable factors affecting the rate of road accidents. Furthermore, practical measures designed to reduce the severity of accidents are urgently needed so that all people concerned can adopt and implement them.

Scope of the Study

Content

Focuses on studying daily driving behavior and attitudes toward controllable and uncontrollable factors that may lead to a high probability of having accidents.

Place

Plaengyao District, Chachoengsao Province.

Period

August 2015 to January 2016

Population

All automobile drivers living in Plaengyao District, Chachoengsao Province.

Sampling Method

Sampling was conducted using a multistage sampling method, whereby the areas were selected first using purposive sampling. There were four areas selected, namely, Hua Samrong

Municipality; the area supervised by Hua Samrong District Administrative Organization; Nong Tapao Village; and Gateway City Industrial Estate. Convenience sampling was then conducted using 80 persons as a quota for each area.

Statistics Used in the Analysis

This study uses both descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential statistics (t-test, F-test).

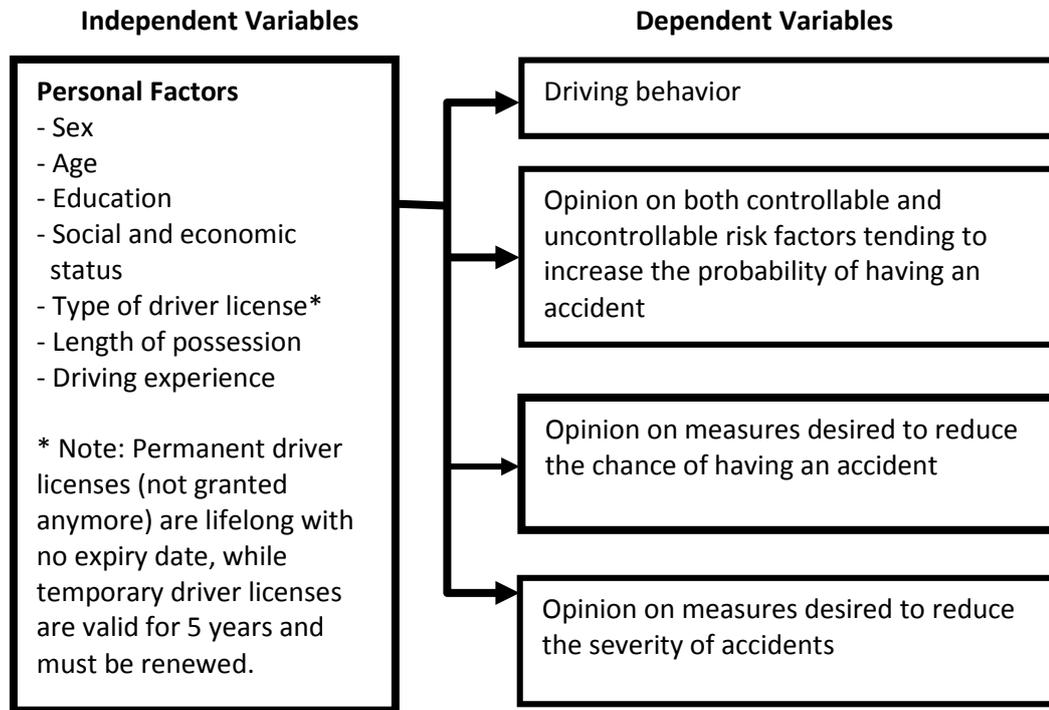


Figure 1. Research Framework

Research Findings

The findings revealed that the majority of respondents were female (52.5 percent), married (55.9 percent), 36-40 years of age (19.4 percent), bachelor degree graduates (25.6 percent), working for private companies (46.9 percent), having temporary driver license (56.6 percent), possessing licenses for between 3-5 years (31.9 percent), and having 10-20 years of driving experience (29.4 percent).

Controllable risk factors affecting the chance of accidents, according to them, are failing to obey traffic signals, violating speed limits, texting while driving, speaking on the phone while driving, and not signaling other drivers.

Table 1 indicates that driving without obeying traffic signals, driving at speeds higher than those allowed by law, driving while having chatting online, driving while talking on the phone, and driving without signaling other drivers are among the controllable risk factors that are highly influence the chance of having a road accident.

Table 1. Attitudes toward Controllable Risk Factors that May Lead to Accidents

Controllable Risk Factors	\bar{x}	S.D	Interpretation
Driving at speeds higher than those allowed by law	3.75	1.38	Highly Influential
Driving without obeying traffic signals	3.76	1.52	Highly Influential
Driving when visibility is poor (e.g. at night/during heavy downpours)	3.41	1.30	Moderately Influential
Driving while talking on the phone	3.51	1.43	Highly Influential
Driving while chatting online	3.58	1.52	Highly Influential
Driving while watching portable television	3.27	1.46	Moderately Influential
Driving without signaling other drivers	3.51	1.41	Highly Influential
Driving on unfamiliar roads	3.32	1.30	Moderately Influential
Driving when weary or suffering from fatigue	3.33	1.44	Moderately Influential
Values and interpretation of \bar{x} : 1.00-1.50 (least influential)		3.51-4.50 (highly influential)	
1.51-2.50 (somewhat influential)		4.51-5.00 (most highly influential)	
2.51-3.50 (moderately influential)			

When these risk factors were weighted, with a weight of two assigned to the risk factor most likely to cause an accident and a weight of one assigned to the second most likely risk factor, we derived the weighted scores shown in Table 2.

Table 2. Weighted Scores of Controllable Risk Factors Tending to Cause Accidents

Controllable Risk Factors That Cause Accidents	Assigned as Rank No. 1	Assigned as Rank No. 2	Weighted Scores
Driving while doing something at the same time	62	55	179
Driving when visibility is poor	37	35	109
Driving without obeying traffic rules	141	51	333
Driving at speeds higher than those allowed by law	44	123	211
Driving on unfamiliar roads	21	31	73
Driving when weary or suffering from fatigue	15	25	55

Table 2 indicates that the top-three controllable risk factors tending to cause accidents, in descending order of magnitude, are driving without obeying traffic rules, driving that exceeds the speed limit, and driving while doing something at the same time.

Table 3 indicates that uncontrollable risk factors that highly influence and increase the chance of having a road accident are driving under the influence of alcohol, driving on damaged roads, driving when traffic is heavy, and driving on narrow roads.

Table 3. Attitudes toward Uncontrollable Risk Factors that May Lead to Accidents

Uncontrollable Risk Factors	\bar{x}	S.D	Interpretation
Driving under the influence of alcohol	4.08	1.26	Highly Influential
Damaged roads	3.73	1.06	Highly Influential
Narrow roads	3.53	1.11	Highly Influential
Heavy traffic	3.65	1.16	Highly Influential
Carelessness due to moral hazards	3.31	1.44	Moderately Influential
Values and interpretation of \bar{x} : 1.00-1.50 (least influential)		3.51-4.50 (highly influential)	
1.51-2.50 (somewhat influential)		4.51-5.00 (most highly influential)	
2.51-3.50 (moderately influential)			

Table 4 indicates that a large number of respondents still exposed themselves to the risk of being seriously injured, or, if they are unfortunate enough, losing their lives or those of their loved ones.

Table 4. Measures Taken to Alleviate the Impact of Accidents

Measures Taken	Always Practiced	Sometimes Practiced	Rarely Practiced
Wearing seat belts	55.6	42.2	2.2
Stop driving during heavy downpours or poor visibility	45.3	52.2	2.5
Sleeping or resting when feeling drowsy	45.3	52.2	2.5
During long holiday periods, travel and return early	48.4	41.6	10.0
Stop driving when feeling weary	66.2	23.8	10.0

Attitudes toward Measures Deemed Most Effective in Reducing Accidents

When measures deemed likely to reduce the number of accidents were weighted, the figures shown in Table 5 were generated. The measure viewed as most effective was given a weight of two, and the second most effective measure was given a weight of one.

Table 5. Weighted Scores of Most Effective Measures to Reduce the Number of Accidents

Measures	Assigned Rank of No. 1	Assigned Rank of No. 2	Weighted Scores
More police, more radar devices to measure speed	60	47	167
More levels of penalties (higher traffic fines, temporary suspension of driver’s license, permanent cancellation of driver’s license)	89	98	276
Unwavering strictness by the traffic police	140	97	377
Warning words with given in a sterner tone	31	78	140

Table 5 indicates that the three most effective measures used to reduce the number of accidents, in descending order of magnitude, are how strictly the traffic police enforce the law, more levels of penalties, and more traffic police, including more speed measuring devices.

Most Effective Measures to be Taken to Reduce Accidents during Festivals or Long-holiday Periods

Table 6 shows that, according to the respondents, the two most effective measures to reduce the number of road accidents during festivals or long-holiday periods are prevention of drunk driving and strict enforcement of speed limits.

Table 6. Attitudes on Measures to Reduce Road Accidents during Festivals or Long-Holiday Periods

Measure(s) Considered Most Effective	percentage
Enforcing speed limits	25.0
Preventing drunk people from driving	35.9
Adding more rest areas	17.8
Restricting access to alcoholic drinks	15.3
Others	6.0

Measures to be Implemented by the Government as Top Priorities to Reduce Road Accidents

Table 7 indicates that respondents’ believe that two of the most important measures that might be taken by the government to cope with the problem of a high rate of road accidents are to reduce the problem of drinking and driving, and to impose high penalties on any violation of traffic laws.

Table 7. Measures to be Taken by Government as to Cope with the High Rate of Road Accidents

Measure(s) Recommended	Percentage
The problem of drinking and driving	45.3
Speedy driving	17.5
Violation of traffic laws	32.8
Others	4.4

Attitudes toward both Controllable and Uncontrollable Factors Based upon Personal Characteristics

Table 8 shows the respondent attitudes toward controllable risk factors based upon their personal characteristics.

Table 8. Attitudes toward Controllable Risk Factors Based upon Personal Characteristics

Factors	Sex ¹	Age ²	Education ²	Occupation ²	Income ²
Driving at speeds higher than allowed by law	0.069	0.004*	0.000*	0.000*	0.005*
Driving without obeying traffic signals	0.027*	0.023*	0.000*	0.000*	0.004*
Driving when visibility is poor	0.002*	0.001*	0.000*	0.000*	0.000*
Driving while talking on the phone	0.041*	0.000*	0.000*	0.000*	0.000*
Driving while chatting online	0.010*	0.000*	0.000*	0.000*	0.000*
Driving while watching portable television	0.000*	0.018*	0.000*	0.000*	0.000*
Driving without signaling other drivers	0.061	0.005*	0.005*	0.000*	0.030*
Driving in unfamiliar roads	0.000*	0.003*	0.000*	0.000*	0.004*
Driving when weary or fatigued	0.000*	0.001*	0.000*	0.000*	0.000*

Notes. 1 = t-test conducted; 2 = F-test conducted

Respondents of different genders differ in their attitudes towards most controllable risk factors. Respondents of different ages, education levels, occupations, and income levels differ in their attitudes regarding all controllable factors. It is of interest to note that the majority of controllable factors investigated were related to personal factors at the 0.05 level of significance. Post-hoc analysis may be used to identify certain type of persons who have attitudes that are liable to cause accidents.

Table 9. Attitudes toward Uncontrollable Factors Based upon Personal Characteristics

Factors	Sex ¹	Age ²	Education ²	Occupation ²	Income ²
Driving under the influence of alcohol	0.470	0.003*	0.022*	0.033*	0.120
Damaged roads	0.442	0.011*	0.003*	0.000*	0.417
Narrow roads	0.016*	0.001*	0.000*	0.000*	0.125
Heavy traffic	0.056	0.004*	0.000*	0.000*	0.096
Carelessness due to moral hazards	0.188	0.006*	0.009*	0.000*	0.000*

Notes. 1 = t-test conducted; 2 = F-test conducted

Table 9 shows respondents of different ages, educational levels, and occupations differ in their attitudes toward all uncontrollable risk factors, while respondents of different genders and income levels differ in one of the uncontrollable risk factors.

Discussion

The findings of this research study pinpoint both controllable and uncontrollable risk factors that can cause road accidents. Thus, it supports as well as complements the studies conducted by Knipling and Wang. (1994), Thanadulburin (2011), and Karnjanaphen et al. (2013). These authors may not use the word controllable and uncontrollable risks, but the factors identified fall within both categories.

It should be noted that it is too easy for one to blame uncontrollable risk factors as the culprits that tend to cause road accidents and ignore what may be done to reduce these factors. Some supposedly “uncontrollable” factors can be controlled and coped with; for example, one who handles

the wheel should never drink even if the chance of getting drunk is slim. Driving with utmost care on damaged roads, narrow roads, or roads with heavy traffic will undoubtedly lower or eliminate the chance of having road accidents. If your car is fully insured, it won't be worth it to drive carelessly, because when an accident occurs, every driver faces the loss of time, inconvenience while his/her car is in the repair shop, and the chance that the driver or family members may be injured, perhaps seriously.

Suggestions and Recommendations

The findings of this study have revealed that a large number of respondents do not take good care of themselves - they do not wear seat belts, they keep on driving even when they are drowsy or when their bodies are not in proper condition, and they drive even in situations where their visibility is poor. Measures to be taken must therefore be both psychological and instrumental. Psychologists may be able to help in devising measure that can change peoples' behavior. As an example, police, pedestrian representatives, and psychologists may work together to design road warning signs using stronger words that can effectively deter speeding drivers from their illicit behavior, while at the same time not agitating social critics.

A study by World Health Organization (2015) reported that Thailand's roads were the second-deadliest in the world (a rate surpassed only by Libya). Thus, all individuals and parties concerned, both public and private, have to admit that road accidents are a big problem for Thailand that is not going to disappear any time soon. It is now time for Thai authorities and those groups responsible for the betterment of the Thai people to ponder and ask themselves what variable(s) have been left out of the equation. Addressing these variables is necessary if there is to be a dramatic reduction in the rate of road accidents in Thailand.

Suggestions for Further Study

It should be noted that road accidents caused by motor vehicles are only part of the story. Motorbikes or motorcycles also play a large part in the number of road accidents in Thailand. Therefore, another study that aims to tackle the problem of accidents caused by motorcycle riders is also urgently needed.

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