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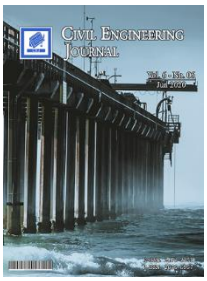

Willingness-To-Pay for Estimation the Risk Pedestrian Group Accident Cost

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Abstract

The proven willingness-to-pay with contingent valuation (WTP-CV) method is an effective tool for evaluating the cost of road accidents in many countries. In Thailand, the most fatalities on Thailand's roads involve the vulnerable road users (VRUs) including motorcycle users, bicyclists, and pedestrians. With the effectiveness of using WTP-CV in analyzing the accident cost of motorcycle users and lack of specific accident cost for pedestrians, this research focuses on evaluating the accident cost on the pedestrians which is the second most VRU fatality. In this research, the road accident cost of pedestrians aged 15-39 years in Bangkok by WTP-CV method was determined. The WTP-CV questionnaire was employed as a tool to measure the payment of which each pedestrian is willing to pay to reduce the fatality and injury risk from road accidents. One thousand and two hundred pedestrians in Bangkok were interviewed. With the results, the value of statistical life (VOSL) for pedestrians in Bangkok is valued at US$ 0.43 million, while the value of statistical injury (VOSI) is estimated at about US$ 0.014 million, respectively. In addition, it is found from the regression analysis that for the fatality risk reduction, higher educational levels and private business pedestrians are likely to pay more to save their lives. In order to reduce the risk of injury, respondents, who are single in marriage status, are likely to pay more to reduce the risk of pedestrian injury. However, a high perception of safety is less likely to pay for the reduction of injury risk.

Keywords: Pedestrian; Willingness-to-Pay; Accident Cost; Value of Statistical Life; Value of Statistical Injury.

1. Introduction

Nowadays, there are a lot of traffic problems in Bangkok resulting in many negative impacts, such as traffic congestion, pollution and environmental problems and an increase in the number of road accidents. Each year, more than 1.25 million people die from road accidents. According to the World Health Organization's World Accident Report stated that Thailand has the 9th highest fatality rate in the world in 2018 which is 1st in Asia. It is estimated that during the year of 2011-2013, the average annual accident cost is 17,883.1 million US dollar (US$1 = 30.5 Thai baht.) (or 6% of the Gross Domestic Product (GDP)) both in terms of life and property. In order to solve this problem, it is of importance for government and stakeholders to acknowledge the actual accident cost as the accident cost is a vital factor in road safety campaign. This enables management planning to reduce road accidents to maximize benefits. Every road accident not only causes fatality, injury and property damage but also causes pain, grief, suffering and quality of life.

As a result of traffic problems, people change the mode of transportation to use more public transport. They also use more bicycles and walk rather than using personal vehicles. These alternatives can benefit in terms of effects on

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the environment, health, economics, and society. However, it is found that most fatalities on Thailand's roads involve the Vulnerable Road Users (VRUs) including motorcycle users, bicyclists, and pedestrians approximately 86.95% of all fatalities. Of those 86.95%, 93.35% of which are motorcycle users, 5.79% are pedestrians, and the remaining 0.87% is bicyclists [1].

To understand the problems of road accidents and the effects of the overall economic problems, it is necessary to analyze the value of losses due to accidents. For many developing countries, including Thailand, the value of losses due to accidents is often analyzed by the Human Capital (HC) method. This method is easy to evaluate the accident cost; however, it has some disadvantages in assessing the value of losses eventually resulting in underestimated valuation. This is because the HC method does not take the loss of opportunity, pain, grief, suffering and quality of life of those involved in the crash into account [2, 3]. Another method that is mostly used in developed countries, and nowadays prevalently used in developing countries is the Willingness to Pay (WTP) method. This method is used to assess the value of a person who is willing to pay for the risk reduction. WTP's accident values in the last 20 years have been evaluated in conjunction with contingent valuation (CV) [4]. However, many researchers stated that this method has some limitations for developing country [5]. Despite the aforementioned challenges, several studies still consider the WTP method as a useful tool to estimate the amount of money and provide the foundation for assessing the road accidents' economic loss of fatality [6].

Recently, many studies on traffic accident analysis or risk cost used the WTP method to evaluate costs but consider different target groups such as car drivers, motorcyclists, and pedestrians. Questionnaires were designed in different scenarios depending on the target road users [7-11].

In Thailand, most Thai studies analyze the value of loss by using the HC method including Patamasiriwat (1994) [12] Tosutho (1997) [13], Boontam (2001) [14], Suwanrada (2005) [15], and Luathep and Tanaboriboon (2005) [16]. However, two studies including Chaturabong (2011) [17], and Thailand Development Research Institute (2013) [18] adopted WTP method in analyzing the value of loss. Chaturabong (2011) estimates the economic costs of motorcycle accidents in Bangkok and surrounding area, and evaluates the factors affecting the willingness to pay of motorcyclists to reduce the risk of fatality and injury. This research indicates that VOSL ranges from $0.18 million to $0.23 million (US$1 = 30.5 Thai baht), while the Value of statistical injury (VOSI) ranges from $0.08 to $0.11 million. Thailand Development Research Institute (2013) estimates the costs of road accidents in Thailand and the data employed from a WTP survey was conducted in Saraburi. This research indicates that VOSL and VOSI are approximately $0.33 million and $0.1 million respectively.

As the most accidents and injuries in Thailand occur within the age of 15-39 years old [19], acknowledging that the accident cost of these ages is of concern and majority to establish the direction for road safety. Also, there is lack of data of specific accident cost for pedestrians. Therefore, the objective of this research was to determine the road accident cost of pedestrians in this target group in Bangkok by WTP-CV method.

2. Materials and Methods

The WTP-CV system with the payment card has been prepared for this analysis. The participants were chosen in two age groups: group 1 is those with the age of 15-24 years old and group 2 is those with the age of 25-39 years old. These target groups were selected as they are among the most risk vulnerable road user group in Thailand. The face-to-face method was adopted in questionnaire surveys as most of respondents were unfamiliar with the WTP concept. Therefore, interpreting the WTP concept and each value definition to the respondent before completing the questionnaire was of importance for face-to-face interviews in order to choose a suitable WTP value [20]. WTP questions were explained in two levels of injury (i.e. fatality and injury) using pedestrian safety facilities for reducing the risk of injuries. The data collection was analyzed by descriptive statistics and linear regression analysis. As for the VOSL/VOSI was evaluated using mean WTP values, and the change of pedestrian risks for each question. Figure 1 shows the flow chart of the research study.

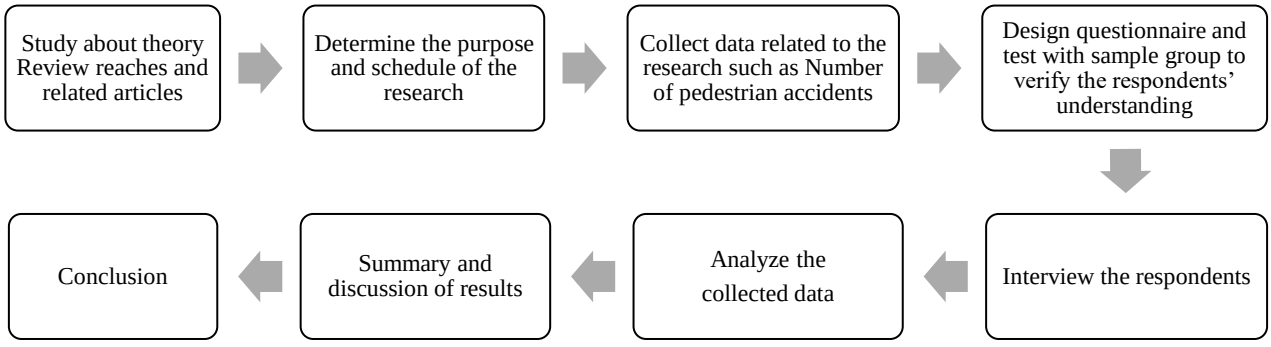

Figure 1. Flowchart of the research study

In questionnaire, there were three parts of questions for respondents to complete including socioeconomics, pedestrian perceptions and WTP questions. Before starting questionnaire, the respondent was addressed the significance and purpose of this research and the WTP definition of road safety so that they felt comfortable in putting the real and suitable WTP values. The pedestrian accident risks in Bangkok were determined from the data reported by Royal Thai Police in 2018. A 50% risk reduction was set for injury for road safety improvement, while a 100% risk reduction was set for fatalities. The VOSL was evaluated from the WTP and change in risk in each injury level. Finally, the factor affecting the WTP was evaluated using linear regressions.

The second part included questions regarding the perception of risk exposure to road accidents as a pedestrian, trip intention, average daily walking distance, how often the own/family members cross the road without crossing facilities and experiences of pedestrian accidents. As shown in the questionnaire, the interviewees have to explain the definition of risk exposure concept to the respondents through a 100,000 square grid, in which each square represented a single individual. From the grid, some squares were marked to indicate injuries or fatalities due to road accidents. In some research for developed and developing countries, the use of a square grid was extended, as it was easy to understand. This method has been proven to be an effective tool for representing risk exposure [21].

The third part included contingent valuation questions, which were shown in two levels of injury. The contingent valuation questions were designed to determine the WTP values of all two levels of injury with varying amounts of pedestrian risk reduction due to road accidents [22]. Based on the number of pedestrian fatalities and injuries caused by road accidents in Bangkok in 2018 the scale of the risk reduction for each injury was estimated. During the interview, the payment card approach was adopted to restrict the thinking for reacting to the WTP values for each respondents' injury. The problem of contingent valuation based on the actual situation for pedestrians outlined in Table 1. For all of the questions in Table 1, respondents had to assess the state of crossing and walking on roads with and without pedestrian facilities and address how much they were willing to pay to reduce the risk of pedestrian accidents. To be easily imaginative, the respondents were presented with figures showing before and after upgrading the facilities at the roads. A payment card was also reached for respondents to select the correct money for each question, as shown in Table 2. In addition to the amount of money not chosen by the respondents on a payment card, respondents were opened to respond to their willing amount.

Table 1. Valuation questions on two levels of pedestrian injury.

Pedestrian injury level	Alternative 1	Alternative 2
Fatality questions: Amount of money in Thai Baht (THB) that the respondent spends for reducing the risk by using the pedestrian crossing or overpass daily	Using the road without crossing facilities • Probability of fatality 4/100,000 per year	1. Using the road with pedestrian crossing • Probability of fatality 2/100,000 per year 2. Using the road with overpass • Probability of fatality 0/100,000 per year
Injury question: Amount of money in Thai Baht (THB) that the respondent spends for reducing the risk by using the footpath with or without the illuminations daily	Walking on the footpath without illumination • Probability of fatality 45/100,000 per year	Walking on the footpath with sufficient light • Probability of fatality 22/100,000 per year

For all questions, the respondents were asked to imagine doing their daily activities by crossing and walking along roads during their traveling. Each question included particular pedestrian facility that was able to reduce injury/fatality risks from road accident. In question 1, question, asking respondents if he/she would like to cross a 6-lane road, which way he/she preferred, contained a road without facility, with a pedestrian crossing and with an overpass. Then, the respondent was subsequently asked if he/she was willing to pay a specified amount to reduce the pedestrian fatality risks, for which the probability of fatality was 4 fatalities per 100,000 people a year, or crossing a road with a pedestrian crossing, for which the probability of fatality was reduced by half (2 fatalities per 100,000 people per year), or crossing a road with an overpass, for which the probability of a fatality was none. Note that all of respondents were reached the payment card in responding their WTP values. In question 2, the interviewer was asked regarding the accident that could cause injury risk if he/she was walking on a footpath at night. The question was assumed that he/she was walking along a footpath at night at which could cause injury (i.e. stumble and fall or hit an object on a footpath), which one he/she was willing to pay to reduce injury between walking on a footpath with or without light. Again, the respondent was asked if he/she was willing to pay a specified amount to reduce the pedestrian injury risks, for which the probability of an injury is 45 fatalities per 100,000 people per year, or walking along a footpath with sufficient illumination, for which the probability of fatality was reduced by half (22 fatalities per 100,000 people per year).

Table 2. Payment Card Format

Thai Baht/year					
0	20	40	60	80	100
150	200	250	300	350	400
450	500	550	600	650	700
750	800	850	900	1,000	1,500
2,000	2,500	3,000	3,500	4,000	4,500
Amount _____ Baht/year					

Note: US$1 = 30.5 Thai baht.

The questionnaires were Thai version and a pilot test with 15 respondents for pedestrian of 2 clusters (i.e. 15-24 years old, and 25-39 years old) was conducted to verify the respondents' understanding on the questionnaire. After verification, the questionnaires were amended subject to comments from respondents. Questionnaires were collected covering eight sections of which have a high road accident occurrence in Bangkok. This research targeted respondents who were primarily beneficiaries of road safety schemes, who had been exposed to traffic [23], and identified respondents for two most risk groups by means of the stratified random sampling process. The respondents who were over 15 years old were selected for interview as they were mature enough to understand the information in the questionnaire. The number of samples was determined based on the calculation of sample sizes with the certain number of populations from the equation of Yamane (1974) study [24]. Based on Yamane (1973) calculation, the minimum number of samples was 300 samples; therefore, 1,200 samples were adequate for this research.

2.1. Methodology for Determining VOSL of Pedestrian

After obtaining the cost from each respondent, the average was employed to determine VOSL and VOSI. The VOSL/VOSI is a currency which expresses all the tangible and intangible values of a lost or a saved life [25]. VOSL is defined as a willingness to pay for a risk change which is differentiated by a risk change. The probability of pedestrian injury/fatality risk can be addressed according to the incident tree in Figure 2.

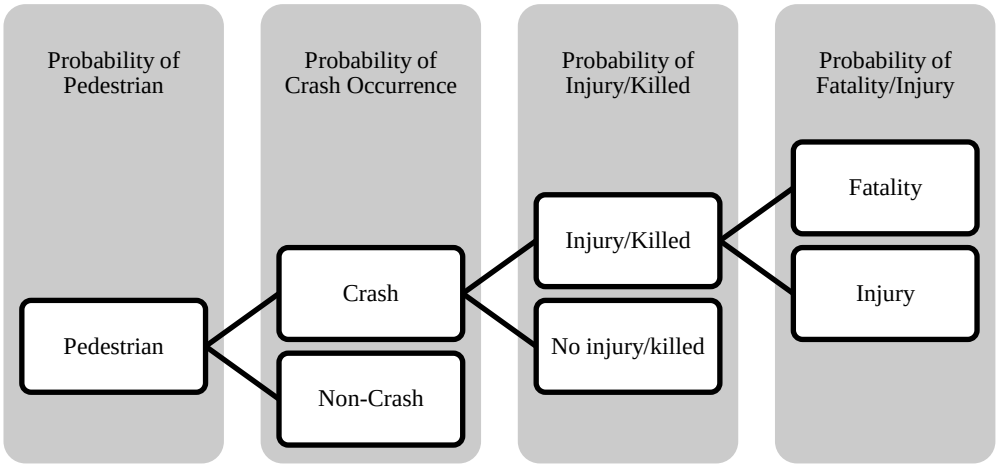

Figure 2. Incident tree for pedestrian crashes

The change in risk (Δ_p) was then determined by the risk reduction percentage based on each problem and the probability of injury/fatality in the pedestrian. The pedestrians ' VOSL / VOSI in Bangkok was calculated by dividing the WTP values for each injury level by the change injury/fatality [26], as shown in Equation 1:

$$\text{VOSL/VOSI} = \frac{\text{Willingness To Pay}}{\text{Change in injury/fatality risk}} \quad (1)$$

According to Equation 1, the VOSL/VOSI was evaluated from WTP values of each injury severity and change in injury/fatality risk. The probability of pedestrian fatality was determined from the data reported by the Royal Thai Police in 2018 in Bangkok based on the pedestrian accident statistics, while the WTP values were directly derived from the questionnaire survey. With the preliminary analysis, this research reported both mean and median WTP values

2.2. Analyzing the WTP Determinants

As previous studies, there were many factors that were taken into account for analyzing the factors affecting Bangkok pedestrian (i.e. 15-39 years old) WTP values to reduce the risk of fatalities and injuries in pedestrian accidents. By considering respondents' social characteristics such as age, gender, marriage status, level of education, occupation, employment, household income, number of family members, perception of risk exposure, walking habits, and other variables, the WTP values of fatality and injury were examined with multiple regressions to investigate how these characteristics influenced the WTP values of pedestrians in Bangkok. Table 3 demonstrates the definitions of the independent variables taken into account in regression analysis [17, 26-28].

Table 3. Definitions of Independent Variables

Independent Variables	Definition
AGE	Age (1=25-39, 0=15-24)
GENDER	Gender (1=Male, 0=otherwise)
EDUCATE	Education (1=Above Bachelor, 0=otherwise)
STATUS	Marriage Status (1=Single, 0=otherwise)
OCCUP1	Occupation1 (1=Private Employee, 0=otherwise)
OCCUP2	Occupation2 (1= Private Business, 0=otherwise)
OCCUP3	Occupation3 (1=Student, 0= otherwise)
OCCUP4	Occupation4 (1=Housewife/Labor, 0=otherwise)
INCOME1	Income Rate 1 (1=US$164-$328, 0=otherwise)
INCOME2	Income Rate 2 (1=$329-$656, 0=otherwise)
INCOME3	Income Rate 3 (1=$657-$984/more than $984, 0=otherwise)
INCOMEh1	Income Household Level 1 (1=$329-$656, 0=otherwise)
INCOMEh2	Income Household Level 2 (1=$657-$984, 0=otherwise)
INCOMEh3	Income Household Level 3 (1= more than $984, 0=otherwise)
HOUSEHOLD NO.	Household membership numbers (1=5 people or more, 0=Less than 5 people)
SAFETY	Safety level as pedestrian (1=Medium/High Level, 0=otherwise)
FREQ	Frequency of walking (1=Every day/Almost every day, 0=otherwise)
DIST1	Average distance to walk a day level 1 (1=1-2 km, 0= otherwise)
DIST2	Average distance to walk a day level 2 (1=3-4 km, 0= otherwise)
DIST3	Average distance to walk a day level 3 (1=4-5 km, 0= otherwise)
DIST4	Average distance to walk a day level 4 (1=5-6 km, 0= otherwise)
DIST5	Average distance to walk a day level 5 (1=more than 6 km, 0=otherwise)
CROSSING	Crossing the street without crossing facility (1=Often/Always, 0=otherwise)
EXP	Own accident experience (1=Yes, 0=No)
EXPh	Family members' accident experience (1=Yes, 0=No)

Note: US$1 = 30.5 Thai baht.

3. Results

3.1. The Statistic Description

A total of 1200 respondents of targeted group included in the survey. The respondents' socio-economic characteristics, perception of risk exposure, walking habits, and pedestrian accident experiences are summarized.in Tables 4 and 5. Also, both tables present the mean and median WTP classified by socio-economic characteristics and walking habit, respectively.

Table 4. Mean and Median of WTP classified by socio-economic characteristics

Socio-economic characteristic		Frequency	Percentage	Mean (US dollar)	
				Fatality	Injury
Gender	Male	498	41.5	38.70	22.76
	Female	702	58.5	31.77	18.88
Age	15 - 24	606	50.5	33.02	20.60
	25 - 39	594	49.5	36.31	20.38
Marriage Status	Single	984	82.0	34.57	21.44
	Married	216	18.0	34.69	16.05
Educational Level	Uneducated	4	0.3	6.56	2.62
	Elementary school	20	1.7	4.98	3.38
	Secondary school	146	12.2	20.66	15.74
	Diploma	120	10.0	21.26	15.88
	Bachelor's degree	742	61.8	36.26	21.45
	Higher than bachelor's degree	168	14.0	53.45	26.14
Occupation	Government officer	126	10.5	45.33	26.47
	Government employee	82	6.8	30.76	15.46
	Private business	120	10.0	55.48	29.93
	Private employee	390	32.5	32.60	19.62
	Student	358	29.8	34.13	22.75
	Housewife	28	2.3	13.82	6.93
	Labor	60	5.0	16.88	10.72
	Other	36	3.0	17.74	12.64
Individual monthly income (THB)	≥5,000	162	13.5	30.53	21.20
	5,001-10,000	200	16.7	32.09	17.18
	10,001-20,000	398	33.2	24.44	24.53
	20,001-30,000	290	24.2	36.54	23.89
	<30,000	150	12.5	65.92	30.32
Household income (THB)	≥5,000	4	0.3	31.15	31.15
	5,001-10,000	30	2.7	18.50	15.32
	10,001-20,000	132	11.0	24.20	15.33
	20,001-30,000	230	19.2	25.24	19.55
	> 30,000	802	66.8	39.73	21.76
Household size (members)	< 5	224	18.7	33.05	20.63
	≤5	976	81.3	41.61	19.87

Note: US$1 = 30.5 Thai baht.

Table 5. Mean and Median of WTP classified by walking habit

Walking habit		Frequency	Percentage	Mean (US dollar)	
				Fatality	Injury
Safety level as pedestrian	Not safe	192	16.0	38.69	26.12
	Low safety level	508	42.3	37.35	21.74
	Medium safety level	482	40.2	31.07	17.09
	High safety level	18	1.5	10.93	10.93
Frequency of walking	Every day	514	42.8	31.85	18.56
	Almost every day	396	33.0	34.7	20.38
	1-2 days a week	222	18.5	36.97	22.83
	Less than 1 day a week	68	5.7	47.94	28.04
Average daily walking distance (km)	< 1	326	27.2	38.18	22.45
	1 - 2	558	46.5	33.40	20.24
	3 - 4	192	16.0	35.24	18.31
	4 - 5	46	3.8	35.38	19.56
	5 - 6	50	4.2	31.41	24.51
	> 6	28	2.3	18.90	11.8
Using the road without crossing facility	Always	184	15.3	38.10	26.06
	Often	474	39.5	34.33	19.22
	Seldom	508	42.3	33.46	19.65
	Never	34	2.8	40.39	22.12
Own accident experience	Never	946	78.8	33.47	20.52
	Once	140	11.7	38.32	22.05
	More than once	114	9.5	39.87	28.30
Family members' accident experiences	Yes	968	80.7	40.10	22.75
	No	232	19.3	32.86	20.37

Note: US$1 = 30.5 Thai baht.

3.2. Mean and Median WTP Values

Table 6 lists the mean and median WTP values for 2 questions of fatality and injury. The WTP for fatality shows higher value than that of injury about US$10 per person. The risk reduction in the questionnaire underlines the high reduction in fatality, however; it is halved for injury. This finding indicates respondents are willing to pay more for a bigger reduction in risk. However, the median WTP does not display the different when the size of risk reduction changed. Note that some respondents stated WTP values as zero, which range from 6.5 to 8.5 percent of the whole samples.

Table 6. Mean of WTP

Type of injury	Mean of WTP *)US dollar)*	Median of WTP *)US dollar)*
Fatality	30.65	16.39
Injury	20.50	9.84

Note: US$1 = 30.5 Thai baht.

3.3. Analysis of Pedestrian Accident

The pedestrian VOSL and VOSI were evaluated as the equation illustrated in previous section. The pedestrian fatality risk in Bangkok was calculated based on 2018 pedestrian accident data obtained from the road safety database analysis as shown in Table 7. According to the mean WTP values indicated in Table 6 and the fatality risk calculated in Table 7, the pedestrian VOSL for fatality and injury can be estimated by using the mean WTP divided by the change in risks (Δ_p). The VOSI value was calculated using the same procedure which the result is shown in Table 8. The estimated VOSL and VOSI for Bangkokian pedestrians in this research are US$0.43 million and US$0.014 million, respectively. The results show high value which can be able to compare with the result obtained by Thongchim et al. [29], which stated that the accident cost in Bangkok shows higher than other provinces.

Table 7. Probability and risk for Bangkok pedestrians [30]

Number	**Bangkok**
Number of pedestrian (1)[a]	382,120
Number of fatalities (2)	31
Number of injuries (3)	702
Number of pedestrian accidents (4)	1,014
Probability	
Prob. of crash (5) = (4/1)	0.00265
Prob. of injury/fatal (6) = (2+3)/4	0.72
Prob. of fatal (7) = (2/2+3)	4.23×10^{-2}
Prob. of injury (8) = (3/2+3)	0.96
Risk	
Risk of fatality (9) = 5×6×7	8.11×10^{-5}
Risk of injury (10) = 5×6×8	1.83×10^{-3}

[a] Pedestrian number = total urban population - people with vehicle ownership

Table 8. VOSL and VOSI of fatal and injured pedestrians

Type of Injury	**Value (US dollar)**
Fatality	427,081
Injury	14,696

Note: US$1 = 30.5 Thai bath

Table 9 provides estimates of the regression results for pedestrian fatalities and injuries using a regression analysis, in which the independent variables consist of the socio-economic characteristics of the respondents, their perception of risk exposure, their walking habits, and other factors. The findings in Table 9 show that certain variables have a major positive or negative impact on the WTP of targeted pedestrians in Bangkok in raising their risk of fatality and injury. The influential variables for the fatality include education (EDUCATE) and occupation (OCCUP2), while those for the injury include marriage status (STATUS) and safety level as pedestrian (SAFETY). Education is a significant

factor that positively affects pedestrians' WTP to reduce fatality risk. The positive coefficient for the education accounts for higher educational levels (i.e. bachelor's degree or higher) pedestrians are more likely to be willing to pay to save their lives. This means that pedestrians with bachelor's degree or higher levels of education tend to place a higher value on their lives compared to those holding lower levels of education (i.e., diploma, secondary school, uneducated). Occupation is another significant factor in minimizing fatality impacting pedestrians' WTPs. The positive sign associated with the occupation variable indicates that private business respondents appear to be more likely than others to pay for risk reduction (i.e. private employee, student, housewife/labor). Marriage status is a significant factor in minimizing the accident impacting the WTP values of the targeted pedestrian group. The positive sign associated with this coefficient is that the respondents, who are single in marriage status, are willing to pay more money for their safety, relative to those of married respondents. Safety level is another factor influencing pedestrians' WTP to reduce injury risk. The negative coefficient signs indicate that pedestrians with a high perception of safety are prepared to pay less for their risk reduction compared with those with low perception of safety. It is rational because pedestrians with higher perception of safety may think that their safety on walking is adequate that they do not need to pay more to save their risk.

Table 9. Results of multiple linear regression analysis

Variable	Fatality		injury	
	b	t-value	b	t-value
AGE	0.011	0.194	0.004	0.064
GENDER	0.047	1.117	0.056	1.316
STATUS	-0.010	-0.216	**0.083***	1.735
EDUCATE	**0.136*****	2.722	0.053	1.042
OCCUP1	-0.048	-0.817	-0.068	-1.120
OCCUP2	**0.087***	1.781	0.055	1.100
OCCUP3	0.027	0.300	0.025	0.272
OCCUP4	-0.080	-1.505	-0.075	-1.389
INCOME1	-0.030	-0.505	-0.057	-0.948
INCOME2	-0.089	-0.941	-0.061	-0.637
INCOME3	0.047	0.404	0.084	0.707
INCOMEh1	0.027	0.325	0.002	0.027
INCOMEh2	0.018	0.171	0.037	0.351
INCOMEh3	0.056	0.467	-0.018	-0.145
HOUSEHOLD NO.	-0.056	-1.373	0.012	0.293
SAFETY	-0.020	-0.467	**-0.071***	-1.646
FREQ	-0.037	-0.869	-0.055	-1.262
DIST1	-0.040	-0.809	-0.035	-0.705
DIST2	-0.009	-0.187	-0.035	-0.714
DIST3	-0.034	-0.788	-0.034	-0.776
DIST4	-0.036	-0.817	0.006	0.129
DIST5	-0.051	-1.197	-0.039	-0.903
CROSSING	0.039	0.911	0.040	0.912
EXP	0.026	0.536	0.012	0.247
EXPh	0.055	1.134	-0.006	-0.125
Constant		1.581		1.485
Number of Observation	1200		1200	

Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively; b = Standardized coefficient

4. Summary and Discussion

The purpose of this analysis is to estimate the economic costs of pedestrian community risk incidents in Thailand's capital city (i.e. Bangkok) using the WTP process. This research also assesses how socioeconomic characteristics, perception of risk exposure, walking habits and other factors impact pedestrians ' willingness to pay to reduce the risk of fatality and injury. The data was gathered from a Bangkok-based WTP survey in which 1200 pedestrians aged 15-39 years were interviewed using questionnaires optimized for fatality and injury using the CV-modified payment card

form. In this research, pedestrian road safety facilities such as a foot bridge, an overpass and lighting were used as various questions in the questionnaire. These questions and payment card method seem to be an effective tool for Thai people as the respondents well perceive the proposed situations and they are able to realize the payment for risk reduction. The authors report that their VOSL is valued at US$ 0.43 million for pedestrians in the study area while the VOSI is estimated at about US$ 0.014 million. This estimates are significantly higher than those calculated in previous studies conducted by Thongchim et al. (2007) which reported that the VOSL and VOSI amounted to US$ 0.20 million and US$ 0.0044 million respectively, primarily because different methods were applied in calculating the cost of the accident, the analysis targeted a different group and was performed with different inflation over different periods of time. In another part of the research, the significant factors that influence respondents ' willingness to pay to reduce the risk of fatality and injury were assessed. It is noted that some of the socioeconomic characteristics of the respondents and the perception of pedestrian safety are of significance for risk reduction when accounting for their WTP. The regression analysis reveals that for the fatality risk reduction, higher educational levels (i.e. bachelor's degree or higher) and private business pedestrians are more likely to be willing to pay to save their lives. To reduce of the risk of injury, the respondents who marriage status is single tend to be willing to pay more to reduce their risk of pedestrian injury accidents. However, a high safety perception is less willing to pay for injury risk reduction.

5. Conclusion

Although there are some drawbacks with the WTP approach used to measure pedestrian accident costs in Thailand, as some respondents were uncertain about the contingency questions, the author used the payment card to clarify by face-to-face interview, so that respondents could get the real values. With these tools, WTP is a promising method for estimating the accident cost for pedestrians. This study can be concluded that pedestrians aged 15-39 who have the educational level equal to or above bachelor's degree are more able and eager to contribute to the development and prevention of their own safety, while those with lower education are not ready to pay for saving their life. This indicates that the education influences the fatality risk perception of risk pedestrian group. Further studies can be expanded to analyze the severe injury question when the data is valid. Additionally, the estimated VOSL in this research can be extended to cost-benefit analysis of road safety systems for pedestrians, especially the program of road safety education for adolescents. Such results are useful in developing effective road safety strategies for pedestrians for decision-makers, community leaders and other stakeholders of road transport as pedestrians are one of the most important vulnerable groups of road users.

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7. Conflicts of Interest

The authors declare no conflict of interest.

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