

MYANMAR MOTORBIKE RIDERS' WILLINGNESS TO PAY FOR FATALITY RISK REDUCTION

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Abstract

The rapid rise in the number of motorbikes in Myanmar over the last few years has resulted in a commensurate increase in road accidents, with nearly half of all road traffic deaths being motorbike riders. Therefore, there is an urgent need to improve road safety in general, with a specific focus on motorbike accidents. This study estimates the value of statistical life (VSL) for Myanmar motorcyclists and examines the influence of the individual rider characteristics on the willingness to pay (WTP) for fatality risk reduction. A contingent valuation payment card approach was used to determine the motorcyclist WTP for fatality risk reduction, after which structural equation modeling was used to explore the factors affecting WTP. The resultant median and mean VSL were found to be MMK 145.833 million (US\$ 121528) and MMK 162.687 million (US\$ 135573), with gender (male) being found to negatively influence and government staff being found to positively influence good driving behavior. Gender (male) was also found to have a positive direct effect on the WTP; however, the resultant total effect on the WTP was negative. Socioeconomic characteristics, good driving behavior, and risk perception factors were found to positively influence the WTP, with the good driving behavior factor being found to have the strongest effect. This study can be used to assist road transport authorities to make decisions on budget allocations for road safety related projects and to develop road safety policies.

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Introduction

Traffic accidents have been identified as the major cause of fatalities and disabilities in developing countries (World Health Organization, 2015). As the number of vehicle owners has risen over the last few years in Myanmar, there has been a significant increase in traffic accidents, which has become a major health issue and has had serious economic and social effects. As more people have moved from the bicycle to the motorbike, there has been a rapid increase in the number of motorbikes over the last fifteen years. A Road Traffic Administration Department (RTAD) statistics report stated that from 2001 to 2015, motorbike ownership increased from around 0.17 million to over 4.5 million, with motorbike ownership increasing from 38% to 84 % of all motor vehicles from 2001 to 2015 (Central Statistical Office, 2016; RTAD, 2016). The RTAD reported that in 2015, the motorbike accounted for 84% of all vehicles, followed by passenger cars (8%) and light trucks (3%). Commensurately, therefore, 53% of all accidents involved motorbikes, followed by passenger cars (18%) and trucks (11%), and of these, nearly half of all road fatalities involved motorbikes (47%), followed by passenger cars (16%) and trucks (14%) (Central Statistical Office, 2016; RTAD, 2016). Therefore, as motorbike accidents are now the major cause of traffic deaths in Myanmar, taking action to increase motorbike safety should be a high priority (Asian Development Bank, 2016).

Experts from the Asian Development Bank have advised that “strong, well-managed and well-funded road safety efforts” are required to reduce road crash frequency and fatalities (Asian Development Bank, 2016). Therefore, scarce resources need to be systematically and consistently allocated for greater effectiveness (Jones-Lee *et al.*, 1985). Policy-makers have used cost-benefit analysis to evaluate proposed regulations and public investments (Jacobs, 1995; Elvik, 2003;

Svensson, 2009) in many developed countries to compare the value of traffic accident fatality risk reduction and the cost of implementing road safety measures (Bhattacharya *et al.*, 2007), for which the value of statistical life (VSL) as measured by a willingness to pay (WTP) approach has been used to estimate the risk reduction value (Persson *et al.*, 2001). Until recently, no such risk reduction valuation research had been conducted in Myanmar; therefore, this study is a pioneer for the VSL estimates for Myanmar motorcyclists.

There are two ways to elicit the WTP; stated preference (SP) and revealed preference (RP). The RP approach derives value from actual real-life decision purchases and choices (Bateman *et al.*, 2002; Andersson, 2005; Wijnen *et al.*, 2009); however, as this approach is unable to be used to estimate non-use value (Bateman *et al.*, 2002), it is difficult to implement in developing countries (Bhattacharya *et al.*, 2007).

The SP approach, however, uses different payment mechanisms and questionnaire designs so that individuals can state their preferences for a marginal rate of substitution between wealth and a specific type of mortality risk reduction (Milligan *et al.*, 2014), and therefore it can be used to value both market goods and nonmarket goods (Heywood, 2010), and can match survey questions to policy risk contexts to achieve broad representation; therefore, SP has been widely used to value safety (Wijnen *et al.*, 2009; Milligan *et al.*, 2014). The SP approach can be sub-divided into contingent valuation (CV) and choice modeling (CM) (Bateman *et al.*, 2002). When using the CV method, participants state the maximum amount they are willing to pay for the goods or services (Beattie *et al.*, 1998; Bateman *et al.*, 2002). When using the CM method, participants choose from different levels of attributes or characteristics (Bateman *et al.*, 2002); however, it was decided that the

CM approach was not suitable for Myanmar participants as they would tend to select without proper deliberation.

In recent years, the CV approach has been widely used to estimate the economic value of nonmarket goods and services in the environmental (Whittington, 1998) and health care sectors (Lim *et al.*, 2017). As road safety is in the category of nonmarket goods, the CV approach was seen as an appropriate tool for measuring the WTP for traffic accident risk reduction. CV surveys can have various formats; open-ended, iterative bidding, dichotomous choice, and payment card, with each format having its own strengths and weaknesses. Of these, the payment card format has been found to avoid starting point bias, reduce outliers (Bateman *et al.*, 2002), provide more information, have a reduced cognitive burden for participants, and be superior to open-ended questions and bidding games (Svensson and Vredin Johansson, 2010).

Based on a literature review, an SP-CV approach with a payment card format was selected as the most appropriate approach for Myanmar participants. This study aimed: (1) to investigate the extent to which Myanmar motorcyclists are aware of road safety, (2) to examine the relationships between the factors and the influence of these factors on the WTP for road accident fatality risk reduction; and (3) to estimate the VSL for Myanmar motorcyclists. This study used the SP-CV payment card format to elicit the WTP of motorcyclists for traffic accident fatality risk reduction. Then, the VSL of the motorcyclists was calculated based on the reported number of road accident deaths in Myanmar in 2015. A structural equation modeling (SEM) approach was employed to assess the relationships between the factors and their influence on the WTP.

Materials and Method

In this study, a WTP-CV questionnaire with a modified payment card format was used to elicit the motorcyclists' willingness to pay for traffic accident fatality risk reduction. Face-to-

face interviews were conducted to ensure a full understanding of the questionnaire and to select a suitable WTP value. Background information, i.e., the research objectives, road accident consequences, and the road accident death rate in Myanmar, was given to participants before the interview. Participants were asked about individual characteristics, travel and driving behavior, accident experience, and risk perception, after which they were asked to nominate a WTP value.

Questionnaire Design

The questionnaire was designed based on the previous related research and was divided into 4 sections: socioeconomic characteristics, which were gender, age, income, education, occupation, and vehicle ownership (De Dios Ortúzar *et al.*, 2000; Yang *et al.*, 2016); travel and driving behavior such as trip purpose, main vehicle, helmet wearing, driving against traffic flow, phone usage while driving, drunk driving, and speeding (Haddak *et al.*, 2016; Yang *et al.*, 2016); and personal traffic accident experience, family or friend's traffic accident, and risk perception (Andersson and Lundborg, 2007). The fourth section was the heart of the questionnaire, in which the participants were asked to nominate the maximum amount of money they were willing to pay for a road accident fatality risk reduction of 50%. Prior to asking this WTP question, the interviewer explained that the goods to be valued were hypothetical and were used only as a sample to allow for an easy risk reduction valuation. Then, the participants were told they had to choose a new motorbike helmet and were given 2 choices (A and B). Each helmet had a one-year safety warranty but, as the head-injury safety quality of each helmet was different - helmet A had the possibility of 8 deaths from head injury per 100000 population and helmet B had the possibility of 4 deaths per 100000 population - the cost for each was different (Chaturabong *et al.*, 2011). The participants were asked how much more they would be prepared to pay for helmet B compared to helmet A to reduce the likelihood of motorbike head injury deaths by 50%. The participants were required to choose the

amount from a modified payment card which had a range of possibilities; however, if their choices were not on the list, they were able to nominate their own amount.

Data Collection

The questionnaire was translated into Burmese and a pilot test was conducted to examine comprehension, after which it was revised. A total of 429 motorcyclists from the Sagaing, Mandalay, Nay Pyi Taw, Magway, Bago, Yangon, and Ayeyarwady regions of Myanmar were interviewed from October 2016 to January 2017. The participants, who were over 18 years with at least eighth grade education, were randomly selected, after which face to face interviews were conducted in several different locations such as government offices, government staff dormitories, universities, student dormitories, and company offices. The sample size was chosen based on the advice garnered from previous research; for example, both Kline (2011) and Loehlin (1998) suggested that to reduce bias to an acceptable level, the minimum sample size for any type of SEM estimation was 200. Stevens (1996) also recommended that the sample size for maximum likelihood (ML) estimation should be at least 15 times the number of observed variables, and Bentler and Chou (1987) and Bentler (1995) advised that the sample size for ML estimation should be at least 5 times the number of free parameters including error terms in the model. Therefore, based on Stevens (1996), $330 (22 \times 15 = 330)$ participants were seen as the minimum possible for the ML estimation as there were 22 observed variables. After removing 9 zero participants, the sample size used in this research was 420 (429-9), which was deemed sufficient for the SEM analysis.

Estimating the Motorcyclists' VSL

The VSL is an aggregate value of the WTP to prevent the expected occurrence of 1 statistical death (Persson *et al.*, 2001; Svensson, 2009) and is usually calculated as the mean or median value of the WTP divided by the change in risk (Δp) (Jones-Lee, 1974;

Persson *et al.*, 2001; Milligan *et al.*, 2014) as shown in Equation 1. As the number of deaths by road user categories was not available in Myanmar, the fatality risk value in this study was determined from the total number of road accident deaths as reported by the RTAD divided by the country's population in 2015. The change in risk (Δp) value of 50% was based on the target action plan for road safety improvement.

$$VSL = \frac{\text{mean or median WTP}}{\text{change in risk } (\Delta p)} \quad (1)$$

Analyzing the WTP Determinants

This study used an SEM analysis which allowed for: (1) an assessment of the complex relationships between the variables using discrete or continuous data, (2) an examination of the direct and indirect effects, and (3) an analysis of the model using multiple dependent observed or latent variables (Golob, 2003; Kline, 2011). SEM was applied to examine the relationship between the WTP responses of the Myanmar motorcyclists and their socioeconomic characteristics, travel and driving behavior, accident experience, and risk perception. Various fit indices, i.e., the ratio of χ^2 to the degree of freedom (χ^2/df), the p-value (p), the standardized root mean square residual (SRMR), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI), were used to assess the overall model fit. The required measures used were $\chi^2/df < 3$, $p > 0.05$ (Kline, 1998), $SRMR \leq 0.08$, $RMSEA \leq 0.08$, $CFI > 0.90$ (Hu and Bentler, 1999), and $TLI > 0.80$ (Hooper *et al.*, 2008) as these could indicate the good fit of the model to the data.

Results and Discussion

Sample Participant Characteristics

There were 46.2% male and 53.8% female participants, with 58.0% being single, 42.0% being married, 54.5% ≤ 30 years, and 66.9% holding a diploma or bachelor's degree. Most participants were government staff (64.6%), 49.2% had a monthly individual income between US\$ 84 and US\$166, 48.7%

had a monthly household income $\leq$ US\$ 250, and 41.7% had a household of 4-5 members. Over half (52.7%) had 2 or more motorbikes, 46.6% had only 1 motorbike, and 84.1% did not have a car in their household.

For travel behavior, 83.9% generally used their motorbikes to commute to school or work, with only 16.1% using their motorbikes for non-compelling trips such as shopping, recreation, or other reasons. A majority (91.8%) of participants used a motorbike when going outside their homes and only 8.2% used other vehicles such as private cars, buses, or taxis. For driving behavior, 81.6% drove often, 62.0% always wore a helmet, 62.9% never drove against the traffic, 61.3% never used their phone while driving, 78.6% never drove after drinking alcohol, and 88.3% drove at less than 50 kph.

In terms of accident experience and risk perceptions, only 8.7% had experienced the death of family members, relatives, or close friends in a traffic accident, and only 14.7% had had personal traffic accident experience in the last 2 years. Interestingly, 74.6%, 21.7%, and 3.7%, respectively, perceived that their accident risk was lower than average, average, and higher than average; that is, very few believed that their traffic accident risk was higher than average. A similar result was found in Sweden (Andersson, 2007), where it was reported that most people believed that their risk of experiencing a traffic accident fatality was low because their driving behavior was safer than that of others.

WTP Value and VSL of Motorcyclists

Table 1 shows the mean and median WTP values for a 50% fatality risk reduction and the motorcyclists' VSL. As can be seen, only 2.1% of participants nominated a zero WTP, with the mean and median WTP values being MMK 7809 (US\$ 6.51) and MMK 7000 (US\$ 5.83) for a 50% risk reduction in road accident deaths (US\$1 = MMK1200), respectively. The traffic accident fatality risk value was calculated based on an RTAD report from 2015, which reported 5037 deaths from the 52.449 million population; that is, 9.6 deaths per 100000 people (Central Statistical Office, 2016). Consequently, the value for (Δp) for a 50% risk reduction in road accident deaths was 4.8 deaths per 100000 people. Based on the WTP median and mean values, the VSL was calculated using Equation 1, from which it was found that the Myanmar motorcyclists' VSL ranged from MMK 145.833 million (US\$ 0.121528 million) to MMK 162.687 million (US\$ 0.135573 million), which was commensurate with other developing countries such as Thailand US\$ 0.17-0.21 million) (Chaturabong *et al.*, 2011) and India (US\$ 0.15 million) (Bhattacharya *et al.*, 2007), but noticeably lower than the VSL in developed countries.

WTP Determinants

As the WTP values were slightly dispersed in this study, as shown in Table 1, the WTP values were converted to a natural logarithm prior to the analysis. As only 9

Table 1. WTP value for 50 percent risk reduction in fatality and VSL of motorcyclists

	WTP MMK ^a (US\$)	Risk Change (Δp) ($\times 100000$ pop)	VSL MMK ^a $\times 10^6$ (US\$ $\times 10^3$)
Mean	7809 (6.51)	4.8	162.687 (135.573)
Median	7000 (5.83)	4.8	145.833 (121.528)
SD	4964 (4.14)		
Skewness	0.76		
SE of Skewness	0.118		
Sample size	429		
% zero WTP	2.1		

^a Myanmar Kyat , US\$1 = MMK1200

participants (2.1%) chose zero WTP values and the logarithm of zero was infinity, these data were excluded from the analysis (Chaturabong *et al.*, 2011). All nominal and categorical variables were then converted to dummy variables (Lee *et al.*, 2008), and the skewness and kurtosis were checked to ensure normality; based on Kline (2011), skewness should be <3 and kurtosis should be <10 .

The ML estimation was used to construct and test the measurement model, and preliminary analyses were conducted on various observed variables for each measurement model. At first, when all indicators were

included in the measurement models, the model fit indices were poor; therefore, after examining the preliminary analyses results, some observed variables were removed to improve model fit. Finally, there were respectively 3, 5, and 3 observed variables left for the socioeconomic characteristics, travel and driving behavior, and risk perception factors. Structural pathways were then developed to connect the exogenous observed variables, latent variables, and endogenous observed variables (the WTP) in the SEM model. After checking the statistical output from the preliminary analysis, pathways were added

Table 2. Definition of observed variables

Code	Definition	Category
G	Gender	1 Male, 0 Female
A1	Age level 1	1 if ≤ 30 , 0 otherwise
A2	Age level 2	1 if 30 – 40, 0 otherwise
A3	Age level 3	1 if > 40 , 0 otherwise
FS	Family status	1 if married, 0 single
E1	Education level 1	1 if $\leq$ High School, 0 otherwise
E2	Education level 2	1 if Diploma or Bachelor, 0 otherwise
E3	Education level 3	1 if Master and above, 0 otherwise
O1	Occupation 1	1 if Student, 0 otherwise
O2	Occupation 2	1 if Government staff, 0 otherwise
O3	Occupation 3	1 if Private employee, 0 otherwise
I1	Monthly Individual income level 1	1 if ≤ 83 , 0 otherwise
I2	Monthly Individual income level 2	1 if 84–166, 0 otherwise
I3	Monthly Individual income level 3	1 if > 166 , 0 otherwise
HI1	Monthly Household income level 1	1 if ≤ 250 , 0 otherwise
HI2	Monthly Household income level 2	1 if 251–416, 0 otherwise
HI3	Monthly Household income level 3	1 if > 416 , 0 otherwise
HM	Household member	Continuous
MC	No of motorcycle	Continuous
C	No of car	Continuous
CM	Compelling (school or work)	1 if School or work, 0 otherwise
VEH	Mainly used vehicle	1 if Motorcycle, 0 otherwise
ETF	Exposure to the traffic (driving frequency)	1 if often, 0 otherwise
HEL	Helmet wearing	1 if often, 0 otherwise
AG	Against the traffic flow	1 if never, 0 otherwise
PH	Speak phone while driving	1 if never, 0 otherwise
DD	Drunk driving	1 if never, 0 otherwise
SP	Usual operating speed	1 if ≤ 50 kph, 0 otherwise
PEA	Personal experience on accident	1 if had accident, 0 otherwise
FEA	Family or friends had accident	1 if had accident, 0 otherwise
PRI	Perceived risk of accident	1 if average or higher than average risk, 0 lower than average risk
WTP	Willingness to pay	Continuous

and removed until the structural model exhibited an adequate fit.

Table 2 gives the explanation for all observed variables, and Table 3 illustrates the sample characteristics of the candidate variables. It can be seen that the skewness was less than 3 for all variables and the kurtosis was less than 10, implying that all variables were normal (Kline, 2011).

Figure 1 shows the parameter estimates for the measurement model and path model. The resulting values for the goodness of fit statistics were: (1) chi-square (χ^2) = 104.656, (2) degree of freedom (df) = 64, (3) χ^2/df = 1.635, (4) p-value = 0.0010, (5) RMSEA = 0.039, (6) CFI = 0.917, (7) TLI = 0.884, and (8) SRMR = 0.046. All statistical values were compatible with the recommended model fit index, other than the p-value <0.05. As the χ^2 value was hypersensitive to large sample sizes ($n > 200$), it led to a rejection of the null hypothesis (Hooper *et al.*, 2008; Kline, 2011). Due the large sample size ($n = 420$) in this study, it was concluded that the model fit well

and was able to explain 27.7% of the WTP variance.

As all estimated values for the factor loadings and path coefficients were standardized solutions, it was considered feasible to compare the effects of the variables on the observed dependent WTP variable. For the direct effects, the gender (male) indicator ($\beta = 0.845$), socioeconomic characteristics ($\beta = 0.295$), good driving behavior (GDBH) ($\beta = 1.141$), and risk perception (RPC) ($\beta = 0.863$) factors were found to be statistically significant and had a positive influence on the WTP.

The government staff (O2) ($\beta = 0.144$) indicator was found to be significant and had a positive influence on the GDBH factor; however, the male indicator ($\beta = -0.867$) was significant and had a negative influence on the GDBH factor. For the indirect effects, government staff (O2) was found to have a positive influence on the WTP mediated through the GDBH factor, while the male indicator was found to have a negative influence. Overall, the GDBH factor ($\beta = 1.141$)

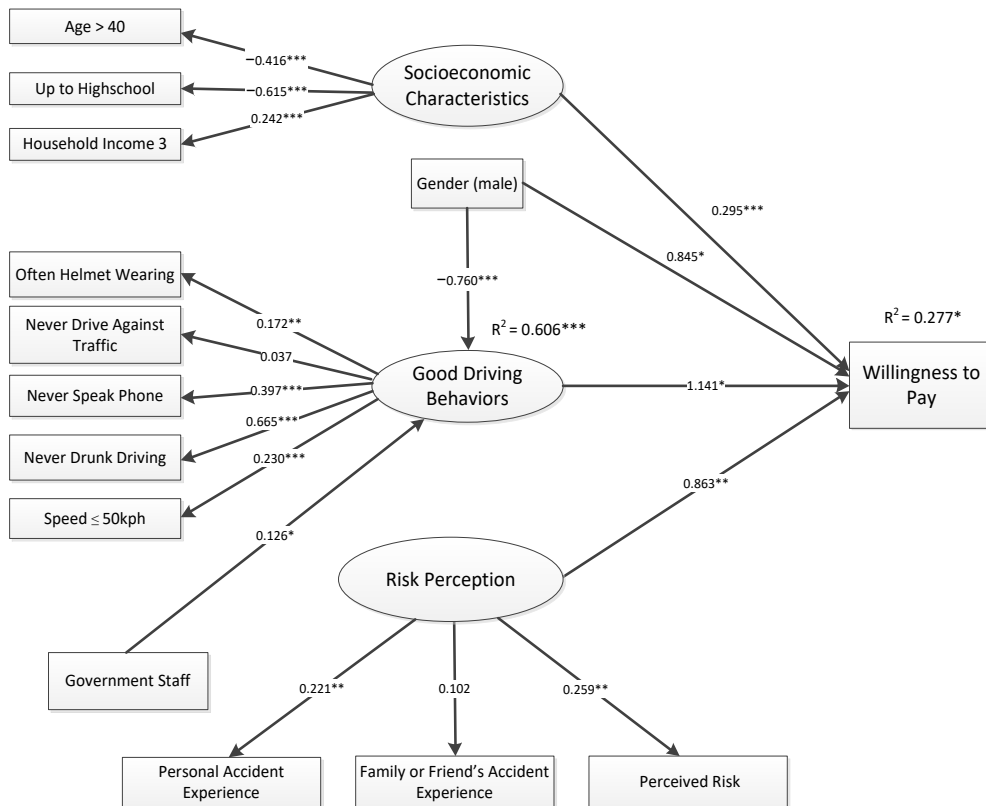
Table 3. Sample characteristics of candidate variables

Code	Variable	N	Min	Max	Mean	SD	Skewness		Kurtosis	
							Stat.	Std. Err	Stat.	Std. Err
G	Gender	420	0	1	0.47	0.499	0.134	0.119	-1.9925	0.238
A3	Age > 40	420	0	1	0.18	0.383	1.685	0.119	0.842	0.238
O2	Government staff	420	0	1	0.65	0.479	-0.609	0.119	-1.637	0.238
E1	Up to high school	420	0	1	0.20	0.402	1.487	0.119	0.212	0.238
HI3	Monthly Household income level 3	420	0	1	0.18	0.3845	1.663	0.119	0.771	0.238
HEL	Helmet wearing	420	0	1	0.84	0.364	-1.891	0.119	1.583	0.238
OP	Against traffic flow	420	0	1	0.63	0.484	-0.524	0.119	-1.734	0.238
PH	Speaking on phone	420	0	1	0.63	0.484	-0.524	0.119	-1.734	0.238
DD	Drunk driving	420	0	1	0.78	0.412	-1.380	0.119	-0.095	0.238
SP	Speed	420	0	1	0.88	0.321	-2.397	0.119	3.762	0.238
PAE	Personal accident experience	420	0	1	0.15	0.357	1.967	0.119	1.880	0.238
FAE	Family or friend accident experience	420	0	1	0.29	0.455	0.926	0.119	-1.147	0.238
PRI	Perceived risk	420	0	1	0.25	0.436	1.144	0.119	-0.694	0.238
WTP	Willingness to pay	420	6.91	10.13	8.764	0.719	-0.623	0.119	-0.106	0.238

was found to have the highest influence on the WTP, followed by the RPC factor ($\beta = 0.863$).

The SEM analysis results shown in Figure 1 were as follows. The socioeconomic characteristics factor was measured using 3 indicators: age more than 40 years (A3), up to high school education (E1), and monthly household income level 3 (HI3). All variables were found to be statistically significant; A3 and E1 had negative associations with the socioeconomic characteristics factor, and HI3 had a positive association, and E1 was found to have the highest influence ($\beta = -0.479$), followed by HI3 ($\beta = 0.338$). Further, the socioeconomic characteristics factor was

found to significantly and positively affect ($\beta = 0.295$) the WTP. From these results, it was reasonable to surmise that older participants were less willing to pay for accident risk reduction compared to younger participants, which was in line with previous studies in Thailand (Chaturabong *et al.*, 2011). It was found that lower educated people were less likely to pay for traffic accident risk reduction compared to more highly educated people. An alternative result reported by Yang *et al.* (2016) was that the more highly educated participants focused more on traffic accidents, had a better appreciation of the potential benefits of traffic safety improvements, and



$\chi^2 = 104.656$, $df = 64$, $p = 0.0010$, $RMSEA = 0.039$, $CFI = 0.917$, $TLI = 0.884$, $SRMR = 0.046$,

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 1. Structural equation model for willingness to pay of fatality risk reduction

therefore were more likely to pay than lower educated people. Participants from higher income families were found to be more willing to pay for traffic accident risk reduction compared to participants from lower income families, which was in line with economic theory and previous studies (Mofadal *et al.*, 2015; Yang *et al.*, 2016) in Sudan and China that indicated that wealthy people tended to value their lives more.

The GDBH factor was measured using 5 observed variables; helmet wearing (HEL), driving against the traffic flow (AG), using the phone while driving (PH), drunk driving (DD), and speeding (SP). All variables, except AG, were found to be positively significant, with the DD indicator having the highest association ($\beta = 0.665$) with WTP. In addition, the GDBH factor was found to have a significantly positive influence ($\beta = 1.141$) on the WTP, indicating that participants who followed traffic rules and regulations were more likely to pay for fatality risk reduction compared to participants who tended to violate traffic rules. However, an alternative result was found in prior research (Moen, 2007) that studied the determinants of safety priorities and the WTP to increase safety, in which it was reported that car drivers with a negative attitude to traffic rules were less willing to pay for traffic accident risk reduction.

The male (G) variable was found to have a significant negative influence ($\beta = -0.760$) on the GDBH factor. G was also found to have a significant and positive direct effect ($\beta = 0.845$) as well as a negative indirect effect on the WTP mediated through the GDBH factor. The resulting total effect of G on WTP was negative, which suggested that male participants were more likely to violate the traffic rules compared to females, as found in prior studies (Holubowycz *et al.*, 1994; Zhang *et al.*, 2000; Yau *et al.*, 2006; Kim *et al.*, 2008; Zhang *et al.*, 2013) in which it was found that male drivers had a higher probability of traffic violations. Therefore, the total effect on the WTP indicated that male participants were less willing to pay for traffic accident risk reduction than females.

The government staff (O2) variable was found to have a significant positive influence ($\beta = 0.126$) on the GDBH factor; therefore, O2 positively influenced the WTP mediated through the GDBH factor. This result could be explained by the fact that government staff were more likely to obey the traffic rules and were more willing to pay for accident risk reduction than other road users as they were following the instructions of their department heads to obey traffic rules and regulations (especially helmet usage). This finding supported the results in Chaturabong *et al.* (2011), which concluded that government officers were more likely to pay to reduce fatality risk than students.

The risk perception (RPC) factor was measured using 3 indicators: personal accident experience (PAE), family or friend's accident experience (FAE), and perceived risk (PRI). The PAE and PRI variables were found to be significantly and positively associated, with the RPC factor significantly and positively influencing ($\beta = 0.863$) the WTP, which suggested that participants who had been involved in a traffic accident were more likely to pay for accident risk reduction than participants who had had no traffic accident experiences; a finding that was consistent with previous studies in Sweden and France (Andersson and Lindberg, 2009; Haddak *et al.*, 2016). In prior research (Andersson and Lindberg, 2009), it was found that the PRI indicated that participants who perceived their road accident risk to be average or higher than average were more likely to pay for accident risk reduction than participants who believed their risk was lower than average.

Conclusions

As the number of motorbikes has increased dramatically over the last few years in Myanmar, motorcyclist deaths, which accounted for half of all total road traffic accident deaths in Myanmar, have become a major road safety concern. This study examined the VSL in Myanmar motorcyclists and the influence of

individual characteristics on the willingness to pay (WTP) for fatality risk reduction. A total of 429 motorcyclists from 7 major regions in Myanmar were interviewed using a WTP-CV approach, after which the VSL for Myanmar motorcyclists was then estimated and an SEM analysis employed to assess the direct and indirect effects of the Myanmar motorcyclists' characteristics, behaviors, and attitude toward the WTP.

The estimated VSL was found to have a mean value of MMK 162.687 million (US\$ 135573) and a median value of MMK 145.833 million (US\$ 121528), which was significantly less than in developed countries, but commensurate with other developing countries. Socioeconomic characteristics, good driving behavior, and risk perception factors were found to positively influence the WTP, gender (male) had a negative effect on good driving behavior, and being government staff had a positive effect. Gender (male) was also found to have a positive direct effect on the WTP; however, the resulting total effects of gender (male) on the WTP were found to be negative. Overall, good driving behavior factor was found to have the highest influence on the WTP.

Based on the result from this study, road authorities need to have a road safety campaign and to educate specific target groups more such as males and students. VSL can also be used as an input for preserving the life of motorcyclists in benefit cost analysis by comparing the cost of road safety measures such as constructing a separate lane for motorcycles. This study could be helpful to road transport authorities when formulating road safety policies for motorcyclists, who are one of the most vulnerable road user groups. It could also be useful in decision-making processes for budget allocations and when prioritizing road safety related project investments to improve national road safety.

Study Limitations and Future Research

This study used the same risk value for the whole population. As the majority of participants in this study were educated and lived in urban areas, their behavior and attitude

toward road safety might differ from illiterate people (who had difficulty understanding the WTP questionnaire) living in rural areas. In future studies, the risk value should be based on road user categories when the accident rate for each category is available. The questionnaire should include various risk reduction levels to determine scale insensitivity. The payment mechanism should also be focused on the public road safety aspect.

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