Road Crashes and Poverty in Myanmar: Yangon Case Study

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Abstract: This paper reveals the involvement and impacts of road crashes on the poor people in Yangon, Myanmar. The study aims to investigate whether poor people are more likely involved in road crashes and to identify whether consequence of road crashes has higher impact on poor households rather than non-poor households. The study was based on the questionnaire survey in Yangon. To identify the involvement of road crashes, and impacts on the household of poor and non-poor people, hypothesis tests were applied. The linear regression model and logit model were applied to evaluate the contributing factors on the declining situation of household income after the road crash involvement. The results shows that the most involvement of road crashes in Yangon are lower social economic groups. The costs and impacts due to road crashes are in a higher burden for poor people. The findings can assist policy makers in determining the appropriate policies to mitigate the impacts and improve poverty alleviation actions. Other than that, transportation planning such as the improvement of public transport and basic road infrastructure could reduce the road crash problem for poor people who are the main group of road users in Yangon.

Key words: road crash, poverty, Yangon, Myanmar

1. INTRODUCTION

According to WHO's recent Global Status Report on Road Safety (2009) (WHO, 2009), over 1.2 million people die each year in the road crashes, and 20-50 million people suffer non-fatal injuries. Findings from the Global Status Report presents that more than 90% of the world fatalities on the roads occur in low-income or middle-income countries where the number of registered vehicles are low. Almost 50% of those who die in the road crashes are vulnerable road users, such as pedestrians, cyclists and users of motorized two-wheelers or three-wheelers, and the proportion of vulnerable road users is higher in the poor countries.

In addition to the suffering from the crashes, the road crashes can cause poverty to the families that have had a member killed or seriously injured in the road crashes. The long term consequences from the crashes include the funeral expenses, the cost for medical treatment and rehabilitation, and the loss of family breadwinner or a family member whose earnings are the primary source of the family. Therefore, the impact of road crashes is more likely to be serious if the victim is a breadwinner or a member from poor family. In recent research studies, little work has been done to understand the socio-economic status of the road crash victims and the impact of road crashes on the poverty especially in low-income countries. A similar study has been conducted in Bangladesh and India by Aeron-Thomas et al. (2004). The findings clearly illustrate a great impact of the road crashes on the poor, and the road crashes can even cause poverty to non-poor family involved in the crashes. This problem has been a major concern to the economic development in many low-income countries as the road crashes are found to be a serious obstacle for the poverty reduction.

Myanmar is one of the countries which are classified by the World Bank as a low-income country. The number of fatalities due to road crash is 2,264 deaths in 2010, and the death rate shows an increasing trend in recent years (Figure 1). The road crash causes a great loss in the economic development of the country as shown in the estimated annual economic loss of 3% of GDP (ADB, 2004). About 52% of the road crash victims in Myanmar are vulnerable road users as presented in Figure 2. It is more likely that these victims are poor people who cannot afford to travel using a safer mode, and the road crash can push their family to poverty due to the loss of income from the family breadwinner. Moreover, the poverty represents a major barrier to the implementation of the road safety prevention in the country. The impact study of road crashes on poverty in Myanmar is therefore needed to better understand the socio-economic status of the road crash victims and the impact of road crashes on the victims and their families. This study can assist policy makers in determining the appropriate policies to mitigate the impacts and improve poverty alleviation actions.

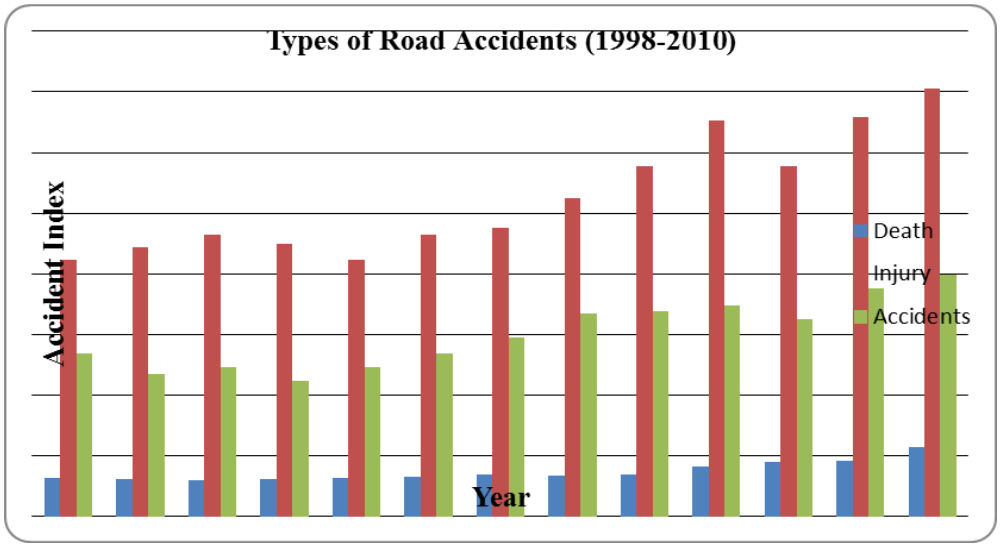

Figure 1. Road accident situation in Myanmar

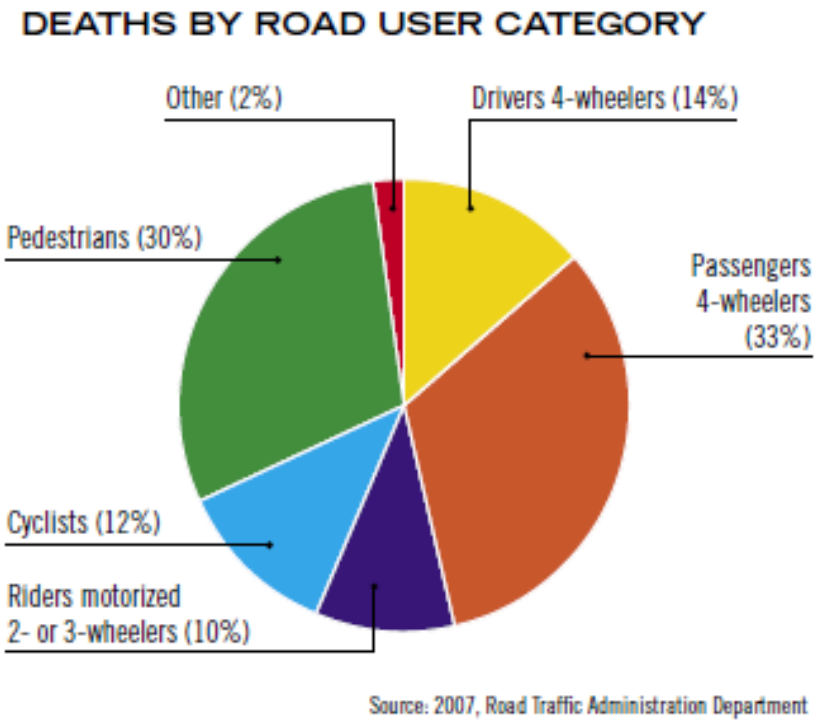

Figure 2. Number of deaths classified by road user type
(Source: WHO Global Status Report on Road Safety (2009))

2. OBJECTIVES

The objective of this paper is to investigate whether poor people in the city of Yangon, Myanmar are more likely involved in road crashes, and to identify whether social consequences of road crashes (e.g., household income and quality of life) are more severe for poor family than non-poor family. The paper is intended to understand the current situation of road crashes in Myanmar, and differences between impact of road crashes on poor and non-poor families. The questionnaire survey of the economic status of the household involving in the road crashes was carried out Yangon. A statistical technique has been applied to the survey data in an attempt to establish the link between socio-economic characteristics of road crash victims and the consequences of road crashes on the socio-economic status and quality of life.

The next section will summarize the findings from recent research studies related to the road crashes and the poverty. Then the overall research methodology will be described, and the results and analysis will be discussed.

3. RESEARCH ON ROAD CRASHES AND POVERTY

Little work has been done to study the socio-economic status of the road crash victims in low-income countries. However, in developed countries, many evidences show that low social economic group of people are at higher risk due to road crash death or serious injuries. There is an increasing fatality rate in lower social economic groups of childhood, youth, and early adulthood in Sweden city (Elmen and Sundh, 1994). Another research also shows that in the Netherlands, higher social economic groups are associated with lower fatality levels (Van Beeck et al., 1991). Laflamme and Diderichsen (2000) and Laflamme and Engstrom (2002) also states that most of traffic injuries are children from worse community positions and in poorer social economic areas. Doughterty et al. (1990) found that in urban Canada, the injury rate of children aged 0-14 years living in the poorest neighbourhoods was four times that of children living in the least poor neighbourhoods. Ghee et al. (1997) studied the socio-economic aspects of road crash in Bangladesh, Fiji, Ghana, Indonesia, Peru, and Zimbabwe, and they indicated that road crashes have substantial economic and social impacts in developing countries.

Many previous studies have illustrated the strong relationship between road crashes and poverty. As most victims involved in the road crashes are poor people, the road crashes can also cause poverty to the involved victims. Many road crash victims at higher risks are the family sole earner, and their deaths often radically diminish family income. Similarly, the serious injuries could also have long-term negative impacts on family incomes and severe consequences on the household quality of life especially for low-income families. Death of the breadwinners, cost of health treatment, and loss of a job and/or income resulting from the road crash have vital unpleasant economic and social consequences on a household (ADB, 2005). The evidences show that the costs incurred from road crashes push family into poverty (Nantulya and Reich, 2003). Aeron-Thomas et al. (2004) have assessed the impacts of road crashes on poor household in Bangladesh and India, and found that the household income and food consumption were reduced for the road crash victim's family. It is also estimated in Bangladesh and India that many poor families after the crash have not been poor before the death or serious injury from the crash. It is stated that road crash has been an obstacle for the poverty reduction in many low-income countries (Aeron-Thomas et al.,

2004). Road crash injuries can cause family to poverty by incurring debt, cutting back of nutrition, taking children out of school and sacrificing future prospective.

4. RESEARCH METHODOLOGY

Data collection in this study was conducted through questionnaire survey in Yangon, Myanmar in 2011. Yangon was selected as a study area because it is a major economic city of Myanmar as well as old capital city. In this study, poor and non-poor household were classified by the national poverty line which is defined in terms of per capita monthly income of that road crash victim's family. The country-wide survey of 18,660 households in Myanmar was conducted in 2009-2010 by the Ministry of National Planning and Economic Development and UN Development Program (UNDP), in coordination with UNICEF and the Swedish International Development Cooperation Agency, and afterwards Myanmar government has defined the poverty line of 754 kyats (or 0.9 USD) per day or an average monthly income of 22,600 kyats (26 USD) or less for adult person (1 USD = 873 MMK). The fatality is classified with the definition of the death within 30 days periods, and the serious injury is defined as the disability for 30 days or more.

This study is divided into two parts. The first part is to study the involvement of the "poor" people in the road crashes. The second part is to assess the impact of road crashes on poor and non-poor families in terms of social consequences, household income and quality of life, after the crashes. Factors affecting the consequences of road crash are also determined. The data collection and the results from data analysis of each part are presented separately in the following sections.

5. INVOLVEMENT OF POOR PEOPLE IN ROAD CRASHES

5.1 Data Collection

Data was simply collected from the respondents whose household member was involved in the road crashes, either death or serious injuries within the past 3 years (from 2008 to 2010). List of casualties in the area of Yangon was identified by traffic police and hospital records, and then the data was obtained from the interview by phone or direct household survey. From the casualties list, a survey of 510 people, who are either the seriously injured victims or the relatives of fatal victims, was done by randomly selecting the households involved in road crashes. It should be noted that a large number of household survey was conducted, but few casualties were found. Level of crash severities, gender, age, education, occupation, road user types, and household income per capita were asked to identify which groups of people are at higher risks to be involved in the road crashes.

5.2 Survey Results

Table 1 summarizes the results of study in the first part to determine the involvement of poor people in road crashes. As the poverty line was used to classify poor and non-poor casualties, it was observed that among 510 surveyed people, 66% of them are poor casualties, and 34% of them are non-poor casualties. From the results, the poor people appear to have more involvement in the road crashes than the non-poor people. However, it should be noted that the findings do not consider the amount of trip made such as the number of trips and trip length. Therefore the comparison made between poor and non-poor does not present any exposure to the risk between poor and non-poor people.

For crash severities, 25% of poor people involved in the fatalities, while 14% of non-poor people involved in the fatalities. In fatal cases, the deaths are higher in the poor than non-poor, while in serious injury cases, the inverse proportion is observed between poor and non-poor. The reason of higher proportion of deaths in the poor may be due to the cost of full medical treatment which is hardly affordable by poor people.

In the comparison between male and female, the proportions of male involved in the road crashes are higher than those of female for both poor and non-poor people. Age group of 21-30 and 31-40 are the highest risk group involved in the road crashes with the proportion of 27% and 20% in the poor, and 22% and 22% in the non-poor, respectively. Similar trend was observed in poor and non-poor groups that as the age becomes older, the number of casualities is less. Therefore, the highest risk group of the road crashes is the group of people in early and middle age group who are working as the main income earner for their families.

According to Table 1, 73% of the poor casualties are educated at lower level than high school, while 17% was observed for the non-poor casualties. This finding implies that most of the poor involved in the road crashes are lower educated people when comparing to the non-poor. The occupation also shows that 63% of the poor casaulties are labor, seller, and driver, and 21% are unemployed. For the non-poor, the causalities are distributed into many occupations, such as government servant (21%), unemployed (21%), self-employed (14%), student (11%), government officer (10%), and others. The findings support the previous studies in other countries that most of casualties are people who are in the lower social economic class.

Pedestrian is the highest risk group involved in road crashes for both poor and non-poor as can be seen that 60% of the poor and 50% of the non-poor casualties are pedestrians. The second highest group of the casaulties is public car for the poor, and bicycle, passenger car, and public car for the non-poor. It still insists that vulnerable road users are at higher risk group to the road crashes in Yangon for both poor and non-poor.

Table 1. Survey results to determine the involvement of poor people in road crashes

	Poor		**Non-Poor**	
	Number	Percent	Number	Percent
Involvement in road crashes	**335**	**66**	**175**	**34**
Crash Severities				
Fatality	84	25	24	14
Serious Injury	251	75	151	86
Total	335	100	175	100
Gender				
Male	245	73	112	64
Female	90	27	63	36
Total	335	100	175	100
Age				
0-10	15	4	7	4
11-20	43	13	24	14
21-30	91	27	38	22
31-40	67	20	38	22
41-50	52	16	28	16
51-60	39	12	23	13
61-70	21	6	12	7
71-80	7	2	4	2
Over 80	0	0	1	1
Total	335	100	175	100
Education				
Higher than Bachelor	0	0	3	2
Bachelor	3	1	66	38
College level	12	4	35	20
High school	78	23	42	24
Secondary school	129	39	21	12
Primary school	91	27	5	3
No education	22	7	3	2
Total	335	100	175	100
Occupation				
Farmer	10	3	1	1
Government officer	0	0	18	10
House keeper	7	2	9	5
State enterprise employee	7	2	15	9
Self-employed	4	1	25	14
Student	12	4	19	11
Unemployed	72	21	36	21
Others (government servant)	13	4	37	21
Others (labor, seller, driver, etc.)	210	63	15	9
Total	335	100	175	100
Road User Type				
Pedestrian	200	60	88	50
Bicycle	43	13	25	14
Motorcycle	4	1	13	7

Three wheelers	17	5	2	1
Passenger car	5	1	22	13
Public car	55	16	22	13
Truck	11	3	3	2
Total	335	100	175	100

6. IMPACT OF ROAD CRASHES ON POOR AND NON-POOR HOUSEHOLDS

The impact of road crashes can affect the household economically, socially and emotionally, even only one person in the family involved in the crash. Particularly, if the road victims are the sole earners or the family leaders, their deaths can possibly reduce household incomes and increase other expenses due to the road crashes, such as the funeral cost and/or medical treatment cost. On the other hand, serious injuries also have long-term negative impacts on household incomes, food consumption, number of household assets, and housing condition of the households. Moreover, the serious consequences from the road crashes can cause debts to the household due to borrowing money or pawning assets to cover expenses from the crashes.

This part of the study uses the questionnaire survey to identify the differences of the impacts of road crashes to the poor and non-poor households, and to assess the economic status of the household before and after involvement in the road crashes.

6.1 Data Collection

The data collection was only focused on the death and serious injuries within the past one year (in 2010) so that the road crash victims or their family members can remember their social economic status before the crashes, and the consequences after the crashes. The lists of road crash victims were obtained from the traffic police record for the past one year. The data was then collected from the household survey of road crash victims in 8 districts in Yangon, Shwe Pyi Thar, North Okkalapa, South Okkalapa, Mingalardon, Hlaing Thar Yar, Thingyungun, Insein, and Thekata. The selected districts include both poor and non-poor households. A total of 76 poor households and 74 non-poor households were equally selected by using their post-crash household income per capita to classify between poor and non-poor.

6.2 Questionnaire Design

The questionnaire survey was designed to include the information which can be grouped into five sections as follows:

Section 1: Respondent Information such as name, relationship to victims, household district, gender, number of people in the household

Section 2: Victim Information such as type of crash severities, victim gender, victim age, marital status, education, occupation, road user type, and household responsibility

Section 3: Loss of Cost such as medical treatment cost, funeral cost, transportation cost for medical treatment, vehicle damage cost

Section 4: Consequences of Road Crashes to Households – The following questions were asked to the respondents:

- How long is the disability period of the victim?
- Does the family need to borrow money?
- Does the family need to pawn the assets?
- What is the time period for injury treatment?

- Is there at least one family member taken leave from job to take care of victim?
- Is there a loss of income for the person taken leave from job to take care of victim?
- After the crash, do the children in the family permanently taken leave from the school?
- Does the victim lose a job that he/she did before the crash?
- Does the victim receive any compensation from the road crash?

Section 5: Household Assets – The respondents were expected to answer the following questions in three periods, before the crash, post-crash within recovery period, and post-crash after recovery period. These questions are to compare the economic conditions and quality of life before- and after the crash, within and after recovery periods.

- Household income
- Food consumption
- Number of household assets (e.g. car, motorcycle, bicycle, refrigerator, washing machine, TV)
- Housing condition (e.g. brick and concrete, wooden, thatch roof and bamboo)

It is expected that the victim may have more financial difficulties within the recovery period rather than after recovery period.

6.3 Impact of Road Crashes: Comparison between Poor and Non-Poor

Table 2 shows the comparison of the loss of cost and the consequences of road crashes between poor and non-poor households. The hypothesis test was conducted to test the difference of sample means. The results of t-test reveal that in the fatal cases, funeral cost and vehicle damage cost are significantly different between poor and non-poor households at the 10% level. The non-poor households spend more funeral cost and vehicle damage cost than poor households. The medical treatment cost and transportation cost are not significantly different between poor and non-poor households. It is clear that these costs incurred are considerably higher than their average family income. The consequences of road crashes therefore become a serious burden to lower income households.

For the serious injury cases, the medical treatment cost and transportation cost are significantly different between poor and non-poor households at the 5% level. The non-poor households spend more medical treatment cost and transportation cost for medical treatment than poor households. However, the medical cost of 437,027 kyats and transportation cost of 32,351 kyats are also a greater burden especially for poor households because the sum of these costs is much higher than their average household income (Table 2).

To compare the consequences of road crashes in the fatal cases between poor and non-poor households, Table 2 shows that poor households are more likely to borrow money or pawn the assets than non-poor households. Similar trend was observed in the serious injury cases. Nevertheless, it seems that at least one of the household members has to take care of the victim in case of serious injury, and that person will face a significant loss of income, especially for non-poor people. Even though the difference is not statistically significant, it is likely that more victims from poor households will lose a job after the road crashes (32.4%) than those from non-poor households (29.7%). Due to a great burden to victim's family, 13.5%-16.2% of the children in the family have to permanently leave the school, and this impact seems to be more serious for the poor. About 50% of poor and non-poor households receive the compensation from the road crashes in the case of fatality. In the

case of serious injury, higher number of non-poor households (62.2%) receives the compensation from the road crashes when comparing to poor households (43.2%).

Table 2. Comparison of loss of cost and consequences of road crashes between poor and non-poor

	Fatal			Serious Injury		
	Poor	Non-Poor		Poor	Non-Poor	
Average Household Income	67,846	106,432		65,351	105,676	
Loss of Cost						
Medical Treatment Cost (Kyats)						
Mean	25,128	59,730		437,027	704,054	**
Funeral Cost (Kyats)						
Mean	344,359	409,459	*			
Transportation Cost for Medical Treatment (Kyats)						
Mean	2,308	8,378		32,351	57,811	**
Vehicle Damage Cost (Kyats)						
Mean	4,103	10,405	*	7,162	40,135	
Consequences of Road Crashes						
Need to Borrow Money						
Yes	46.2%	21.6%	**	67.6%	40.5%	**
No	53.8%	78.4%		32.4%	59.5%	
Need to Pawn Assets						
Yes	33.3%	16.2%	*	29.7%	40.5%	
No	66.7%	83.8%		70.3%	59.5%	
Taking Care Person Income Loss (Kyats)						
Mean				31,330	76,486	***
Victim lost a job						
Yes				32.4%	29.7%	
No				67.6%	70.3%	
Children in a household permanently taken leave from schools						
Yes	16.2%	5.1%		13.5%	10.8%	
No	83.8%	94.9%		86.5%	89.2%	
Compensation Receipt						
Yes	51.3%	51.4%		43.2%	62.2%	
No	48.7%	48.6%		56.8%	37.8%	

Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level.

Table 3 shows the changes in the economic conditions and quality of life for poor and non-poor households. The comparison was made between before crash and post-crash within recovery period, and before crash and post-crash after recovery period. For the serious injury cases, the recovery period is the time duration when the victims are still under the medical treatment due to the injury from road crashes. For the fatal cases, the recovery period is the time duration when the family is taking care of the funeral cost and facing difficult situation because of a loss of their family member.

The results from Table 3 illustrate that the household income, the food consumption, the number of household assets, and the quality of housing condition decrease after the road deaths or serious injuries. Although the reduction of some of these economic conditions is not significant when comparing between poor and non-poor, the proportion of the reduction seems to be larger for poor households than non-poor households. According to the results, the impact on poor people seems to be more serious than non-poor people for both within recovery period and after recovery period.

Table 3. Economic status of the households after the crash

	Fatal			Serious Injury		
	Poor	Non-Poor		Poor	Non-Poor	
Within Recovery Period						
Household Income Reduction						
Yes	84.6%	70.3%		97.3%	97.3%	
No	15.4%	29.7%		2.7%	2.7%	
Food Consumption Reduction						
Yes	94.9%	89.2%		81.1%	56.8%	**
No	5.1%	10.8%		18.9%	43.2%	
Reduction in Number of Household Assets						
Yes	20.5%	16.2%		32.4%	13.5%	*
No	79.5%	83.8%		67.6%	86.5%	
Lower Quality of Housing Condition						
Yes	33.3%	10.8%	**	40.5%	24.3%	
No	66.7%	89.2%		59.5%	75.7%	
After Recovery Period						
Household Income Reduction						
Yes	84.6%	70.3%		51.4%	29.7%	*
No	15.4%	29.7%		48.6%	70.3%	
Food Consumption Reduction						
Yes	94.9%	89.2%		83.8%	43.2%	***
No	5.1%	10.8%		16.2%	56.8%	
Reduction in Number of Household Assets						
Yes	23.1%	21.6%		32.4%	13.5%	*
No	76.9%	78.4%		67.6%	86.5%	
Lower Quality of Housing Condition						
Yes	35.9%	13.5%	**	45.9%	27.0%	*

No	64.1%	86.5%	54.1%	73.0%

Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level.

6.4 Factors Affecting Consequences of Road Crashes

To evaluate the significant factors affecting the consequences of road crashes, the multiple linear regression and the logistic regression techniques were applied in this study. The data obtained from the survey are analyzed using multiple linear regression model and logit model so as to determine the factors that influence the lower of economic conditions and quality of life of the households due to the road crashes. The dependent variables in these regression models are listed in Table 4. The independent variables considered in the analysis, as summarized in Table 5, include individual characteristics of the road crash victims, such as gender, marital status, education, occupation, household responsibility, types of severities, economic condition, and income loss of taking care person. However, the test of multicollinearity indicates the existence of strong correlation between two variables: types of severities and income loss of taking care person (i.e. the pair-wise correlation coefficient is higher than 0.6). Only one of these two variables is therefore included in the preferred model selection.

Table 6 presents estimation results from the linear regression models and the logit models. The relative magnitude of estimated coefficients indicates the extent to which social economic characteristics of victims affect the consequences of the road crashes in terms of the economic conditions and quality of life of the victim's households.

Table 4. Definitions of the dependent variables

Variables	Definition	Category
Y1	Household income reduction within recovery period ($\text{Household Income}_{\text{before crash}} - \text{Household Income}_{\text{post-crash in recovery period}}$)	Continuous variable
Y2	Household income reduction after recovery period ($\text{Household Income}_{\text{before crash}} - \text{Household Income}_{\text{post-crash after recovery period}}$)	Continuous variable
Y3	Food consumption reduction within recovery period ($\text{Food Consumption}_{\text{before crash}} - \text{Food Consumption}_{\text{post-crash in recovery period}}$)	Continuous variable
Y4	Food consumption reduction after recovery period ($\text{Food Consumption}_{\text{before crash}} - \text{Food Consumption}_{\text{post-crash after recovery period}}$)	Continuous variable
Y5	Amount of money that the household needs to borrow from others	Continuous variable
Y6	Need to pawn the assets (1 if the household needs to pawn the assets, 0 otherwise)	Binary variable
Y7	Housing condition within recovery period (1 if the housing condition is in lower quality, 0 otherwise)	Binary variable
Y8	Housing condition after recovery period (1 if the housing condition is in lower quality, 0 otherwise)	Binary variable

Table 5. Definitions of the independent variables

Variables	Definition
X1	Gender (1 if the victim is male, 0 otherwise)
X2	Marital status (1 if the victim is married, 0 otherwise)
X3	No Education (1 if the victim is non-educated, 0 otherwise)
X4	Primary School (1 if the victim graduated at primary school level, 0 otherwise)
X5	Secondary School (1 if the victim graduated at secondary school level, 0 otherwise)
X6	High School (1 if the victim graduated at high school level, 0 otherwise)
X7	College (1 if the victim graduated at college level and higher, 0 otherwise) – Base case
X8	Business owner (1 if the victim is business owner, 0 otherwise)
X9	Student (1 if the victim is student, 0 otherwise)
X10	Unemployed (1 if the victim is unemployed, 0 otherwise)
X11	Seller/labour (1 if the victim is seller or labor, 0 otherwise) – Base case
X12	Household responsibility (1 if the victim is sole earner, 0 otherwise)
X13	Type of severities (1 if the victim is fatal, 0 otherwise)
X14	Income loss of a person who need to take care of a victim after the crash. (1 if there is an income loss, 0 otherwise)
X15	Economic condition of victim's household (1 if the victim household is poor, 0 otherwise)

In Model 1, a dependent variable in this multiple linear regression analysis is the reduction of household income within the recovery period. It is found that the coefficients of all independent variables except 'Gender' are statistically significant at the 1-10% level; however, the signs are varied depending on the effect of each variable. Lower educated victims cause less impact on their household income reduction. This could be explained that lower educated victim earns less income; thus resulting in less impact on the reduction of household income. Students and unemployed victims have little impact on the reduction in the household income because they do not earn any income to their family. If the victims are the business owner, there will be a great impact on their household income reduction as the victims can earn much more income to their family. If the road crash victims are the sole earner of the family, a great loss in the household income is observed. Within the recovery period, if there is at least one family member taken leave from his/her job to take care of the road crash victims, the household income is significantly reduced. The results also show that it is likely to have more household income reduction in non-poor family than poor family. It could be explained due to the fact that the victims from non-poor households can earn higher income than those from poor households, and this causes a great loss to the non-poor household income.

In Model 2, a dependent variable is also the reduction of household income, but after the recovery period. The coefficient signs of significant variables 'Business', 'Student', and 'Unemployed' remain unchanged as found in Model 1. In addition, 'Severity' variable is found to be significant at the 1% level, and the positive sign implies that if the victim is dead due to the crash, there will be a greater impact on the household income than the serious

injury case. This is because, after recovery period, the serious injured victims could be recovered from the crash and return to work, resulting in less impact on their household income.

Model 3 and 4 present factors affecting the food consumption reduction within and after recovery periods. The student and unemployed victims cause less reduction in the food consumption of the household in both models. However, in Model 3, the negative sign of 'Sole earner' variable shows that as the victim is the sole earner of the family, there is less impact on the food consumption reduction. In Model 4, the 'Severity' and 'Economic Condition' variables are significantly affect the food consumption reduction after recovery period.

In Model 5, a dependent variable is the amount of money that the victim's family has to borrow from others to cover the burden due to the road crash. 'Business' and 'Severity' variables are significant at the 1-5% level. The negative coefficients of both variables reveal that if the victims are business owner, or if they are dead in the road crash, their family will borrow less money to cover expenses due to the road crash.

Model 6, 7, and 8 present the estimation results from the logit models. A dependent variable in Model 6 is the need to pawn the assets. It is found that if the victims are the family sole earners, the household tends to pawn the assets after the road crash. In addition, if at least one family member has to leave a job and take care of the victims, there is a potential that the household has to pawn the assets as well. Model 7 and 8 reveal that as the victims become sole earners of the family, or at least one family member has to leave a job and take care of the victims, or the victims come from poor household, the household tends to have a negative impact in the lower quality of housing condition. This could be due to the impact of lower income in the poor household after the crash that could push the victim's family living in poorer housing condition.

Table 6. Coefficients of models for consequences of road crashes

Variables	Model 1: Household Income Reduction within Recovery Period (Y1)	Model 2: Household Income Reduction after Recovery Period (Y2)	Model 3: Food Consumption Reduction within Recovery Period (Y3)	Model 4: Food Consumption Reduction after Recovery Period (Y4)	Model 5: Amount of Money borrowed from Others (Y5)	Model 6: Pawn the Assets (Y6)	Model 7: Housing Condition within Recovery Period (Y7)	Model 8: Housing Condition after Recovery Period (Y8)
Gender (X1)	-266.65	1,314.80	-1,452.77	-865.74	20,918.27	-0.405	-0.759	-0.465
Marital Status (X2)	**7,133.19 ***	1,657.57	-1,389.34	-756.22	6,795.90	0.358	0.027	-0.264
No Educated (X3)	**-18,130.00 ****	497.18	3,783.69	2,825.42	-23,916.15	-0.258	0.516	-0.092
Primary (X4)	**-20,129.06 *****	-7,227.12	77.39	115.48	-7,481.58	**1.708 ****	**1.575 ****	1.298
Secondary (X5)	**-18,961.78 *****	-6,168.91	142.90	1,395.78	-19,452.38	1.009	0.522	0.100
High Sch. (X6)	**-17,111.03 *****	-7,733.49	1,960.88	1,506.51	-39,044.07	**1.804 ****	0.730	0.649
Business (X8)	**16,647.22 ****	**13,109.52 ****	-4,673.01	-3,229.03	**-181,853.30 ****	-0.521	0.228	0.921
Student (X9)	**-19,699.16 *****	**-10,762.64 ***	**-11,454.30 *****	**-9,012.37 *****	-75,724.50	-0.674	-0.208	-0.603
Unemployed (X10)	**-23,107.81 *****	**-24,730.18 *****	**-5,435.10 ****	**-6,619.07 *****	-22,930.11	-0.987	-0.444	-0.495
Sole earner (X12)	**19,170.27 *****	-733.72	**-5,454.81 ****	-3,693.60	-8,116.97	**1.440 ****	**1.948 *****	**1.818 *****
Severity (X13)		**19,889.21 *****		**8,899.63 *****	**-146,535.50 *****			
Income loss of taking care person (X14)	**15,769.45 *****		-2,407.55			**1.354 *****	**1.272 *****	**1.442 *****
Economic Condition (X15)	**-8,598.59 ****	-606.43	2,458.34	**4,168.76 ****	-6,445.11	0.173	**0.985 ****	**1.225 ****
No. of obs.	150	150	150	150	150	150	150	150
Adj. R^2	0.386	0.278	0.122	0.303	0.019			
Log likelihood						-77.280	-74.062	-75.51

Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level,
* indicates significance at the 10% level.

7. SUMMARY AND DISCUSSION

This paper attempts to investigate if poor people in the city of Yangon, Myanmar are more likely to involve in road crashes and to identify the social consequences of road crashes in the poor and non-poor households. The study is divided into two parts. The first part is to study the involvement of the "poor" people in the road crashes. The second part is to assess the impact of road crashes on poor and non-poor families in terms of social consequences such as household income reduction and quality of life after the crashes.

In the first part of the study, the poor people appear to have more involvement in the road crashes than the non-poor people. Poor people are more likely to be dead in the road crashes than non-poor people which could be due to the fact that poor people cannot afford to pay for the full medical treatment. In Yangon, most people involved in the road crashes are those in the age between 21-40 years old which is early and middle age of the working group in the country. Most of the poor involved in the road crashes are lower educated people, and work as labors, sellers, and drivers, while non-poor people involved in the road crashes are higher educated, and work in higher class of occupations. Pedestrian is in the highest risk group involved in the road crashes for both poor and non-poor.

The second part of the study uses questionnaire survey to identify differences in the impacts of road crashes to the poor and non-poor households, and to assess the economic status of the households before and after involvement in the road crashes. The results reveal that non-poor households spend more funeral cost and vehicle damage cost than poor households in case of fatality, and non-poor households spend more medical treatment cost and transportation cost for medical treatment than poor households in case of serious injury. Poor households are more likely to borrow money or pawn the assets than non-poor households after the crashes. The consequences of road crashes such as the household income reduction, the food consumption reduction, the number of household assets, and the quality of housing condition seem to be worse in both fatal and serious injury cases. However, the reductions of these economic conditions are not significantly different between poor and non-poor.

To evaluate the significant factors affecting the consequences of road crashes, the multiple linear regression and the logistic regression techniques were applied in this study. The occupation of victims seems to affect the consequences of road crashes in terms of household income reduction, food consumption reduction, and the amount of money borrowed from others. The household responsibility as sole earner significantly affects household income reduction, food consumption reduction, quality of housing condition, and the need to pawn the assets. If at least one family member taken leave from his/her job to take care of the road crash victims, it is more likely that the consequences of road crash seem to be worse. Non-poor family tends to have a greater loss in the household income than poor family due to the fact that before the crashes, the victims from non-poor households can earn more income than those from poor households.

Evidences was found in this study that the poor is at a higher risk to the road crashes than the non-poor, and non-poor family can become poorer after the crashes as can be seen in a significant loss of their income. This study provides the implications that there is a great impact of the road crashes on both poor and non-poor families. The road crashes can cause more poverty to the families whose family member is involved in the crash. To alleviate the

poverty problem especially in the developing countries, like Myanmar, more efficient road safety policies should be implemented to reduce the number of deaths and injuries from road crashes. For example, road safety education such as rules and regulations is needed to be disseminated especially among poor people. Other alternatives of transportation mode such as public transport and safer road infrastructure for the pedestrian should be provided. Lastly, it is needed to provide better pre-hospital and trauma care including the rehabilitation program especially for poor casualties who normally have difficulties to access to full medical services.

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