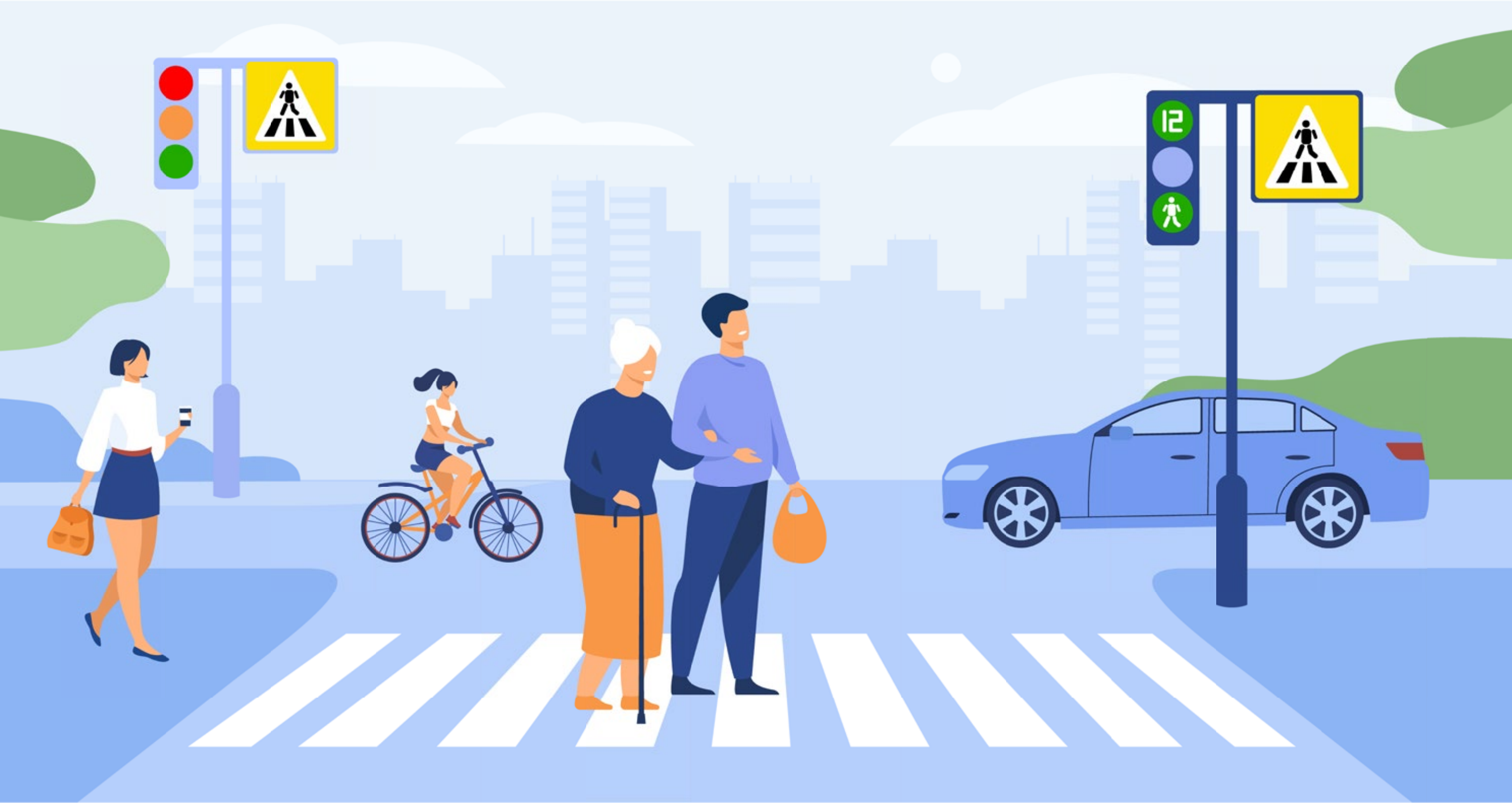
ROAD TRAFFIC ACCIDENTS IN CAMBODIA

Contents

Acronyms

CDC	Centers for Disease Control and Prevention
CSES	Cambodian Socio-Economic Survey
GDP	Gross Domestic Product
GSNRSC	General Secretariate of National Road Safety Committee
MPTW	Ministry of Public Works and Transport
NRSC	National Road Safety Committee
PPP	Phnom Penh Post
RTSD	Road Traffic Safety Department
RCIVS	Road Crash and Victim Information System
RTA	Road Traffic Accident
UNDP	United Nations Development Programme
WHO	World Health Organization



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Executive Summary

Human and economic costs

Road traffic accidents are a leading cause of death in Cambodia. An average of 5.4 people die every day from traffic accidents in Cambodia, making it the sixth leading cause of mortality, greater than all deaths from HIV/AIDS. As a middle-income country Cambodia now faces the mortality and morbidity challenges that come with increased levels of prosperity.

Road traffic accidents impose a major economic burden. This report re-estimates the cost of road traffic accidents in Cambodia for the first time in 10 years and finds this to be $466.8 million for 2019, equivalent to 1.7% of annual GDP. Of this total cost, 88.8% is due to loss of life and associated lifetime earnings.

Factors associated with traffic accident fatalities

Road user behaviour is the deciding factor in road accident fatalities. The report shows that once we control for other variables, the dominant factors associated with loss of life in traffic accidents are the "fatal four": use of alcohol and drugs, speeding, ignoring traffic rules and use of phone while driving. When these "fatal four" behaviours are present, the likelihood of loss of life in a traffic accident are between 3 and 3.5 times significantly higher, as compared to otherwise.

Surrounding conditions matter, but much less so than behaviour. Factors such as road quality, weather, time of day are significant but much less so than the "fatal four" of alcohol and drugs, speeding, ignoring traffic rules, and phone use while driving. For example, use of alcohol or drugs while driving are associated with loss of life three times more than poor road conditions.

Timely medical response saves lives. First aid at the scene is associated with loss of life by a log-odd of 1.3, and a response from an ambulance, by a log-odd of 0.7.

Wearing a crash helmet on a motorbike and a seatbelt in a car is always important, but avoiding the "fatal four" of alcohol and drugs, speeding, ignoring traffic rules and use of phone while driving, is even more important. Use of a helmet or seatbelt is associated with reducing the likelihood of loss of life by a log-odd of 0.2. Avoiding alcohol or drugs is more than 17 times the more significant factor.

Policy implications

Behaviour change is key. This suggests that policy should focus on attitudes of drivers to create awareness and motivate safer driving. That could include education programmes at school to help future generations of road users protect themselves and others.

Reduce alcohol consumption. Non-communicative diseases are the leading cause of mortality in Cambodia, and poor health outcomes are linked to unhealthy behaviours such excessive consumption of alcohol. Policies that can reduce this disease burden by reductions in alcohol use can also reduce road accident fatalities.

Emergency response is essential. There are a series of time sensitive actions that are essential to provide effective care for the injured, beginning with activation of the emergency care system and continuing with care at the scene, transport, and hospital-based emergency care. To activate the emergency care system, ideally there should be a single telephone number that is valid throughout the country, easy to remember and available toll-free.


SONY
TOYOTA

1. Introduction

Sustainable and resilient transport is key to sustainable development and is among the cross-cutting issues of relevance for progress towards achieving several of the sustainable development goals and targets. Road safety is also an important sustainable development issue as illustrated by its express inclusion in the 2030 Agenda for Sustainable Development.

The need for improving road safety has been acknowledged by the United Nations and its Member States for over 60 years, with extensive work being carried out particularly by the United Nations regional commissions, the World Health Organization (WHO), and the World Bank. Nonetheless, deaths and injuries resulting from road traffic crashes remain a serious problem globally and current trends suggest that this will continue to be the case in the foreseeable future. Road traffic crashes account for 2.2% of all deaths globally (WHO 2018).

In Cambodia, approximately 5.4 people died every day from road traffic accident in 2019. According to the Centers for Disease Control and Prevention (CDC), it was ranked as the sixth major cause of death in Cambodia following stroke, lower respiratory infections, cirrhosis, ischemic heart disease, and neonatal disorders. Three major factors account for this including an increase in the number of vehicles, an imbalance in ratio between road infrastructures and vehicles and poor driving behavior were identified as the main causes (PPP 2020).

Concerted efforts and commitments have been made by the government, development partners and other relevant stakeholders to minimize road traffic accidents. Nevertheless, without knowledge of the magnitude of the problem and the risks of death and injury, the ability to implement context-specific and appropriate interventions is severely limited. To fill this gap, the Ministry of Public Works and Transports (MPWT) and United Nations Development Programme (UNDP) collaborate to undertake a study on road traffic accident in Cambodia.

This report is intended to stimulate actions to improve road safety in Cambodia through the identification of (1) the economic and social costs of traffic accidents, and (2) identifying the key drivers of accidents including problematic localities. More specifically, the objective of this study is twofold. First, the study attempts to estimate the economic cost of road traffic accidents in Cambodia by revisiting the former methodology, reviewing its adequacy and MPWT's in-house capacity to undertake the analysis and subsequently updating these or proving alternatives. Secondly, it explores the determining factors, which explains the causes of fatal accidents and deaths by using econometric method.

A number of activities were undertaken to ensure that the report considers every aspect required within a given time frame. First, consultative meetings were held with the technical team at the Road Traffic Safety Department (RTSD) and with senior policy makers of MPWT to discuss expectation of the study and to verify the findings and policy recommendation. Second, existing methods employed for estimating the economic cost of road traffic accidents in Cambodia and literature related to causes of fatal accident or those of death due to road accident were carefully reviewed to identify gaps for improvement. Third, based on the discussion and review, a new methodology is proposed to estimate the economic loss due to road traffic accidents. Fourth, secondary data were collected from MPWT and other sources and the estimation of economic loss of the road traffic accidents and analysis of the causes of fatal accident and dead were undertaken.

The rest of this report is divided into four sections. Section 2 discusses how the data is generated and collected. Section 3 provides descriptive statistics on key variables overviewing the road traffic accidents. Section 4 analyzes the causes of fatal accident and dead using logistic regression and discusses the findings from that analysis. Section 5 is the conclusion section which also discusses policy recommendation to minimize the cost and number of the traffic road accidents in Cambodia based on the findings from previous sections.

2. Data

The Road Crash and Victim Information System (RCVIS) was initiated and developed by Handicap International, in close collaboration with the Ministry of Public Works and Transport, the Ministry of the Interior, and the Ministry of Health. Data are reported by traffic police and health facilities nationwide.

Currently, the Ministry of Health and the Ministry of Interior are in charge of data collection at the provincial level and provide a soft copy to the General Secretariate of National Road Safety Committee (GSNRSC). The GSNRSC combines data from the Ministries of Health and Interior using a data linkage system developed with support from the Institute for Road Safety Research (SWOV) of the Netherlands, in the framework of twinning under the International Road Traffic and Accident Database. Duplicate entries are automatically identified. Work is ongoing to assess the level of underreporting. Most of the data are available from 2006. Data presented in this report covers the period of six years from 2014 to 2019.

Figure 1: Data Generation Process

It is worth noting that this is a large-pooled cross-section dataset which recorded accident-based data (RTA incidents), consisting of 59 variables, covering six-year periods from 2014-2019 with 80,398 observations. While the full dataset was used to run the logistic regression analysis in Section 5, only dataset in 2019 was used for estimating the annual economic loss in Section 4.


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3. Summary statistics

Results of summary statistics from 2014-2019 RCVIS pooled data analysis indicates that accidents are more likely to happen during the weekends (Figure 2). The number of fatal and serious accidents increase gradually from Tuesday through Friday and remarkably from Friday through Sunday. This can be due to the possibility that most social events are organized on those days when everyone is released from work. People tend to consume drinks that contain alcohol substance on weekends during their social gatherings which may result in drunk driving and consequently leads to road traffic accidents.

The comparison of the number of accident cases throughout the six-year period shows that the number of total injuries generally tends to be on declining tend but the number of seriously injured likely remains high and stable over time (Figure 3). This seems to suggest that efforts to fight RTA made by the government and relevant stakeholders are effective in terms of containing the number of seriously injured but not significant to reduce the total cases of injuries. The latter can be partly explained by the fact that the number of vehicles including cars and motorbike keeps increasing every year thanks to growing population and rising income.

A contrast between types of accidents with hours of the days gives an interesting result (Figure 4). The number of seriously injured and fatal accidents tends to pick at 6 PM, when the sun almost set and when drivers recklessly rush to go home from work before dark. Like many other developing countries, Cambodia traffic system, albeit improved, continues to suffer from a lack of investment on various equipment including road signs. Traffic light and street lighting, which might seem insignificant in terms of cost effectiveness, may be a necessary condition to save human life at night.

Over 2014-2019, number of road traffic accidents along the one-digit National Roads are higher than two-digit and three-digit National Roads. These roads are considered the most dangerous roads in Cambodia due to the occurrence of traffic accidents and limited management by authorities. Furthermore, the roads are congested and in need of maintenance. These roads were built especially for the transport of goods between the capital and the borders and to the port, by heavy trucks and container. From RCVIS data analysis, there were more than 3,500 accident cases recorded to have happened along National Road 5 (Figure 5).

Breaking down injuries by seriousness reveals that more than half of the total injuries are either fatal or serious (Figure 6). While the percentage of fatal injuries is relatively smaller, existing literature shows that the economic and social cost it incurred is significantly higher than all other injuries combined.

Although economic growth has benefited and improved the standard of living of the Cambodian population, a death of a family member could still impoverish the whole family. Thus, this is particularly a major concern for policy makers and related stakeholders who are keen on working to eradicate poverty and reduce deaths due to road accidents. The next section is devoted to giving an estimation cost of road traffic accidents in Cambodia which comprises of fatality cost and other costs.

Figure 2: Most Accidents Happen at Weekends (2014-19)

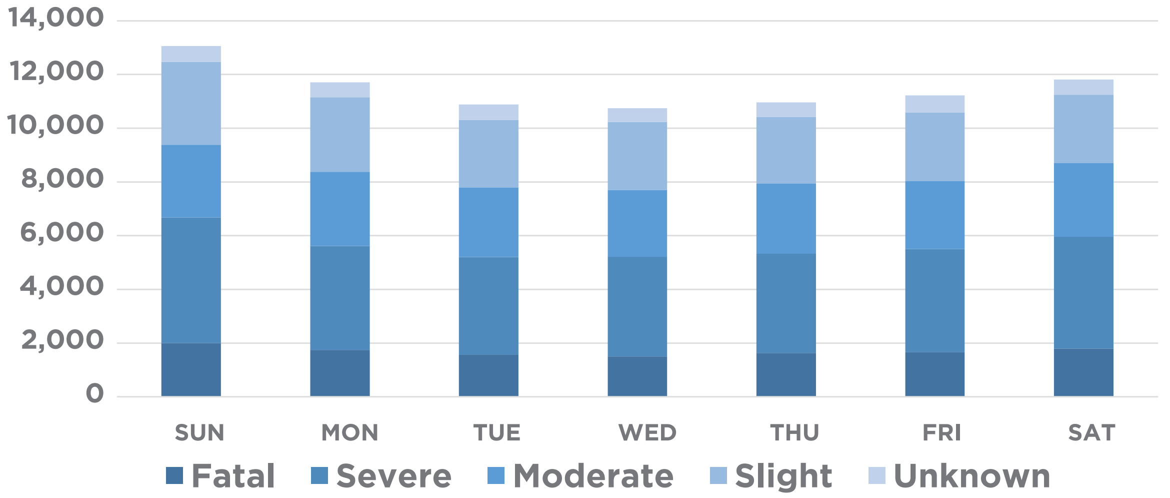


Figure 3: Injuries falls but more serious stable (2014-19)

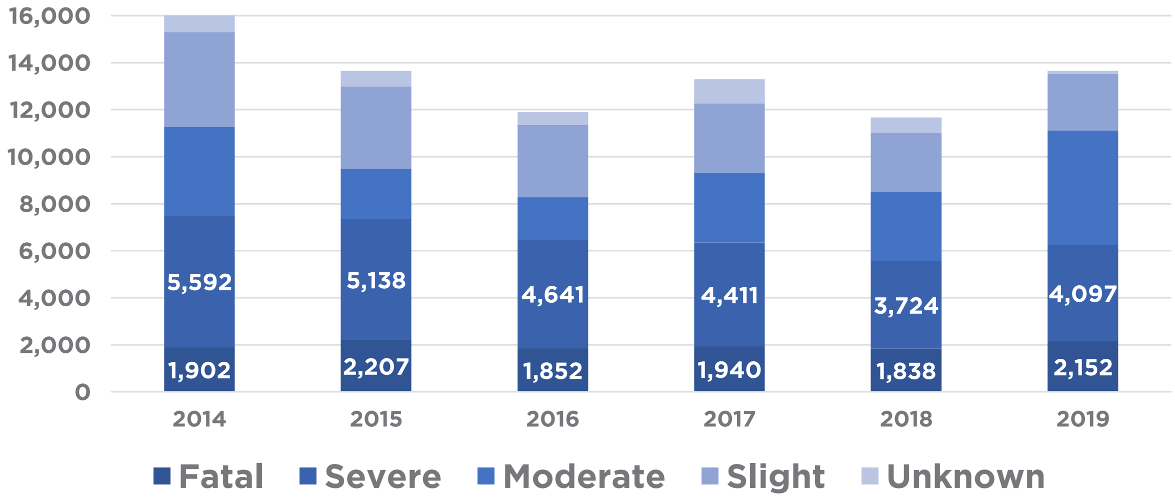


Figure 4: Severity of Accident: Time of Accident Peaks at 6 PM (2014-19)

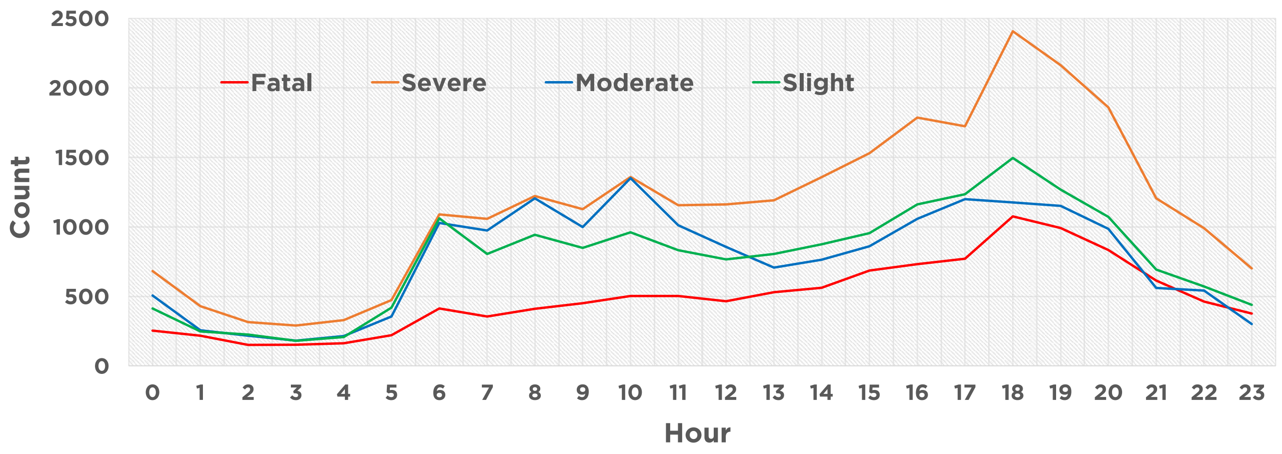


Figure 5: NR where Most Accidents Occur (2014-19)

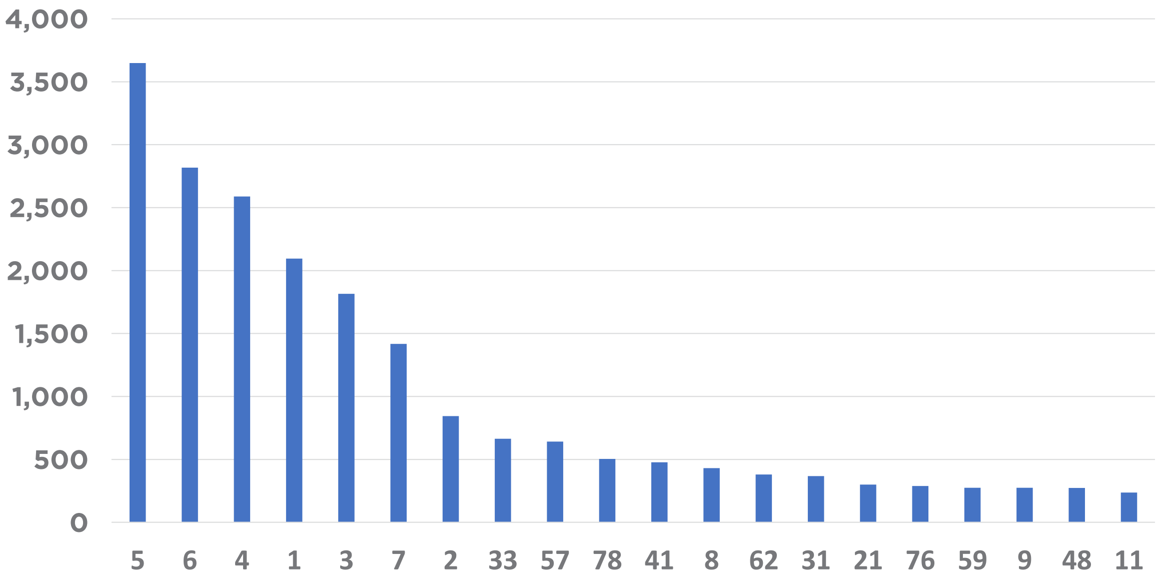
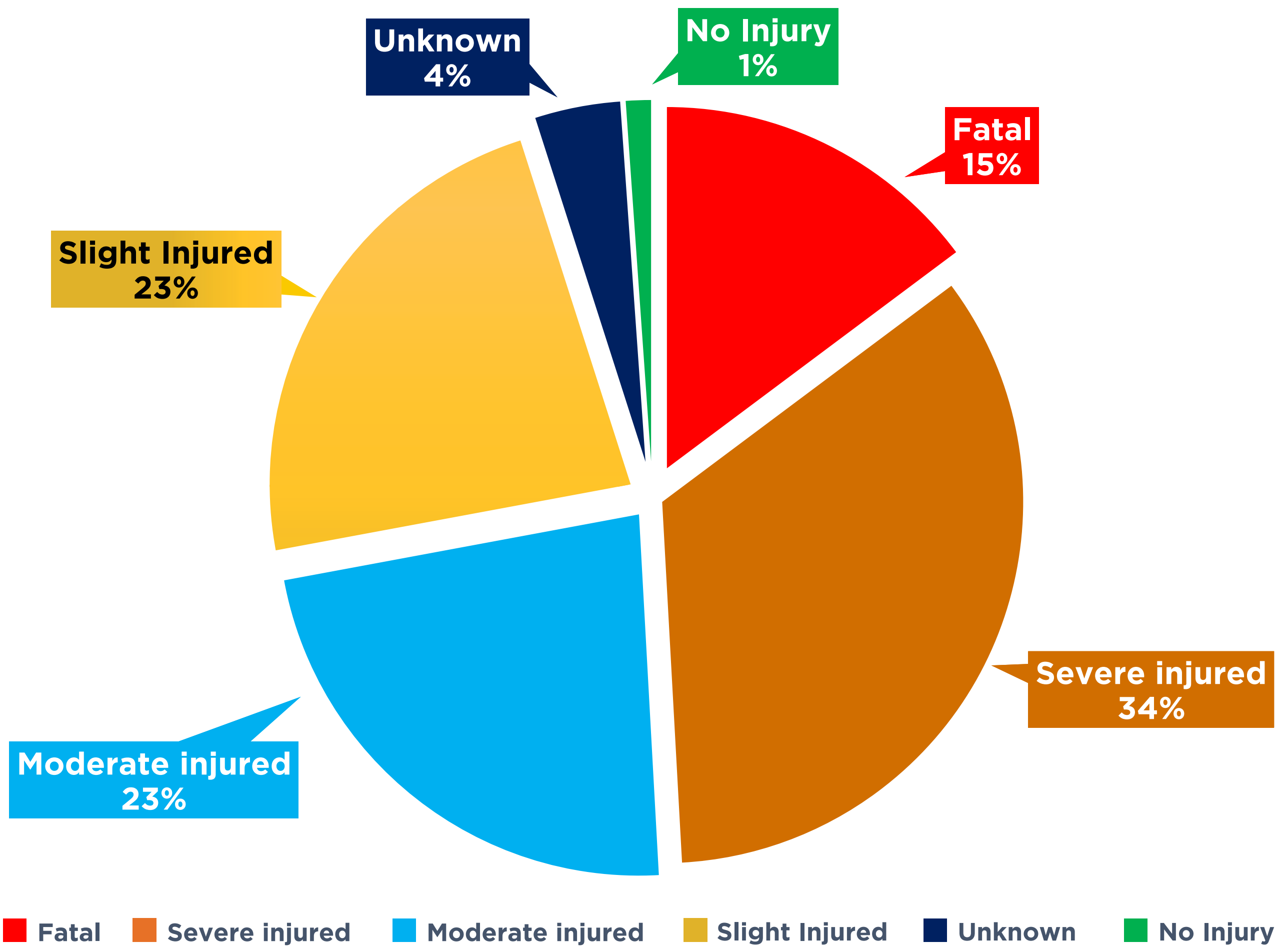


Figure 6: Nearly 50% Injuries are Fatal and Serious (2014-19)




CALTEX
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HONDA
HONDA

4. Cost of Traffic Road Accident

4.1 Methodology

There are numerous ways to undertake cost analysis. The commonly used methods include (1) Gross output or human capital approach, (2) Net output approach, (3) Life-insurance approach, (4) Court award approach, (5) Implicit public sector valuation approach, (6) Value of risk change or willingness to pay approach. A summary of these approaches is given in the box below.

Box 1: Various approaches for costing road traffic accident

A) The gross output or human capital approach: In this method the cost of a fatal casualty is the loss of future output, which equivalent to foregone earnings.

B) The net output approach: the cost of an accident is equivalent to the gross output figure minus the discounted value of the victim's consumption.

C) The life-insurance approach: the cost of an accident is directly related to sums typical individuals are willing to insure their own lives.

D) The court award approach: With this approach, the sums awarded by the courts to the surviving dependents of those killed or injured are regarded as an indication of the cost that society associates with the road accident.

E) The implicit public sector valuation approach: With this method an attempt is made to determine the costs and values that are implicitly placed on accident prevention in safety legislation or in public sector decisions taken either for or against investment programmes that affect safety.

F) The value of risk change or willingness to pay approach: with this method the value of a given improvement in safety (ie. a reduction in risk) is defined in terms of the aggregate amount that people are prepared to pay for it. That is the value of a particular safety improvement is defined as the sum of all the amounts that people (affected by the improvement) would be willing to pay for the (usually very small) reductions in risk provided by that improvement.

Source: Jacobs (1995): Costing Road Accidents in Developing Countries.

It is worth noting that the disability-adjusted life year or DALY is another approach commonly used by World Health Organisation (WHO) to measure losses of healthy year life due to diseases or Road Traffic Accidents. DALY is a summary measure of public health widely used to quantify burden of disease. In the DALY philosophy, every person is born with a certain number of life years potentially lived-in optimal health. People may lose these healthy life years through living with illness and/or through dying before a reference life expectancy. These losses in healthy life years are exactly what is measured by the DALY metric. Ten DALYs, for instance, correspond to ten lost years of healthy life, attributable to morbidity, mortality, or both. On a population level, diseases with a higher public health impact will thus account for more DALYs than those with a lesser impact.

This rapid assessment attempts to re-estimate the road traffic accident cost in Cambodia by employing the Gross Output or Human Capital Method which has been recommended by ADB and has been used to so far. Gross Output method is also the most common costing approach to calculate economic cost of road traffic accidents according to the World Health Organisation[1]. Nevertheless, it only follows the general concept, since the detail of the method is not available.

Following Human Capital Method above and considering the availability of data for this assessment, the Road Traffic Accident (RTA) cost can be expressed as below:

RTA Cost = Loss due to Fatality + Hospital Fee + Production Loss + Loss due to Disability + Vehicle Damage Cost + Public Asset Loss (1)

Loss due to Fatality: According to human capital approach a fatal casualty cost is the loss of future output, which equivalent to foregone earnings which can be expressed as equation below[2].

[1] https://apps.who.int/iris/bitstream/handle/10665/44122/9789241563840_eng.pdf;jsessionid=D52C4B43899B62F7FA3B6C069732121A?sequence=1

$$\textit{Loss due to Fatality or Disability} = \sum \frac{\hat{y}_i[((1+g)/(1+d))^T - 1]}{(1+g)/(1+d) - 1} \qquad (2)$$

Where

$\hat{y}$ is the expected yearly income of victim i (= minimum wage of garment sector x12)

g is the growth rate of income of victim i each year (=average past growth rate = 9.7%)

d is the discount rate (=5%, UN-REDD[3])

T is life expectancy less the age of fatality or disability

Hospital Fee = number of severely injured x $5,000

+ number of moderately injured x $2,500

+ number of slightly injured x $200

+ number of unknown x $200

+ number of fatal x $200 (3)

Productivity loss

= ((number of severely injured x 24)

+ (number of moderately injured x 12)

+ (number of slightly injured x 3))

x daily wage (4)

Vehicle Damage Cost $= \sum C_{ij} V_{ij}$ (5)

Where C_{ij} is the repair cost of vehicle type i, at the damage severity degree j

V_{ij} is the number of vehicle type i, at the damage severity degree j

It is worth noting the following points and assumptions:

- The administrative cost of RTA is not included due to absence of data (see Equation (1)).
- Loss due to fatality and disability is assumed to be equal to the net present value of the income of the fatal, multiplied by the remaining number of years expected to live if the victims did not meet accident (see Equation (2)).
- Hospital fee is calculated based on the assumptions that the severely, moderately and slightly injured would pay $5,000, $2,500 and $200, respectively, while the unknow and the fatal would pay $200 as well (see Equation (3)).
- The productivity loss is assumed to be equal to income multiplied by the number of days lost due to accident until fully recovered (see Equation (4)).
- Vehicle damage cost is equal to the sum of the repair fee by vehicle types and by severity of accidents.

4.2 Key Findings

- Total cost of RTA is around US$ 466.8 million in 2019, which is higher than costs estimated in previous years.
- Fatality cost took up 88.8% of the total cost of RTA, followed by hospital fee (7.2%) and disability loss (3.0%).
- The estimation cost is based on conservative assumptions and the estimation methodology could be improved by conducting surveys.

[2] G. William Dick (1974), "Determining the Present Value of Future Income", American Risk and Insurance Association.
[3] UN-REDD (2016): Cambodia REDD+ Costs and Benefits Spreadsheet tool 2016

Following Human Capital Cost calculation approach and using RCVIS data from MPWT, Road Traffic Accident (RTA) cost is estimated to be around US$ 466.8 million in 2019 up from US$ 350 million from previous estimation. The largest share of the cost comes from the loss due to fatality which makes up 88.8% of the total cost. This suggests that to reduce the RTA cost, there is a need to prevent fatality due to RTA.

Previous studies suggested that in Cambodia, among the major risk factors responsible for road traffic crashes and fatalities, the use of helmets (particularly at nighttime) and drunk driving are two that are especially important in Cambodia. Given that the police do not systematically test riders for alcohol, it is expected that many of the other causes of fatal crashes such as speeding or dangerous over-taking are also related to drunk driving.

Table 1: Estimation of RTA Cost in 2019

Variable	Obs	Cost (US$)	Key Assumptions
Fatality	2,152	414,584,785	Net present value of fatal victim income from the age of accident until reaching life expectancy
Hospital fee	13,654	33,570,500	Severely injured $5,000, moderate $2,500, died at scene/on the way/died at hospital $200, other $200
Production lost	11,425	1,417,201	Number of days lost x wage
Disability	63	14,159,871	Net present value of disable victim income from the age of accident until reaching life expectancy
Vehicle damage	13,654	2,693,702	Type of vehicles & severity of accidents
Public property lost	Cambodia	369,891	Public property loss due to TRA in 2019 (MPWT)
	Total	**466,795,950**	

Similarly, the use of helmets differs between nighttime and daytime hours, because during the daytime, wearing or not wearing helmets is more visible. During nighttime hours, it becomes more difficult to confirm helmet use among motorcycle riders and therefore more difficult to enforce. The result, as confirmed by our bimonthly observations, is that a very low proportion of motorcycle drivers—and even fewer passengers—wear helmets at night.

The same discrepancy was not observed for drink driving. The observational studies, which were conducted in collaboration with the police enforcement campaigns, revealed that between 2%-5% of drivers in the intervention sites had alcohol levels exceeding the legal limited by law on Road Traffic in Cambodia. When we surveyed motorists in the same areas about their drink driving habits, nearly 95% of them indicated that they never drink and drive. Although the observational study results appear to corroborate the survey results, the actual rate of drink driving in Cambodia is suspected to be significantly higher.

4.3 Ways Forward

As mentioned in the methodology section, this estimation is based on Human Capital Approach using available secondary data from MPWT. The estimation could further be improved as follows:

- The current estimate used average income in Phnom Penh and outside of Phnom Penh to calculate the loss due to fatality and the loss due to disability. This estimation could be improved if the next round of data collection conducted by the policy can include occupation of those who meet accidents as detailed in the occupation category of the Cambodian Socio-Economic Survey (CSES).
- Hospital fee calculation is based on the assumptions according to severity of accident. A proper survey to understand those costs by that will improve the accuracy of the estimate.
- Vehicle damage cost calculation is based on the assumptions according to severity of accident and type of vehicles. A proper survey to understand those costs by that will also improve the accuracy of the estimate.
- The total cost does not account for administrative cost. To fully capture the RTA cost, this cost also needs to be estimated and included.

5. Causes of Traffic Road Accident

Due to recent economic and technological developments, the number and quality of motor vehicles are rapidly increasing; however, alongside this increase, the number of accidents and deaths is also on the rise. Each year, approximately 1.5 million people die, and 60 million people are injured worldwide due to traffic accidents on the road. If effective measures are not taken, by the year 2030, the rate of traffic accident-related mortality is estimated to rise to the fifth highest rank globally among all other causes of death (WHO, 2010).

From 2014-2019, 80,398 traffic accidents occurred in Cambodia, according to the RCVIS data. With more or less 2,000 fatalities every year, road traffic accident ranks sixth among all known causes of death in Cambodia. The previous section of the current study shows that the economic cost of road crashes and injuries is estimated to be around US$ 466.8 million accounting for 1.7 % of the gross domestic product (GDP) of Cambodia in 2019. It is clear that there is a need to conduct a serious study on its causes as the problems caused by them seem to continue to increase in seriousness.

5.1. Descriptive Statistics

In this section, data related to 80,398 accidents that occurred in Cambodia between 2014 and 2019 are used for regression analysis. The description and levels of these variables are given in Table 2. These accidents comprise of 11,891 fatalities, 27,603 seriously injured, 18,454 moderately injured, 18,477 slightly injured, and 3,973 unknown.

Among the total number of accidents, 82% were found not wearing helmets or belts, 80% weren't carrying a driver's license, and 13% occurred during festivals, with most occurring during Khmer New Year (6% of total accidents). Youth seems suffer the most from fatal accident or serious injuries but they are found to be the ones who disobey traffic law, use drug and drink, and overspeed at the same time.

Figure 9: Youth Suffer Most Serious/Fatal Injuries

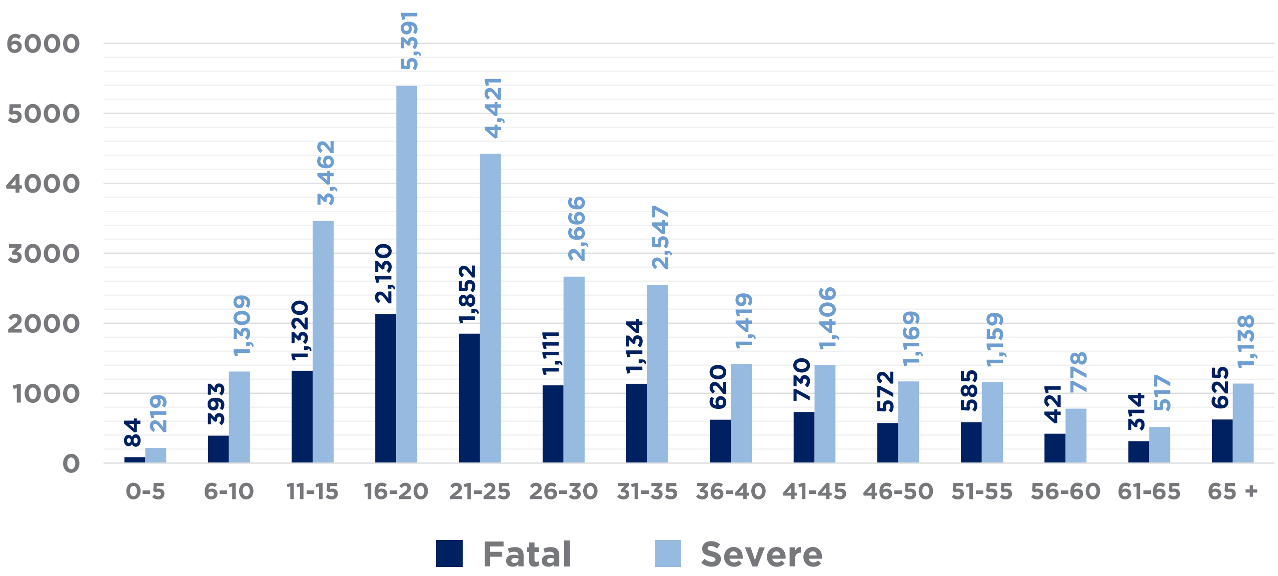
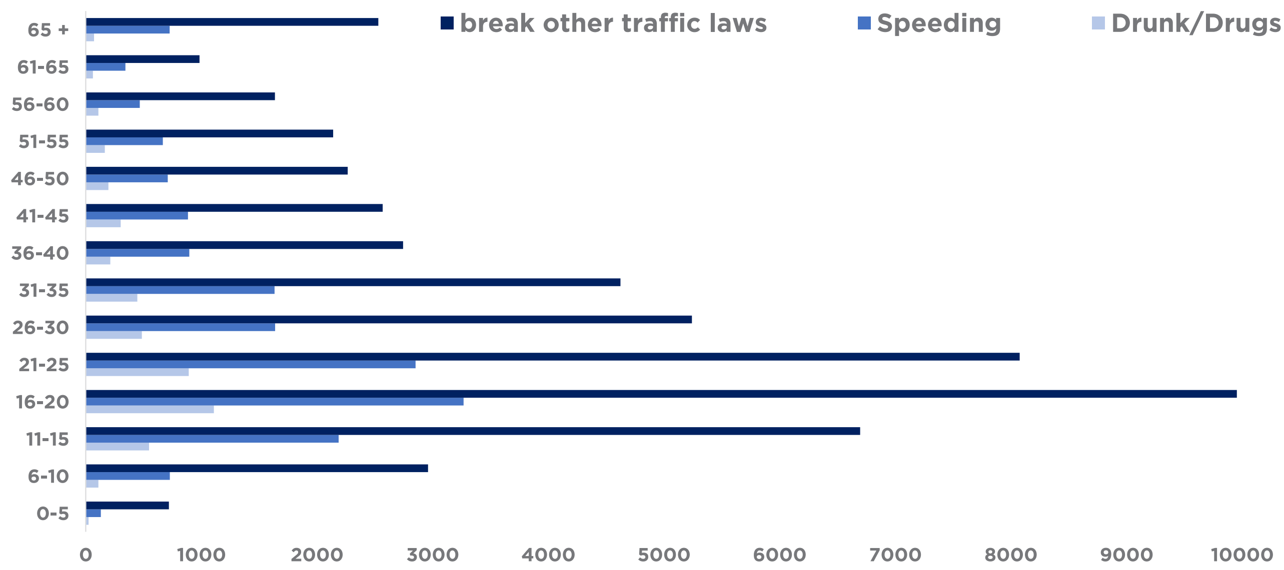


Figure 10: Most Cases of Drink/Drug & Speeding



However, the findings above are based on bivariate analysis which can be distorted by possibility of covariant relationships, intervening variables, and lack of precision. A more scientific method such as regression analysis is needed to explore the causes of fatal accident and death.

5.2. Regression Analysis

a. Model Specification

Many statistical methods have been used in research related to traffic accidents. Numerous logistic models have been constructed, including the following: Hilakivi et al. (1989), predicting accidents among young drivers; James and Kim (1996), determining the importance of child car seats in accidents; Tay, Barua, and Kattan (2009), determining the factors contributing to hit-and-run in fatal crashes; Tay, Shakil, and Hoong (2008), determining the factors related to hit-and-run accidents in Singapore; Murat and Uludag(2008), determining the route choice model of transportation network in Denizli using fuzzy logic model and logistic regression model and Chen, Pan, Wei, and Zhibin (2012), determining and predicting the factors affecting the seriousness of accidents occurring in crossroads.

Likewise, in this study, the logistic regression technique is applied to explore factors which contribute to fatal accident and death. Logistic regression analysis is widely used to test the significance of traffic accident risk factors for which the dependent variable is binary (Chen et al., 2012; Tay et al., 2008; Yan, Essam, & Mohamed, 2005). Logistic regression belongs to the group of regression methods that describe the relationship between explanatory variables and a discrete response variable. Binary logistic regression is appropriate for use when the dependent variable represents a dichotomy and can be applied to test the association between a dependent variable and the related independent variables (Yan et al., 2005). The independent variables can either be categorical or continuous in logistic regression. The regression model can be expressed as:

$$Y_i=\alpha+X_{1i}\,\beta_1+X_{2i}\,\beta_2+X_3\,\beta_3+X_4\,\beta_4+\varepsilon \qquad (7)$$

where

Y: Dependent variables (fatal accident and death)

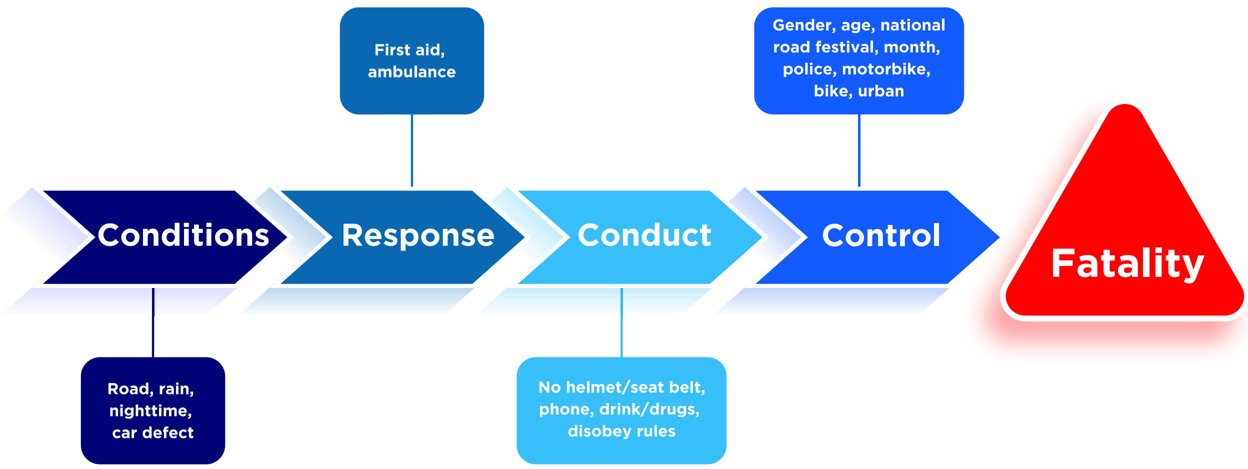
X_1: Condition variables (road defect, rain, night-time, and car defect)

X_2: Response variables (first aid and ambulance)

X_3: Conduct variables (helmet & seatbelt, driving license, hit & run, drink & drug, speeding etc)

X_4: Controlled variables (gender, age, urban, weekend, festival, bicycle, motorbike etc)

Figure 10: Causes of Fatal Accident or Death



b. Explanatory Variables

The explanatory variables include condition, response, conduct and controlled variables. As mentioned earlier, the condition variables are road defect, rain, night-time, and car defect variables. Response variables here refer to whether there is a first aid or ambulance provided after the accident. Conduct variables include helmet & seatbelt, driving license, hit & run, drink & drug, speeding, using phone, and rule disobey. The controlled variables involved variables such as driver's gender, driver's age, urban, weekend, festival, bicycle, and motorbike. The basic concepts of these variables and their relationships to the welfare are briefly explained below.

Table 2: Description of Variables and Expected Signs

Variable		Description	Expected sign
Dependent variables	fatal accident/death	1 = yes; 0 = no	
Condition			
	Road defect	1 = yes; 0 = no	+
	Rain	1 = yes; 0 = other	+
	Night	1 = yes; 0 = day	+
	Car defect	1 = yes; 0 = no	+
Response			
	First aid	1 = yes; 0 = no	-
	Ambulance	1 = yes; 0 = no	-
Conduct of driver			
	Helmet & seatbelt	1 = yes; 0 = no	-
	license	1 = yes; 0 = no	-
	Hit & run	1 = yes; 0 = no	+
	Drink & drug	1 = yes; 0 = no	+
	Speeding	1 = yes; 0 = no	+
	Phone	1 = yes; 0 = no	+
	Rule disobey	1 = yes; 0 = no	+

c. Regression Results

Table 3 presents the results of regression analysis based on logistic regression explores condition, response, conduct, and controlled variables affect dependent variables including involvement in fatal accident and death. It is worth noting that the explained variable "fatal accident" is the severity of accident, while the variable "death" refers to severity of injuries.

Table 3: Regression Results

		fatal accident			death		
Condition		Coefficient	Odd Ratios		Coefficient	Odd Ratios	
	Road defect	1.117	3.057	***	0.969	2.634	***
	Rain	1.537	4.649	**	0.507	1.660	
	Night	0.589	1.802	***	0.854	2.350	***
	Car defect	0.659	1.933	***	0.663	1.940	***
Response							
	First aid	-1.265	0.282	***	-0.595	0.552	***
	ambulance	-0.702	0.496	***	-1.067	0.344	***
Conduct of driver							
	Helmet & seatbelt	-0.181	0.834	***	-0.297	0.743	***
	License	-0.179	0.836	**	-0.328	0.720	***
	Hit & run	0.715	2.043	***	0.782	2.186	***
	Drink & drug	3.484	32.588	***	2.784	16.190	***
	Speeding	3.318	27.593	***	2.606	13.549	***
	Phone	2.971	19.512	***	1.647	5.193	**
	Rule disobey	3.054	21.205	***	2.327	10.248	***
Control							
	Female	-0.383	0.682	***	-0.450	0.638	***
	Age	-0.011	0.989	***	-0.002	0.998	
	Age2	0.000	1.000	***	0.000	1.000	***
	Urban	-0.307	0.736	***	-0.323	0.724	***
	Weekend	0.057	1.059	**	0.040	1.040	
	Festival	-0.024	0.976		-0.058	0.943	
	Bicycle	-0.699	0.497	***	-0.202	0.817	
	Motorbike	-0.344	0.709	***	-0.053	0.948	
	Bicycle vs car/truck	1.400	4.054	***	1.614	5.023	***
	Motorbike vs car/truck	0.492	1.635	***	0.882	2.417	***
	_cons	-3.667	0.026	***	-4.290	0.014	***
Number of observations		44,964			44,964		
Pseudo R-square		0.280			0.263		

Note:

*** statistically significant at one percent level, ** statistically significant at five percent level,

* statistically significant at ten percent level

The regression results in Table 3 above shows that almost all the independent variables in the regression model are statistically significant which means that fatal accident and death are affected by those variables. Discussion on how each of those variables influence fatal accident and death is provided as below.

Condition Variables

Road defect is a dummy variable taking value 1 if the road is defected and 0 otherwise. Its coefficients are positive and statistically significant and its odds ratios in both regression models (fatal accident and death) indicate that if the odds of engaging in fatal accident or death increase by 3.0 and 2.6, respectively, for defected road as compared to good road.

Rain is a dummy variable taking value 1 if it was raining when the accident took place and 0 otherwise. Its coefficients in both models are positive and statistically significant. Its odds ratios suggest that rain increases the odds of meeting a fatal or death accident by 4.6 and 1.6, respectively, as compared to that of a normal weather.

Night is a dummy variable taking value 1 for the accident occurred during the nighttime, and 0 otherwise. Its coefficients are positive and statistically significant while its odds ratio values suggest the odds of engaging in a fatal accident or a death accident increase by 1.8 and 2.3 times, respectively, if the accident was at night.

Car defect is a dummy variable. It is equal to 1 if the car is defect and 0 otherwise. Its coefficients are positive and statistically significant. Its odds ratios indicate that driving a defect car increases the odds of meeting a fatal accident and a death accident by a factor of 1.9, as compared to those of driving a good car.

Response Variables

First aid is a dummy variable. It takes value 1 if the victim received first aid at the accident scene and 0 otherwise. Table 3 shows that the coefficients of first aid in both models are negative and statistically significant. Its odds ratios suggest that the odds of meeting a fatal accident or a death accident reduce by a factor of 3.5 and 1.8, respectively, if first aid was provided .

Ambulance is a dummy variable. It takes value 1 if the victim was transported by an ambulance to hospital from the accident scene and 0 otherwise. Table 3 shows that the coefficients of ambulance in both models are negative and statistically significant and its odds ratios suggest that the odds of meeting a fatal accident or a death accident reduce by a factor of 2.0 and 2.9, respectively, if ambulance was used to take the victim to hospital.

Conduct Variables

Helmet & seatbelt is a dummy variable taking value 1 if the victim was using a helmet or wearing a seatbelt during his/her drive and 0 otherwise. The coefficients of Helmet & seatbelt are negative and statistically significant and its odds ratios suggest that the odds of meeting a fatal accident or a death accident reduce by a factor of 1.2 and 1.3, respectively, as compared to otherwise .

License is a dummy variable taking value 1 if the victim has a driving and 0 if not. The coefficients of License are negative and statistically significant, and its odds ratios suggest that the odds of meeting a fatal accident or a death accident reduce by a factor of 1.2 and 1.4, respectively, if the victim possesses a driving license as compared to otherwise.

Hit & run is a dummy variable taking value 1 if the accident was involved with hit & run and 0 if not. The coefficients of Hit & run are positive and statistically significant, and its odds ratios suggest that the odds of meeting a fatal accident or a death accident increase by more than double, if it was a hit & run accident compared to otherwise.

Drink & drug is a dummy variable taking value 1 if the victim was drunk or drug abused and 0 if not. The result of the regression analysis shows that the coefficients of Drink & drug are positive and statistically significant meaning this variable positively effects the dependent variables. Its odds ratio values suggest that the odds of meeting a fatal accident or a death accident increase by more than 32.5 and 16.2 folds, respectively, if the victim was under alcohol or drug influence as compared to otherwise.

Speeding is a dummy variable taking value 1 if the victim committed speeding and 0 if not. Drink & drug is found to have positive and statistically significant coefficients meaning this variable positively effects the dependent variables. Its odds ratio values suggest that the odds of meeting a fatal accident or a death accident increase by more than 27.6 and 13.5 folds, respectively, if the accident was caused by speeding as compared to otherwise.

Phone is a dummy variable taking value 1 if the victim used phone while driving and 0 otherwise. From the regression analysis, the coefficients of Phone are positive and statistically significant implying this variable positively effects the dependent variables. Its odds ratio values suggest that the odds of meeting a fatal accident or a death accident increase by more than 19.5 and 5.2 folds, respectively, if the driver was using phone before the accident as compared to otherwise.

Rule disobey is a dummy variable taking value 1 if the victim did not obey traffic code and 0 if not. The coefficients of Rule disobey are positive and statistically significant meaning this variable positively effects the dependent variables. Its odds ratio values suggest that the odds of meeting a fatal accident or a death accident increase by more than 21.2 and 10.2 times, respectively, if the rule was not obeyed as compared to otherwise.

Controlled Variables

Female is a dummy variable taking value 1 if the victim is female and 0 otherwise. The coefficients of Female are found to be negative and statistically significant meaning this variable negatively effects the dependent variables. Its odds ratio values suggest that the odds of meeting a fatal accident or a death accident reduce by more than 38 % and 45 %, respectively, if the victim is female as compared to otherwise.

Age is a continuous variable. Its coefficients are found to be negative and statistically significant suggesting that when the older driver the less likely she/he would engage a fatal. However that can only decrease by 1 %.

Urban is a dummy variable. It is equal to one if the accident occurred in urban areas and 0 otherwise. Table 3 shows that the coefficients of Urban are negative and statistically significant at one % level. The odds ratios of urban suggests that accident in urban area likely reduce to be a fatal accident or death accident by 30 % and 32%, respectively.

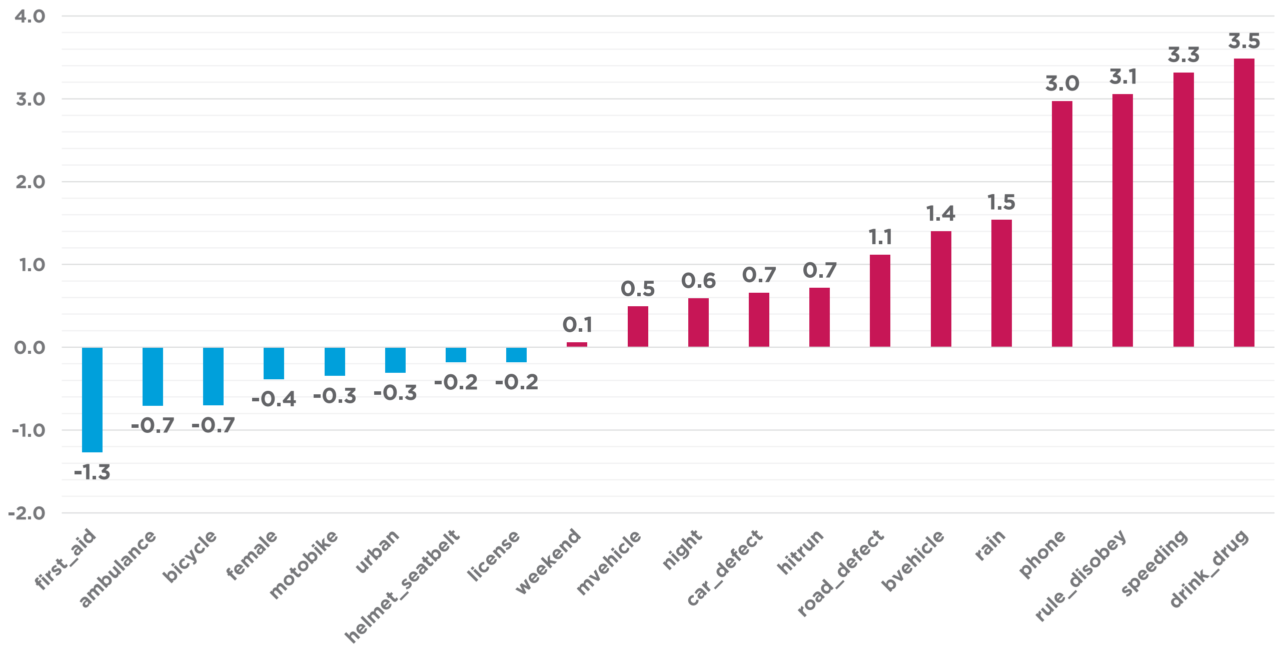
Weekend is a dummy variable taking value 1 if the accident happened on weekend and 0 otherwise. This variable is found to be statistically significant only with the first model which explained the causes of fatal accident. Its coefficient suggests that Weekend accident likely increases the odds of being a fatal accident by 5.7 %.

Festival is a dummy variable taking value 1 if the accident was during the national holiday and 0 otherwise. This variable, however, is found to be statistically insignificant for both fatal accident and death.

Bicycle is also a dummy variable with 1 was assigned if the mode of transport during the accident is bicycle and 0 otherwise. Bicycle is statistically significant, and its odds ratios suggests that riding a bicycle reduce the odds of having a fatal accident or death by the factors of 2.0 and 1.2, respectively, compared to other modes of transportation. However, if bicycle collides with car or truck, the odds of being a fatal accident or dying increase by 4.0 and 5.0 times, respectively.

Motorbike is also a dummy variable with 1 was assigned if the mode of transport during the accident is motorbike and 0 otherwise. Motorbike are statistically significant, and its odds ratios suggests that riding a motorbike reduce the odds of having a fatal accident or death by the factors of 1.4 and 1.1, respectively, compared to other modes of transportation. Nevertheless, if a motorbike was hit with a car or truck, the odds of being a fatal accident or death increase by 1.6 and 2.4 times, respectively, compared to the collision of motorbike with other types of vehicles.

Figure 11: Coefficients of Variables that Explain Causes of Fatal Accident



6. Conclusion & Policy Recommendation

6.1 Economic Cost of RTA

Using RCVIS data 2019 from MPWT and applying Human Capital Cost calculation method, road accidents are found to cost approximately US$ 466.8 million in 2019, accounting for 1.7 %of the GDP in the same year. Fatality is estimated to have the largest chunk that makes up 88.8 % of the total cost, implying that to minimize the economic loss due to RTA, the government need to formulate policy interventions which can cut down such fatality cost by prevent it from happening or at least convert deaths to injuries.

The estimation above is based on improved Human Capital Approach and available secondary data from MPWT. It could further be strengthened through (1) collecting required data including occupation of those who meet accidents as detailed in the occupation category of the Cambodian Socio-Economic Survey (CSES); (2) conducting a proper survey to understand those hospital costs incurred by the victims; (3) conducting a survey to understand those costs needed to repair damaged vehicles and public assets due to RTA; and (4) including administrative cost.

6.2 Regression Analysis

The new findings from the logistic regression analysis show that conduct is major issue causing fatal accident and death (Fig 11). Youth is not the issue if they do not drink, use drugs, break rule set in the Law on Road Traffic. The regression result also indicates that women are less likely to die in the accident. As expected, road defects; vehicle defects; rain; night-time; hit & run along with drink & drug use; speeding; using phone; disobeying the Law on Road Traffic; reckless drivers tends to increase the odds of having fatal accident while first aid at scene; helmets/seat belts or ambulance are likely to decrease it.

6.3 Policy Recommendation

Economically and humanitarianly speaking, policy action should focus on reducing fatalities as the fatality cost makes up almost all the entire pie of total cost. There is an urgent need to address conduct issues including drink/drugs, speeding, using phone, disobeying the Law on Road Traffic rules, and helmet & seat belts. Improving road user behaviour is fundamental to reducing road traffic injuries and fatalities. Road user behaviour can be improved by road safety campaigns, which in combination with behavioural measures (e.g., law enforcement, education or training), can become a powerful way to persuade the public to behave more safely in traffic.

Focus should also be placed on key conditions such as road quality, rain, national roads, and streetlights. Some physical investments supported including road conditions, street lighting (including on highways), first aid & ambulances would yield an economic pay-off. Emergency care is also important. There are a series of time sensitive actions that are essential to provide effective care for the injured, beginning with activation of the emergency care system and continuing with care at the scene, transport, and hospital-based emergency care. To activate the emergency care system, ideally there should be a single telephone number that is valid throughout the country, easy to remember and available as a free call.

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