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Analysis of Jaywalking Behavior among University Students of Bangladesh

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Abstract

In Bangladesh, majority of pedestrian road crossing fatalities involve young pedestrians. Among them, university students were found to be at higher risk of road traffic accidents, with most of these accidents occurring during commutes to and from the university. However, while exploring the causation of crashes involving these young university students, their jaywalking behavior was not thoroughly examined and was often ignored. In our study 430 samples of data were collected through a questionnaire survey and logistic regression analysis was conducted to explore the influence of socioeconomic, demographic, risk perception, traffic law awareness, and other situational factors on jaywalking among university students in Bangladesh. Based on various parameters, the logistic regression model assists in predicting the students' decision-making process before crossing a road. The findings suggest that the most influential factors concerning jaywalking behavior are gender, study year, current living area, eye problem, mode of transportation, mental trauma, use of smartphone, attention to traffic signs, level of safety knowledge, seasonal variation, presence of friends. The outcome of this study will inform policymakers about the characteristics of the students who are more prone to jaywalking and the necessary road safety education training that can be initiated for them.

Keywords: *Jaywalking; University students; Young pedestrian; Logistic regression model; Road crossing.*

1 Introduction

Jaywalking, the act of pedestrians crossing the road illegally or in an unsafe manner, has emerged as a widespread global phenomenon. Understanding the factors contributing to jaywalking behavior is crucial for developing effective strategies to improve pedestrian safety. An astonishing 1.35 million people lose their lives in traffic accidents every year, while an additional 20 to 50 million people are injured (Mahmud et al., 2019). Pedestrians are in significant danger, with around 400,000 pedestrian deaths happening each year in pedestrian-vehicle accidents (Naci et al., 2009). Pedestrians accounted for 24% of all road fatalities in Great Britain in 2015 (National Statistics, 2015). Specifically, pedestrians belonging to the younger age cohort are more prone to jaywalking and thus face more peril on the roads. When crossing roads, university students belonging to the age group of 18 to 24 face significant distractions and obstacles (Pasha et al., 2015). Americans between the ages of 20 and 24 and those between the ages of 15 and 19 witnessed the most severe accident rates in 2016 (National Center for Statistics and Analysis, 2016). Most people in Bangladesh favor walking to other modes of transportation and long walking distance thus increases their risk of jaywalking. (Rifaat et al., 2017). 72% of all fatalities on the road in Dhaka in 2008 involved pedestrians with 281 fatalities (Bangladesh Road Transport Authority, 2008). In 2019, vehicle accidents claimed the lives of over 5000 people and injured 6500 more, many of whom were jaywalking university students. Like other vulnerable road user cohorts, university students in Bangladesh face significant dangers and obstacles when crossing roads. Their behavior, such as phone usage, talking to friends, and risk-taking tendencies, combined with a lack of road safety knowledge make them more prone to road traffic accidents (Pasha et al., 2015). Given the significant research on the pedestrian road crossing behavior and pedestrian safety, just a handful of these studies have investigated the critical pedestrian safety elements linked with illegal road crossing conduct among Bangladeshi university students. Most prior research has focused on traffic law infractions and other safety issues associated with unauthorized road crossings. The

key purpose of the study is to identify the safety factors including weather variance, sociological, demographic, situational factors that affect university students' decisions regarding road crossings and to comprehend level of awareness and approach toward illegal road crossing among university students. Understanding the specific jaywalking behaviors and motivations among university students is crucial for developing targeted interventions and policies that address their unique needs.

Many previous studies have been conducted to identify the factors influencing the jaywalking behavior of pedestrians. Factors such as age, gender, marital status, gap size, and waiting time were included in various studies (Rosenbloom, 2009; Kadali et al., 2014; Jain et al., 2014). Additionally impact of type of vehicles, vehicle speed, walking speed, condition of built environment such as traffic congestion, traffic volume, presence of crosswalk was analyzed in various previous studies (Shaaban et al., 2018; Bansal et al., 2019; Brosseau et al., 2013; Shaaban, 2019; Sze and Wong, 2007). Studies based on crossing location e.g., unsignalized crosswalks or the road pattern were also analyzed (Rifaat et al., 2011; Guo et al., 2017). Personal characteristics such as perceived behavior control which is a component of theory of planned behavior was the strongest predictor of road crossing and when the activity was easy to perform the individual was more likely to engage in any hazardous event related to road safety (Evans and Norman, 1998). Also, pedestrians would prefer convenience over safety while crossing a road (Daff et al., 1992). Due to presence of friends and other groups, a pedestrian would normally follow the crowd behavior (Chen et al., 2011; Yagil., 2000;). Environmental features like presence of guardrail, refuge island had influence on pedestrians' decision regarding compliance to traffic regulations (Supernak , 2013; Yang and Sun, 2013). Zebra marking was observed to be resulted in higher risk for an individual pedestrian than crossing at other intersections (Ekman and Hyden, 1999). Higher pedestrian clashes were observed at six-lane divided roads compared to two-lanes roads due to high vehicle speed. (Kadali and Vedagiri, 2016). Many studies evaluated the significance of road width and lane numbers on road crashes (Gårder, 2004; Lightstone et al., 2001). Moreover, A study based on undivided roads with a greater number of lanes was undertaken to find the significant parameters related to pedestrian crashes in Florida (Lee and Abdel-Aty, 2005). Road network parameters influencing the pedestrian jaywalking related accidents in 24 California cities including low road density with low intersection counts were analyzed (Marshall and Garrick, 2011). Situational parameters such as visibility were found to be the major risk factor for illegal road crossing (Stoker et al., 2015). A higher tendency to cross a road earlier was observed among those who were in hurry (Chen et al., 2011). Impact of weather and temperature were studied in a very few studies. High levels of caution were observed among pedestrians while the outside temperature was warm and traffic volume was low (Harrell, 1991). In another study it was observed that during rainy season pedestrians took more risk while crossing the road. Influence of various distractions while road crossing was also analyzed where it was concluded that using headphones, talking on a mobile phone, eating, and smoking had negative impact on cautiousness of pedestrians (Bungum et al., 2005). Talking on a mobile was linked to reduced walking speed while crossing for females at signalized crossings, and for males at unsignalized crossings. Additionally, texting and watching contents on smart phone while crossing road influenced the pedestrians' behavior though listening to music had the less impact (Pešić et al., 2016). Impact regarding traffic safety knowledge was studied where students who achieved road safety education in high school were concerned while crossing roads compared to those who did not.

Although there is sufficient literature on the factors that influence jaywalking among pedestrians, very few studies exist that specifically investigate this road crossing behavior among university students. This study aims to expand the extant knowledge on jaywalking by identifying the significant factors that influence the jaywalking decisions of university students in Bangladesh.

2 Data Collection & Methodology

A purposive sampling approach was used to account for the diverse student population and the number of universities. Data was collected from 434 students using a structured questionnaire survey, out of which 20 participated in a pilot survey. Pilot survey focused on several issues such as safety awareness, societal norms, environmental conditions, and demographics to finalize the questionnaire. The questionnaire consisted of 51 questions divided into six subcategories including sociodemographic information, road safety knowledge, road and traffic information, situational information, accident experience, rules, and regulation to select factors that can predict the likelihood of jaywalking. Variables such as gender, study year, university location, road width, were selected from the review of existing similar literatures. After the pilot survey, several variables, such as eye difficulties, weather variation, mental trauma, and prior accident experience, were added to the questionnaire. The research was conducted in accordance with ethical standards, and participants were permitted to withdraw at any time during the survey.

The study concentrated on how university students make decisions to jaywalk. In our study, the student's choice to jaywalk was a binary variable. Therefore, the binary dependent variable was predicted using the logistic regression model. In earlier studies, the hit-and-run case scenarios were discovered using the logistic regression approach (Valent et al., 2002; Lui et al., 1988; Jones and Whitfield, 1988). The mathematical expression of the probability P for a student's decision is,

$$Y = \text{logit}(P) = \ln[{}^{P}/_{(1-P)}] = \beta X \quad (1)$$

Here, β is a group of expected values and X is a list of independent variables. Microsoft Excel was used to organize and arrange the data while the logistic regression analysis of the data was carried out using STATA 15.

3 Results and Discussions

Table 1 shows the logistic regression estimates for our model. Several iterations have been executed to reach the results shown in Table 1. Based on the p-values of the t-tests, 35 variables from 22 factors are found to be significant ($p \leq 0.05$) or marginally significant ($p \leq 0.1$).

Table 1. Estimation of logistic regression model

Significant Variables	ODD Ratio	P Value
1. Sociodemographic information		
i. Gender (Male)	0.487	0.028
ii. Study Year		
First year	2.861	0.002
Fourth Year	0.091	0.018
iii. Years spent in current living area		
2 to 4 years	2.083	0.061
4 to 15 years	0.091	0.063
iv. Current living area to university distance		
Less than 2 km	2.871	0.001
Between 4 to 10 km	0.355	0.022
Greater than 10 km	0.383	0.050
v. Eye problem (Yes)	2.360	0.014
vi. Mode of transport (Rickshaw)	2.473	0.012
vii. Need to cross road for university(Yes)	0.442	0.013
viii. Arrival time to reach class		
Well ahead of class	2.310	0.011
Just in time	0.310	0.001
Late in class	2.251	0.059
2. Accident Experience		
i. Past painful experience due to accident of any acquaintances (Yes)	3.240	0.000
ii. How often do you look for traffic safety information on your smartphone?		
Never	1.966	0.039
Always	4.838	0.074
iii. Frequency of observing traffic sign before crossing		
Rarely	2.093	0.032
Often	0.163	0.013
3. Safety Education Information		
i. Prior Road Safety knowledge (Yes)	0.545	0.077
4. Situational Information		
i. Preference during crossing a mid-block		
Join group	1.925	0.050
Use foot over bridge	0.499	0.051
ii. Effect of Seasonal Variation (Yes)	0.540	0.092
iii. What is the preference when you are late for class		
Cross without wait	1.778	0.082
iv. Decision time before initiating a cross		

10 to 15 sec	2.310	0.011
More than 20 sec	0.407	0.014
v. When do you mostly cross a road? (Shopping)	2.872	0.006
vi. If there is no traffic sign/signal on a road. What is your preference?		
Cross with friends	0.351	0.014
Cross alone	3.088	0.001
5. Road and Traffic Information		
i. Usual traffic density of the road usually you cross		
Heavy traffic	0.341	0.004
Light traffic	1.903	0.049
ii. Frequency of observing roadside activity		
Often	2.959	0.009
iii. Effect of presence of Construction material (Yes)	0.538	0.071
iv. Knowledge about the fine regarding jaywalking (Yes)	0.436	0.042
Goodness of fit statistics		
Sample Size		433
Log-likelihood		-34.179
LR Chi-square (37)		207.41
Prob > Chi-square		<0.001
Pseudo R-squared		0.752

Maximum statistically significant variables are found from the sociodemographic characteristics of the respondents while the least number of variables are observed from accident experience information and information of rules and regulations. Surprisingly, analysis show that, female students are more likely to jaywalk than male counterparts, with an odds ratio of 0.487. This result differs from those of other studies, where men were identified as the most risk-takers (Xie et al., 2017; Zhou et al., 2009; Ferenchak, 2016; Papadimitriou et al., 2016). More in-depth study is required on this issue in future. Those who have lived in the city where their school is located are less likely to be caught jaywalking. Perhaps staying a longer time in a city makes them more safety conscious. First year students (OR=2.861) have higher possibilities of jaywalking than other year students which have similarity with previous studies' findings (Marin et al., 2019; Xiao et al., 2021; Papadimitriou et al., 2016). It is likely that the first-year students are less safety conscious because of less experience compared with the senior students. From the model results it is observed that when the university is much closer (<2 km) to the respondent's residents, the probability to be involved in jaywalking would be much higher (OR=2.871). A delayed starting time due to less distance would be the reason for this finding. Those who had eye problems were less likely to initiate jaywalking as expected perhaps because of this vision restriction (OR=2.360). Compared with students who are just in time (OR=0.310) to catch classes, latecomers (OR=2.251) and early comers (OR=2.310) are more likely to jay walk as they may not have proper time management skill which is reflected in their jaywalking behavior as well.

Students searching for road signs of legal crossing are less likely to jaywalk (OR=0.163), perhaps this cohort of students are more cautious on their safety and vice-versa (OR=2.093). Students having past trauma due to accident of any acquaintance have less impact on their safety behavior (OR=3.240). Similarly, the frequency of observing safety news seems to have no impact on promoting legal road crossing (OR= 4.836). The result also indicates that those students who have prior safety knowledge (OR=0.545) are less likely to be involved in unlawful road crossing.

Students who think that seasonal variation affects their road crossing behaviors are less likely to jaywalk (OR=0.540). 10-15 seconds wait before crossing the street increases the likelihood of jaywalking by 2.3 times. As expected, those who are taking more time to cross the road (more than 20 sec.) are more safety cautious and less likely to jaywalk (OR=0.407). The likelihood of students jaywalking increases by 2.87 times for those who frequently cross the road for shopping where overconfidence may be the reason of this finding. Those who travel alone (OR= 3.088) rather than travel in a group (OR=0.351) and in light traffic (OR=1.903) conditions, the chances of jaywalking are more. These results reflect that the influence of peers has a positive impact of not violating the traffic rules. The presence of construction material on the road had a positive impact regarding the decision making of students where students were less likely to cross a road illegally (OR=0.538). This result indicates that presence of obstruction discourages jaywalking. Students who are aware that fine may be imposed for jaywalking (OR=0.436) are less likely to be involved in illegal road crossing than expected.

4 Conclusion

The current study aims to explore the variables influencing Bangladeshi university students' behavior when crossing roads illegally. To examine the decision-making process of the students as they crossed a road, a logistic regression model was created using the data from 434 students collected using a questionnaire survey. Study revealed that female students had higher probability of jaywalking than their male counterparts. Residence also showed a significant influence in the decision-making process with students residing in the same city as their school had lower probability of jaywalking. The presence of construction materials on the road also encouraged students to safe road crossing. Age, study year, current residence, proximity to school, eye condition, mode of transportation, arrival time at school, mental trauma, smartphone use, attention to traffic signs, level of safety knowledge, use of facilities for pedestrians, seasonal variating, waiting time, crossing location, and friends' presence were the most influential factors in university students' road crossing decisions. This study will aid policymakers, road safety authorities, and university administrators in identifying the traits of students who are more likely to jaywalk to cross a road, thereby assisting them in setting up necessary road safety education training programs and implementing suitable road crossing facilities for that student cohort.

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