STUDENT PERCEPTION OF PEDESTRIAN RISK

Mohammad Shafayat Hossain, John Douglas Hunt, Richard Tay

Introduction

Traffic accidents involving pedestrians have become a major safety problem all over the world. In Canada, for example, pedestrian fatalities account for about 12% of all road user fatalities while pedestrian injuries account for 6.1% of all road users injuries. In Alberta alone, 34 pedestrian were killed and 1260 were injured in 2008. These pedestrian causalities accounts for 5.8% of the total casualties; and about 34.2% of the cases, the drivers involved in pedestrian collisions were driving properly (Alberta Transportation, 2008). This suggests pedestrian misbehaviour in some aspect might also be responsible for pedestrian collisions.

It has also been reported that casualty rate per 10,000 populations was the highest for pedestrians between the ages of 15 and 19 (Alberta Transportation, 2008). One reason for this result is that adolescents may not perceive their risk of crash involvement a very high. Compared with adults, young people may also view some preventive measures as less effective in reducing the risk of a crash or injury. These perceptions, combined with inexperience, may contribute to more risk taking among young people (Johan et al, 1987). Hence, understanding the risk perceptions of young adult road users is essential in improving pedestrian safety.

Considerable effort has been invested in the study of the factors influencing pedestrian risk perception (Albery, 1996; Rutter et al, 1989). There are several studies that focused on childhood pedestrian safety and parent's perception of children's road safety (Lam, 2001,

2005) as well as studies concentrating on college student's safety beliefs and safe behaviour (Blair et al, 2004; Schwebel et al, 2009).

However, no study has been on the risk perceptions of university students in the City of Calgary which is currently attempting to promote more sustainable modes of transportation like walking, cycling and transit use. University students often expose themselves to dangerous road crossing situation and have higher probability of being injured while walking or crossing the streets. Therefore, the aim of this article is to explore the risk perception of pedestrians in the university population. It will also assess their preference for various pedestrian facilities such as crosswalk & side walk.

2. Literature Review

From a theoretical perspective, risk perception is considered a crucial factor in understanding the process of behavioural change. It refers to the subjective interpretation involved in different traffic situations (Deery, 1999). Brown and Groeger (1988) suggested that this perception is determined by information regarding the potential hazards in the traffic environment and information on the ability of the actor to prevent those potential hazards from being transformed into actual accidents.

Pedestrian characteristics are also expected to have a significant effect on risk perception. Schwebel et al (2009) found that students with high intensity pleasure were more likely to experience collisions with traffic in the virtual environment. In addition, Blair et al (2004) found that safe behaviour increase with age and females are more conscious of safe behaviour and beliefs. Kouabenan (1997) found social practices and ethnic membership to influence risk perception as well as the causal explanation that pedestrians give for accidents. Greater variance in risk perception can also be found between countries than between different regions in one country due to cultural differences of how people perceive different risk sources.

With respect to road design, various pedestrian facilities exist to increase pedestrian accessibility and improve safety. Comparing signalized intersection pedestrian crossings to over- and under-passes, Tanaboriboon & Jing (1994) found that users preferred signalized intersections. Rouphail (1984) performed a user compliance and preference study on marked mid-block crosswalks in downtown Columbus, Ohi and found that users perceived un-signalised mid-block crosswalks to be unsafe although it was rated highest with respect to crossing convenience. Sisiopiku & Akin (2003) also found mid-block crosswalk to be the most preferred pedestrian facility.

3. Methods

3.1. Questionnaire

A questionnaire was designed to gather information on pedestrian risk perception, preference of various pedestrian facilities, travel characteristics, and some socio-demographics. As shown in Figure 1, perception of pedestrian risk was assessed by a 4 point scale ranging from "Almost always" to "Rarely".

Figure 1: Risk perception questions on pedestrian safety

1. While walking, how often do you feel that crossing street is dangerous?
2. While walking, how often do you feel that crossing street is not safe because of fast-moving automobiles on the street?
3. While crossing street near an intersection without traffic control devices or on mid-block without crossing facilities, how often do you feel it's unsafe to cross?
4. While crossing street on a pedestrian push-button facility, how often do you feel that vehicles would not stop?
5. While walking on a side-walk just alongside a street (without buffer zone), how often do you feel that a fast moving car could lose control and swerve into you?
6. How often do you feel that it's still dangerous walking on the sidewalk because of cars entering driveways?
7. While walking through a way without any walking facilities (e.g. parking lot, alongside street without sidewalk), how often do you feel it's safe to do so?

For statistical analyses, numerical scores (1-4) were assigned to indicate the level of perceived risk. For an example, if a respondent marked “Almost always” to the question 1 and question 7, a score of 4 was assigned to the response of first question and a score of 1 was assigned to the response of last question.

An internal-scale reliability measure for these seven risk perception items was computed and the alpha value was estimated at 0.64 which was above the acceptable limit of 0.6 (Hair et al., 1995). Thus the scores assigned against each of the questions were summed up to assess the overall risk and this aggregate score has a minimum of 7 and a maximum of 28.

Besides perceived risks, students were asked to rank order eight different pedestrian facilities according to their preference in terms of safety and comport. The items are shown in Figure 2. A score of 1 to 8 was used, where 8 represent the highest preference. .

Figure 2: Ranking of pedestrian facilities

1. Separate pedestrian signal phase at crosswalk or intersection
2. Pedestrian push-button on crosswalk or intersection
3. Separate pedestrian signal phase with timer at crosswalk or intersection
4. Raised cross-walk
5. Pedestrian footbridge
6. Pedestrian underpass
7. Buffer zone between side-walk and traffic lane
8. Continuity of side-walk

3.2 Data Collection and Analysis

The survey was piloted tested using a sample of transportation engineering students. It was then administered to a sample of students across the campus at convenient locations such as student lounges and food courts. Of the students approached, about 7.9 % declined to participate. Those who agreed to participate, 5.26 % did not complete or return the questionnaire, resulting in a final sample of 165. Participation in the survey was strictly voluntarily and students could withdraw at any time. The survey was approved by the Research Ethics Board.

A variety of univariate analysis were employed to discover any association between the risk perception score (the dependent variable) and demographic variables (independent variable). One way analysis of variance (ANOVA) was conducted for the categorical independent variables while correlation analysis was performed for continuous independent variables.

From the univariate analysis, the factors that might be associated with student's risk perception were identified. These identified factors were then fed into a multiple linear regression model to further elucidate their associations with student's risk perception. The stepwise backward elimination procedure was employed in the analysis to reduce the model.

To analyse the ordered rank preference data, first order spectral analysis was applied. In addition, the analysis of variance (ANOVA) was also conducted to investigate any significant difference among the mean rank of the facilities. Because of the exploratory nature of the study, neither second order nor any higher order interaction terms of the independent variables were included in the analysis.

4. Results

4.1 Student Profile and Risk Perceptions

The profile of the respondents is reported in Table 1. For categorical variables, the shares of the sample with the different characteristics are reported in column 2 while the group mean of the aggregate risk scores are reported in column 3. Column 4 reports the results of test of equality of means between the groups. For continuous variables, the sample means are reported in column 2 while the correlation between the aggregate risk score and the variables are reported in column 3 together with the t-statistics in the last column.

Table-1: Respondent Profile and Perception of Risk

Variables	**Distribution (%)**	**Mean Risk Score (SD)**	**Mean Score Test**
Sex			
Male	59.8	13.47 (3.44)	$t\ (162) = -\ 0.33$
Female	40.2	13.65 (2.95)	$P > 0.05$
Age			
16 to 24 years (base)	68.7	13.03 (3.17)	$t\ (161) = -2.96$
25 years and above	31.3	14.62 (3.18)	$P < 0.05$
Students Status			
Undergraduate	65.2	13.18 (3.32)	$t\ (162) = -\ 1.86$
Graduate	34.8	14.17 (3.04)	$P = 0.06$
Area of Study			
Engineering	35.4	13.93 (3.11)	
Science	36.6	13.16 (3.19)	
Business	17.7	13.79 (3.68)	$F\ (3{,}160) = 0.69$
Others	10.3	13.11 (3.21)	$P > 0.05$
Driving License			
Yes (base)	76.4	13.15 (3.04)	$t\ (163) = -2.7$
No	23.6	14.74 (3.59)	$P < 0.05$
Race			
White (base)	39.9	12.77 (2.93)	
Asian	43.7	14.30 (3.21)	$F\ (2{,}155) = 3.84$
Others	16.5	13.57 (3.51)	$P < 0.05$

Annual Household Income			
Less than \$50000	55.9	13.85 (3.51)	
\$50000 to \$100000	21.7	13.54 (2.47)	F (2,140) = 1.86
More than \$100000	22.4	12.53 (3.28)	$P > 0.05$
Mode of Travel			
Car/Carpool	44.8	13.44 (3.26)	
Transit	47.3	13.69 (3.26)	F (2,162) = 0.24
Walk/Bicycle	7.9	13.07 (3.14)	$P > 0.05$
Avg. Walk Time per Week			
Less than 1.5 hours (base)	23.8	14.82 (2.93)	
1.5 hours to 3 hours	23.8	12.56 (3.12)	
3 hours to 4.5 hours	21.3	13.48 (2.72)	
4.5 hours to 6 hours	12.8	14.23 (3.74)	
6 hours to 7.5 hours	3.7	10.16 (3.31)	F (5, 158) = 3.69
More than 7.5 hours	14.6	13.33 (3.35)	$P < 0.05$
Witnessed Accident Before			
Yes	25.6	13.30 (2.97)	t (162) = -0.55
No	74.4	13.63 (3.34)	$P > 0.05$
Accident Involvement			
Yes	6.1	13.60 (3.47)	t (163) = 0.067
No	93.9	13.52 (3.24)	$P > 0.05$
Variables	**Mean**	**Correlation**	**Test Statistics**
Household Size	3.21	$r = -0.04$	$P > 0.05$ (1-tailed)
# vehicle in household	1.38	$r = -0.13$	$P = 0.08$ (1-tailed)

The mean of the aggregate risk perception score was found to be 13.54 (S.D. = 3.24). To test the effects of different variables of interest on this risk perception score, several ANOVAs were performed. As shown in Table-1, students' risk perception was found to be significantly influenced by age, student status, license status and ethnicity but not related to their gender, area of study, household income, travel mode, or accident involvement.

4.2 Multiple Regression Results

Multiple linear regression analysis was conducted by regressing the risk perception score on the possible explanatory variables identified in the univariate analyses. Table-2 shows final model output of risk score and other explanatory variables.

Table-2: Multiple Regression Results

Variables	**B**	**S.E.**	**Significance**
Constant	13.13	0.33	0.000
Age: 25 years and above	1.77	0.53	0.001
No Driving License	1.44	0.55	0.010
Walk: 1.5 to 3 hours	- 1.47	0.56	0.010
Walk: 6 to 7.5 hours	- 4.03	1.23	0.001
# Observation		165	
R^2		0.187	
Adjusted R^2		0.165	
F-Statistics		8.40	
P-value		< .001	

In general, the model fitted the data reasonably well, with a very small p-value that indicated good model fit. Compared to 16 -24 years old students, students from the age group 25 years and above perceived the pedestrian environment to be more risky. The age sensitivity towards risk perception was also reported by several other authors (Blair et al, 2004; Parker et a., 1992). All of these researches found adolescents to show a tendency to be less sensitive to risks, and to underestimate the probability and severity of risks caused by traffic situations compared to elderly people.

Students having no driving license perceived more risk than the students having a driving license. Students who do have a driving license might walk less and have less exposure to pedestrian-vehicle conflicts. Moreover, their perceptions on pedestrian-vehicle conflicts and pedestrian risk would be influenced by their driving experience.

Our model also showed that students who walk more perceived the walking environment as less risky. Students who walk more would be more familiar with the pedestrian environment. Alternatively, it might simply be that students who perceived a less risky pedestrian environment would be more inclined to walk and walked more.

4.3 Preference for Pedestrian Facilities

A first order spectral analysis was performed to analyze students' preferences toward various pedestrian facilities. As shown in Table 3, push-button crossing facility was scored highest by the highest number of respondent, followed by the continuity of sidewalk and pedestrian signal phase with timer.

Table-3: Spectral Analysis of Preference for Pedestrian Facilities

Pedestrian	**Score**							
Facilities	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Option1	7.9	10.9	11.5	15.8	10.9	13.9	18.8	10.3
Option2	4.8	8.5	7.9	13.3	16.4	18.2	10.9	20
Option3	6.7	6.1	15.8	11.5	13.9	18.8	11.5	15.8
Option4	17.6	18.2	17	9.7	15.8	7.3	8.5	6.1
Option5	12.7	15.8	15.8	12.1	10.3	6.1	13.9	13.3
Option6	16.4	15.8	15.2	10.9	8.5	12.7	13.9	6.7
Option7	10.9	18.2	7.9	15.2	14.5	13.3	9.7	10.3
Option8	23	6.7	9.1	11.5	9.7	9.7	12.7	17.6

Table 4 showed the average score against each of the pedestrian facilities. Analysis of variance found the difference in average scores to be statistical significant [$F(7,1312) = 8.15$, $P < 0.001$]. Note that push-button crossing facility got the highest average score (5.26) probably because of pedestrians' desire to always keep moving (Tanaboriboon & Jing, 1994).

Table-4: Average rating of various pedestrian facilities

Facility Options	1	2	3	4	5	6	7	8
Mean Score	4.79	5.26	5.01	3.74	4.32	4.07	4.35	4.46

Pedestrian underpass and pedestrian foot over bridge received very low priorities from the respondents, which was consistent with the finding of Tanaboriboon & Jing (1994) who found that users preferred signalized crossings to the overpass or underpass crossings. One reason for undervaluing these two grade-separated pedestrian facilities would be inconvenience (Wibowo & Olszewski, 2005). They showed that the effort to climb up or down one ascending step is approximately 3 meters of level walking.

5. Conclusion

This study examined the factors that influenced university students' perception of pedestrian risk. The results obtained from the study identified four significant factors: age of the students, driving license, race and average walk duration per week. Students having a valid driving license perceived the pedestrian environment as less risky than the students having no driving license. Interestingly, students who walked more perceived the pedestrian environment to be less risky.

Students' preference of various pedestrian facilities showed that pedestrian push button crossing facility was preferred the most by the students in terms of safety and crossing convenience, while overpass, underpass and raised cross walk remained least preferred. These findings would help traffic engineers and planners to understand pedestrian behaviours and attitudes and to take appropriate measures to promote a walk-able community.

References

Alberta Transportation (2008). Traffic Collision Statistics, Edmonton, AB, Canada

Albery, I. P. (1996). Drivers' biased perceptions of the adverse consequences of drink-driving. *Drug and Alcohol Review*, 15.

Blair, E.H., Seo, D., Torabi, M.R., & Kaldahl, M.A. (2004). Safety beliefs and safe behaviour among Midwestern college students. *Journal of Safety Research*, 35.

Brown, I. D., & Groeger, J. A. (1988). Risk perception and decision making during the transition between novice and experienced driver status. *Ergonomics*, 31.

Deery, H.A., (1999). Hazard and risk perception among young novice drivers. *Journal of Safety Research* 30.

Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W.C. (1995). Multivariate Data Analysis with Readings, fourth ed. Prentice-Hall, New Jersey.

Jonah, B.A., & Dawson, N.E., (1987). Youth and risk: Age differences in risky driving, risk perception, and risk utility. *Alcohol Drugs Driving*, 3.

Kouabenan, D.R. (1998). Beliefs and the perception of risks and accidents. *Risk analysis*, 18 (3).

Lam, L.T. (2001). Parental risk perceptions of childhood pedestrian road safety. *Journal of Safety Research*, 32.

Lam, L.T. (2005). Parental risk perceptions of childhood pedestrian road safety: A cross cultural comparison. *Journal of Safety Research*, 36.

Parker, D., Manstead, A.S.R., Stradling, J.T., Baxter, J.S., (1992). Intentions to commit driving violations: An application of the theory of planned behaviour. *Journal of Applied Psychology*, 77.

Rouphail, N. M. (1984). Midblock crosswalks: a user compliance and preference study. *Transportation Research Record*, 959.

Rutter, D. R., Quine, L., & Albery, I. P. (1989). Perceptions of risk in motorcyclists: unrealistic optimism, relative realism and predictions of behaviour. *British Journal of Psychology*, 89.

Schwebel, D. C., Stavrinos, D., & Kongable, E. M. (2009). Attentional control, high intensity pleasure, and risky pedestrian behaviour in college students, *Accident Analysis and Prevention*, 41.

Sisiopiku, V. P., & Akin, D. (2003). Pedestrian behaviors at and perceptions towards various pedestrian facilities: an examination based on observation and survey data. *Transportation Research Part F*, 6.

Tanaboriboon, Y., & Jing, Q. (1994). Chinese pedestrians and their walking characteristics: case study in Beijing. *Transportation Research Record*, 1441.

Wibowo, S. S. & Olszewski, P. (2005). Modeling Walking Accessibility to Public Transport Terminals: Case Study of Singapore Mass Rapid Transit. *Journal of the Eastern Asia Society for Transportation Studies*. 6.