CHILD PEDESTRIANS SAFETY FACILITIES CLOSE TO THE SCHOOL PREMISES LOCATED IN MAJOR ARTERIAL STREETS IN DHAKA CITY

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ABSTRACT

Children are at maximum danger of pedestrian collision, mainly because of the commencement of free movement while their skills and perception to use roads are not yet quite developed. The objective of this paper is to investigate the availability and adequacy of existing child pedestrian safety facilities at few selected school premises in Dhaka metropolitan area. A questionnaire survey was conducted at four vulnerable junctions identified out of fifty two (52) junctions previously surveyed by ARI, BUET. From these three junctions four (4) schools were selected, namely Dhanmondi Govt. Boys High School, Oxford International School, Monipir High School and College and Rajdhani Govt. High School. Parents took part in the survey on behalf of the students aging 3-5 years and 6-10 years. However students aged 11-15 years responded spontaneously at their own. Result shows that majority of the students' walk or use school van or private car on the way to and from school. Most of the students cross the road at their own responsibilities without using any pedestrian facilities. Only a few students use zebra crossing. It depicts that students are very much casual on crossing roads using existing facilities. More than half of the students claimed speedy vehicle is a major difficulty while crossing the road. There are number of methods that might enhance the safety of child pedestrians.

Keywords: *child pedestrian; pedestrian facilities; speedy vehicle.*

1. INTRODUCTION

Pedestrian injury is a significant cause of casualty and disability among children in developing as well as developed cities. Everyday thousands of people are killed and injured on roads worldwide. According to WHO report 1.24 million deaths and more than 30 million injuries worldwide caused by traffic accidents in 2010. Fatalities due to road accidents are frequent in developing countries encompassing 90% of the world's road fatalities. The burden of injury is heaviest among the poor with the burden greatest on children in the poorer countries with lower incomes (WHO, 2008). Approximately 95% of child injuries occur in low and middle income countries (Harvey et al., 2009). A study made by Sayer et al. (1997) revealed that on an average, 20 percent of all people killed in traffic accidents in developing countries are aged under 16. Another study (WHO, 2006) shows that on an average children in the age group 5-14 years, injury accounts for more than a quarter (27%) of all deaths worldwide. Children are at maximum danger of pedestrian collision, mainly because of the commencement of free movement while their skills and perception to use roads are not yet quite developed. Since children, especially those aged between 5 and 9 years, have to get to and from school, they may be exposed as "commuters," particularly if they walk to school, but also as they walk to and from the buses, cars or rikshaws that take them to school. Large portion of pedestrian injuries occur near schools, as children travel to and from school (Warsh et al., 2009; Abdel-Aty et al., 2007) and hence there is a greater chance of children being hurt near schools (Abdel-Aty et al., 2007).

Children between the ages of 5 and 9 years are at greatest risk for pedestrian death and injury, and comprise 49% of all child pedestrian fatalities (RTMC, 2008). Child pedestrian safety is likely influenced by individual differences in temperament and personality (Barton and Schwebel, 2007; Briem and Bengtsson 2000). Even children may have ample awareness to be safe pedestrians, their safety might be jeopardized if they are inattentive while crossing streets. Literature suggests that young children are less competent in traffic than adults because of poorly developed perceptual, attention, and cognitive abilities (Connelly et. al.1998; Dunbar et. al, 2001). Pedestrian safety is also influenced by the type of environment a child pedestrian walks within in several ways. The most significant hazardous issue may be the population and traffic density of that area. Since higher exposure to traffic consequences to greater pedestrian injury risk, children in urban with high population and high traffic density areas are more likely to experience pedestrian injury than those in less populated areas (Schieber and Vegega, 2002; Cho et al. 2009).

Dhaka is the capital city of Bangladesh and the tenth largest city in the world. Dhaka is situated in the economic and commercial heartland of Bangladesh. It has an estimated population of more than 15.5 million people in the greater Dhaka city which is expected to reach 36 million by 2024 (Hoque and Alam, 2002). Rapid urbanization and traffic growth has led to the high population densities and lack of delineation of people and vehicles (Sukhai, et al., 2004) in developing cities. The development of informal neighborhoods, especially those located beside arterial roads consequences a challenge where children and youngsters are compelled to traverse busy streets to and from school. A study by Bass et al. (1995) shows that child pedestrian injuries commonly occur on residential roads nearby or close to the child's home or school, whether in urban or rural settings. Unfortunately, lots of schools are located at Arterial streets in Dhaka city where children get a close contact to motor vehicles while commuting to school. Besides children are most at risk while crossing the road because of their age, psychology, immaturity and inabilities. Therefore, it is extremely essential to ensure safe environment for children while commuting to school. There is evidence that sometimes pedestrians do not use the facilities provided for them to cross the road (for example zebra crossing, overpass or underpass). It is also true that some of the pedestrian facilities are not well designed so that pedestrians are not interested to use it. Moreover policies and institutions related to pedestrians and walking environments in Asia shows that generally, there is lack of relevant policies dedicated to institutions and political support that cater the needs of the pedestrians (Leather et al. 2011).

Pedestrian's especially children are among the most vulnerable road users group as they travel to and from school. Engineers are challenged to design safe and convenient pedestrian facilities that will function well even for those persons who purposely or unconsciously disobey rules of safe walking behavior. An inclusive strategy to prevent child pedestrian injuries as well as to improve pedestrian safety is to increase childrens road safely knowledge and skills (Duperrex et al., 2002; Wyke et al., 2007). Pedestrian safety education can enhance children's knowledge and observed road crossing behavior, but the range to which this lessens actual child pedestrian injury occurrence is unknown (Duperrex et al., 2002). The value of child pedestrian safety education versus the implementation of engineering countermeasures has long been debated by researchers (Schieber and Vegega, 2002).The specific objective of this research is to investigate the availability and adequacy of existing child pedestrian safety facilities at few selected school premises in Dhaka metropolitan area.

Following this introduction, description of the study area is provided in Section 2. Survey methodology followed by data analysis is portrayed in Section 3. The final section of this article provides a conclusion regarding the results of the analysis.

2. DESCRIPTION OF STUDY SITES

The study has been conducted in the greater Manik Mia Avenue area and in Mirpur area in Dhaka city. The survey was conducted near four vulnerable junctions identified out of fifty two (52) junctions previously surveyed by ARI, BUET. Four (4) schools located near the junctions were selected for the survey namely Dhanmondi Govt. Boys High School, Oxford International School, Monipir High School and College and Rajdhani Govt. High School were. Moreover all of them are located on major arterial streets. Study locations of this research are given in Figure 1 and Figure 2. From 1998-2012, 43 accidents occurred in the Manik Mia Avenue and Indira road junction which is the 2nd highest number of accidents among the 4 junctions in the study site. From 1998-2012 total 38 accidents occurred in the junction just in front of the Dhanmondi Govt. Boys' High School of which 12 accidents involved pedestrians. The junction (Lalmatia - Aarong) connecting Mirpur Road and Manik Mia Avenue has the highest number of accidents among the junctions of the study area. In 14 years from 1998-2012, 48 accidents occurred in this junction. This junction also has the highest number of pedestrian accidents. There were 18 accidents involving pedestrians in
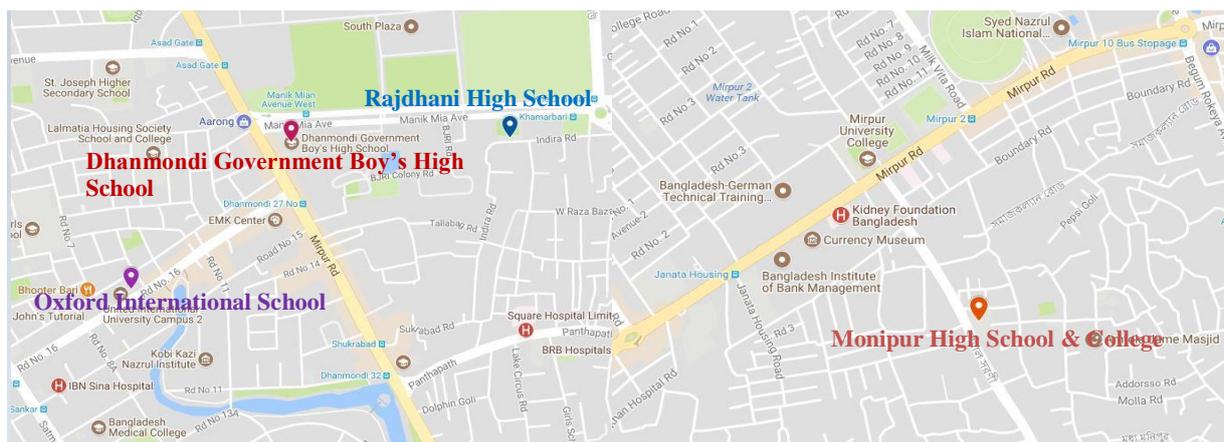
Figure 1: Google Map of Study Locations

Oxford International School Main Campus besides Dhanmondi 27 (major arterial road)

Dhanmondi Govt. Boys High School besides Mirpur road (major arterial road)

Monipur High School & College, Shewrapara, Mirpur
(major arterial road)

Rajdhani High School, Besides Manik Miah Avenue
(major arterial road)

Figure 2: Study locations

this junction during this period among which 11 accidents were fatal. Majority of the victims (12 victims) were near the center line of the road when they met the accident.

3. METHODOLOGY

The research involves two step survey procedures which includes questionnaire survey and model development. The questionnaire survey was conducted during the morning peak period (just before school starts) and during noon when school ends. In-person interview survey method was adopted. A set of 17 questions were asked to 400 respondents. The survey was conducted near four schools located close to the vulnerable junctions identified out of fifty two (52) junctions previously surveyed by ARI, BUET. Near these four junctions four (4) schools were selected, namely Dhanmondi Govt. Boys High School, Oxford Intl. School, Monipir High School and College and Rajdhani Govt. High School for te survey. Parents took part in the survey on behalf of the students aging 3-5 years and 6-10 years. However students aged 11-15 years responded spontaneously at their own. For the research, binary logistic regression model was developed with 390 complete questionnaires.

3.1 Questionnaire Survey

The questionnaire was divided into three parts. First part was about respondents demographics information such as their age, occupation, gender and main mode of travel. Second part consists questions regarding the existing condition of crossing facilities near schools and the role of guardians or accompanying person during crossing roads. Crossing facilities refer to foot over bridge, zebra crossing, traffic/community police, and traffic signal in this research. Third part was respondents opinion about the reason of accidents, and users level of interest to follow traffic rules & regulations.

3.2 Results

3.2.1 Travel mode to and from school

Majority of the students come to school on foot, or by rikshaws or school van or by private car. Few students come by public bus or school bus as shown in Figure 3.

3.2.2 Problems faced by the respondents during crossing the road

Most of the respondents (75%) focused on speedy vehicle as major problem while crossing the roads on the way to and from school as shown in Figure 4. Some expressed that scattered rikshaws (11%) and sidewalk with street shops (6%) as problems while crossing. Non-availability of foot-over bridge or zebra crossing is also a problem as expressed by the respondents.
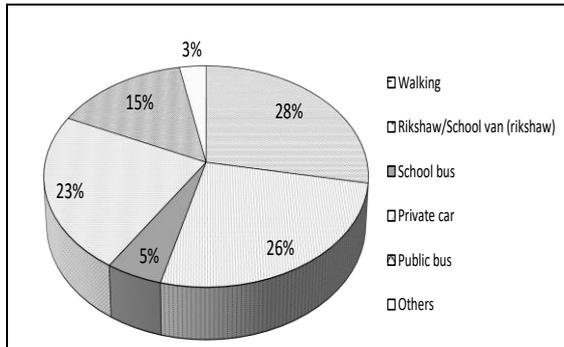
Figure 3: Travel mode during coming to school
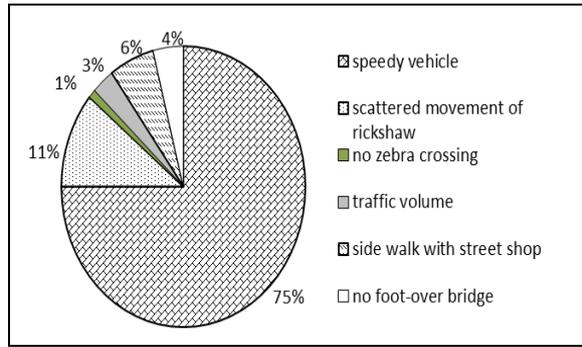
Figure 4: Problems faced by the respondents during crossing the road

3.2.3 Students accompanied by adults' on the way to school

Majority of the students are accompanied by an adult on their way to school as revealed in Figure 5. Students within the age group of 3-5 years are always accompanied by parents. Students in the age group of 11-15 are not accompanied by adults always.

3.2.4 Utilization of road crossing facilities

Most of the students (77%) cross road on their own responsibility without using any pedestrian facilities. Some of the students (12%) use zebra crossing. Very few (8%) students use foot over bridge even if it is available on the site as revealed in Figure 6. Only 3% of the students take help from traffic/community police while crossing the road. Whatever facilities might be available on the site, very few students are particular in using those facilities. 50% of the respondents replied they use the existing facilities sometimes, 30% use the existing facilities always, and 20% never use them.
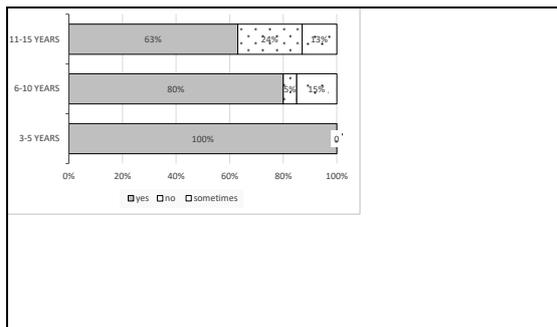

Figure 5: Percentage of students accompanied by an adult
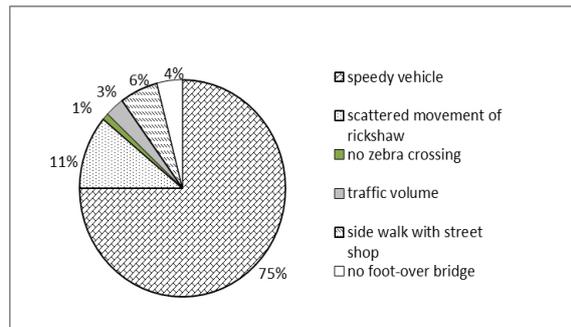
Figure 6: Utilization Road Crossing Facilities

3.2.5 Problem on the sidewalk

The respondents were asked abut the problem they face while using sidewalk. Figure 7 shows that 42% of respondents do not use sidewalk because of roadside hawker, 21% due to other reasons (for example may be due to tiredness), 20% due to presence of dustbins/garbage and rest (17%) of respondents do not use due to presence of cycles or motor cycle.
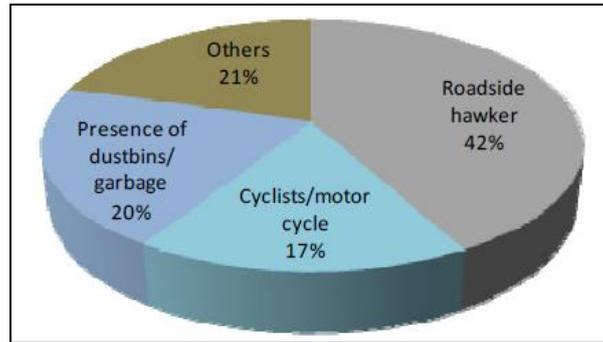
Figure 7: Respondents opinion about the problem they face while using sidewalk

3.3 Binary Logistic Regression Model

The Binary Logistic Regression (BLR) model is one of the most commonly used statistical techniques for the analysis of binary categorical response variable (Nelder and Wedderburn, 1972; Agresti, 2007). The model assumes a binomial distribution for the binary dependent variable and a logit link function. Binary logistic regression analysis was employed in this research to explore the adequacy of crossing facilities near selected schools using software LIMDEP. The model parameter estimates are provided in Table 1. The model coefficients has very small *p-value*, i.e. far lower than .05, which means the independent variables make a significant difference in predicting the adequacy of crossing facilities. The value of the chi-square distribution with 8 degrees of freedom is 51.997. For the Binary logit regression "Hosmer and Lemeshow test" was conducted fo check the goodness-of-fit. The value is less than 0.05 inferring a good model fit. In this research, the demographic variable gender has substantially contributed to explain the adequacy of crossing facilities. The coefficients for gender were negative, which implied that male thinks that the crossing facility is not adequate for their children which is opposite for females. In the model, choice of vehicle type to and from school was found significant. Those traveling by rickshaw think the facility is adequate for child pedestrians. The reason may be that rikshaws drop the passengers near the school gate and can pick them from close to the school as well. There is a probability that

Table 1: Binary Logistic Regression model for adequacy of crossing facilities in Dhaka city

Variables	B	S.E.	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Gender (male)	-.614	.252	.015	.541	.330	.886
Cross			.572			
1) Alone	-.801	.768	.297	.449	.100	2.021
2) With guardian	-.790	.767	.303	.454	.101	2.039
Vehicles			.153			
1) Rickshaw Cycle	.763	.374	.041	2.145	1.030	4.468
2) Bus	.695	.411	.090	2.004	.896	4.480
3) Walking	.815	.460	.077	2.258	.917	5.562
Facility			.041			
1) Own responsibility	.834	.550	.129	2.302	.784	6.764
2) Manual police	1.432	.587	.015	4.188	1.327	13.225
Speed	.831	.527	.115	2.296	.817	6.453
Foot over bridge	.034	.425	.937	1.034	.450	2.378
Sidewalk			.853			
1) Road side hawker	-.253	.510	.619	.776	.286	2.109
2) Cyclists Motorcycle	.037	.572	.949	1.037	.338	3.180
3) Presence of dustbins/ garbage	-.018	.634	.977	.982	.283	3.402
4) Rickshaw	-.176	.434	.685	.839	.359	1.962
Accident			.609			
1) Fault of drivers	-.274	.305	.368	.760	.418	1.381
2)Lack of knowledge of pedestrian	-.040	.339	.906	.961	.494	1.867
Drivers			.501			
1) Careless	-.035	.411	.933	.966	.432	2.162
2) Over speeding	-.419	.470	.373	.658	.262	1.654
Defective Vehicles			.001			
1) Brake	2.112	.561	.000	8.262	2.754	24.790
2) Tire burst	1.401	.977	.152	4.057	.597	27.560
3) Mechanical fault/lack of fitness	.207	.341	.543	1.231	.631	2.400
Pedestrian			.022			
1) Careless	-.474	.414	.252	.622	.277	1.400
4) Negligence of traffic Law	.378	.513	.462	1.459	.534	3.986
Dangerous			.227			
1) Rickshaw/ cycle/car/minivan	3.047	1.538	.048	21.051	1.033	428.86
2) Laguna tempo	2.166	1.453	.136	8.725	.506	150.36
5) Bus	.615	.527	.243	1.849	.659	5.191
Forbidden			.207			
1) Laguna	.623	.940	.507	1.864	.296	11.759
2) Bus	2.708	1.545	.080	14.993	.726	309.77
Ability			.046			
1) Significantly	2.824	1.254	.024	16.838	1.442	196.670
2) Better than average	3.106	1.229	.012	22.337	2.008	248.53
3) Average	2.351	1.258	.062	10.498	.893	123.47
4) Worse than average	2.725	1.288	.034	15.254	1.221	190.57
Teach	.797	.307	.009	2.218	1.216	4.044

Chi squared test: $\chi^2 = 51.997$; df = 8; p-value = .00
Hosmer and Lemeshow test $\chi^2 = 12.942$; df = 7 ; p-value = .013

respondents who cross the road with the assistance of mannual/community police think that the crossing facility is adequate. Defective vehicle specially brakes are the main reason of accidents as perceived by the respondents. The respondents perceive that Rickshaw/Cycle/car/minivan are maily responsible for pedestrian accidents. Respondents who rate their child's ability to safety cross the road compared to other children of same age perceive the crossing facilities are adequate. Result shows that respondents who teach their child to follow traffic laws or rules perceive the crossing facilities are enough.

4. CONCLUSION

This study reveals the respondents' perception about the availability and adequacy of existing child pedestrian safety facilities near the school premises of Dhaka metropolitan area. The problems faced while using sidewalk are roadside hawkers, presence of dustbins/garbage, cyclists/motor cycle etc. Most of the children, cross the road at own responsibility without using any crossing facilities. Children may not always posses adequate knowledge to comprehend the danger and cannot accurately judge oncoming vehicles speed and distance. Moreover it is somewhat difficult for a child to decide safe crossing points in the road etc. This paper aims to identify some of the factors associated with child pedestrians crossing facilities for young child under the age of 16 years in few particular school locations in Dhaka city, to raise awareness of the issues amongst the users. Although guardians are much aware of their children safety yet they do not follow safety rules during crossing the road.

Based on the study it can be inferred that rickshaw/cycle/car/minivan are maily responsible for pedestrian accidents as observed by the respondents. Respondents who rate their child's ability to safety cross the road compared to other children of same age stated that the crossing facilities are adequate.

Parents tend to believe their children are safe pedestrians and allow their children to walk alone on streets, despite the fact that they recognize the limitations of child pedestrian skills (Morrongiello *et al.*, 2009). Because of the carelessness and inattentiveness accidents occurs while crossing the road. A major contributory factor in many of these accidents is a lack of road safety knowledge leading to unsafe behavior by children and guardians who accompany the children. In order to attain safe pedestrian capabilities parents, teachers or elders should train children to cross independently together with following safety rules. In addition to education, parents and authorities should encourage for safer pedestrian atmospheres. Education can train children to become safe and independent road users (Quimby, 2001). The objective of road safety educational programs is to reduce pedestrian injuries usually emphasise on furnishing individuals with information and skills to safely accomplish the traffic environment. Few recommendations can be considered as footpath should be free from hawkers and traders and motor cycle or car parking. Footpath should be user-friendly and free from garbage. Foot over bridge on major arterial roads is essential for the safety of child pedestrian. To improve the facility more, ability to cross the road safely and also to acknowledge child pedestrians about rules and regulations is very important.

It is expected that the results of this study could lead to better understanding of pedestrian crossing behavior in Dhaka and support policy makers in their decision making regarding the improvement of road crossing facilities in Dhaka city and thereby contribute to decrease fatality.

REFERENCES

Abdel-Aty M, Chundi SS, Lee C. (2007). Geo-spatial and log-linear analysis of pedestrian and bicyclist crashes involving school-aged children. J Safety Res. 38:571–579. [PubMed: 18023642]

Agresti, A. (2007). An Introduction to Categorical Data Analysis: Second Edition. John Willey and Sons, Inc., Hoboken, New Jersey.

Barton, B., & Schwebel, D. (2007). The influences of demographics and individual differences on children's selection of risky pedestrian routes. Journal of Pediatric Psychology, 32(3), 343-353.

Bass, D., Albertyn, R., & Melis, J. (1995). Child pedestrian injuries in the Cape Metropolitan area – final results of a hospital-based study. South African Medical Journal,85(2), 96-99.

Briem, V., Bengtsson H. (2000). Cognition and character traits as determinants of young children's behavior in traffic situation. Intern J Behav Dev. 2000; 24:492–505.

Cho, G., Rodriguez DA, Khattak, AJ. (2009). The role of the built environment in explaining relationships between perceived and actual pedestrian and bicyclist safety. Accident Analysis and Prevention; 41:629–702.

Connelly, MJ., Conaglen, HM. (1998). Parsonson BS, Isler RB. Child pedestrians' crossing gap thresholds. Accident Analysis and Prevention; 30:443–453. [PubMed: 9666241]

Dunbar, G., Hill, L., & Lewis, V. (2001). Children's attentional skills and road behavior. Journal of Experimental
Psychology: Applied, 7(3), 227-234.

Duperrex, O., Roberts, I., & Bunn, F. (2002). Safety education of pedestrians for injury prevention. Cochrane Database of Systematic Reviews, 2002(2), DOI: 10.1002/14651858.CD001531.

Harvey, A. Towner, E. Peden, M. Soori, H. & Bartolomeos, K. (2009). Injury prevention and the attainment of child and adolescent health. Bull World Health Organ. 5(87), 390 – 394.

Hoque, M., and J. Alam. 2002. Report on Urban Transport Issues and Improvement Options in Bangladesh.

Leather, J., Fabian, H., Guta, S., & Mejia, A. (2011). Walkability and Pedestrian Facilities in 31 Asian Cities: State and Issue. Mandaluyong City: Asian Development Bank.

Morrongiello, BA, Barton BK. (2009). Child pedestrian safety: Parental supervision, modeling behaviors, and beliefs about child pedestrian competence. Accident Analysis and Prevention. 2009; 41:1040–1046.

Nelder, J.A. and Wedderburn, R.W.M. (1972). Generalized Linear Models. Journal of Roayal Statistical Society A 140, 48-77.

Quimby, A. (2001). Teaching children in developing countries to be safe road users. Paper presented at First Road Transportation Technology Transfer Conference in Africa, Arusha, Tanzania, May 23 – 25, TRL Limited (International Division), UK.

Sayer, I.A., Palmer, C.J., Murray, G., & Guy, J. (1997). *Improving road safety education in developing countries; Ghana.* TRL Report 265. Crowthorne: Transport Research Laboratory.

Schieber, R., & Vegega, M. (2002). Eduction sp versus environmental countermeasures. Injury Prevention, 8, 10-11.

Sukhai, A., Noah, M., & Prinsloo, M. (2004). Road traffic injury in South Africa: An epidemiological overview for 2001. In S. Suffla, A. Van Niekerk (Eds.) and N. Duncan (Cons. Ed.), Crime, violence and injury prevention in South Africa: Developments and challenges (pp. 114-127). Tygerberg, Cape Town: Medical Research Council – University of South Africa, Crime, Violence and Injury Lead Programme.

Warsh J, Rothman L, Slater M, Steverango C, Howard A. (2009). Are school zones effective? An examination of motor vehicle versus child pedestrian crashes near schools. Inj Prev. 15:226–229.

World Health Organization, WHO. (2008). World report on child injury prevention. Geneva: World Health Organization. http://whqlibdoc.who.int/publications/2008/9789241563574_eng.pdf ac

Wyke, S., Capleton, A.C., O'Connell, S., Duarte-Davidson, R., & Health Protection Agency. (2007). Development of a UK children's environment and health strategy. Oxfordshire: Health Protection Agency" Retrieved August 19, 2009, Zeedyk, S., M., Wallace, L. & Spry, L. (2002).