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Characteristics of Pedestrians in Bangladesh Who Did Not Receive Public Education on Road Safety

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Abstract: The safety of pedestrians, such as workers who largely walk to and from work, has not been given sufficient attention, especially in the area of traffic safety in developing countries, including Bangladesh. Although the National Road Safety Strategy has a very strong emphasis on road safety education and publicity campaigns, the road safety knowledge may not have reached these vulnerable road users who most needed them. Moreover, little is known about the penetration rate of these campaigns and who have benefited or not benefited from them. On the other hand, the developing country, like Bangladesh, is heavily dependent on its Readymade Garment (RMG) workers for earning foreign currency, and walking is one of the major mode of transports of those workers. The objective of this study is to identify those who are not reach by the safety education. Results from a survey of 1020 RMG workers around Dhaka identified several socioeconomic, demographic, travel characteristics and accident experience that affect the most vulnerable segments who are left out of the system. The findings of this study would help the policy makers to arrange necessary road safety education for the most vulnerable cohorts of pedestrians to encourage the continued use of this sustainable mode of commute.

Keywords: traffic safety; safety education; road safety campaign; pedestrian safety; vulnerable road users

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1. Introduction

Walking is one of the most sustainable modes of transportation. Active transportation is being promoted by a growing number of governments throughout the globe in an effort to improve community health while also lowering levels of traffic congestion, consumption of fuel and emissions. The number of pedestrian-vehicle accidents may, however, increase when walking rates go up [1,2]. Pedestrian safety is a major concern in many developed and developing countries, including Bangladesh [3]. The capital of Bangladesh, Dhaka, is one of the cities in the world with the highest population density, and the current situation regarding the safety of pedestrians may be described as worrisome [4]. According to the findings of one research, pedestrians account for as many as 72 percent of all deaths that occur as a result of vehicle accidents in the Dhaka Metropolitan region [5]. This safety issue is of particular concern in Bangladesh, especially the ready-made garment (RMG) industry where walking is a major mode of transportation for many workers commuting to and from work.

Bangladesh is a developing country with a significant RMG sector that generates a revenue of US$15 billion in 2010, and accounts for the 13% of GDP and 75% of export. Moreover, the industry experiences a 12% per annum growth rate and employs 3.6 million people, including about 1.5 million females [6,7]. The RMG sector has, thus, enabled

women to contribute significantly to the economy, obtain employment opportunity and ensure their economic freedom and independence. Although this sector has immense contribution to economy, there are many problems associated with this sector which relate to the employees' social, housing, transport, safety and security issues. The safety issue that has generated a lot of attention in both the academia and media is workers' safety, especially building and fire safety, such as the collapse of Rana Plaza in 2013 [8]. However, the traffic safety of the employees is one major safety issue that has yet to receive sufficient attention in the work safety literature.

Many of the garment's factories are situated beside major arterial roads and highways with extremely heavy traffic. Furthermore, the presence of the garments industries generates a huge pedestrian traffic and large truck movements on the roads which were not designed to handle such heterogeneous traffic [9]. Most of the workers (88%) cannot afford the travel expenses and must commute on foot, and only 12% of the workers can afford to travel by bus [9]. The high pedestrian and vehicular traffic on these major roads will greatly increase the risks of vehicle-pedestrian collisions [10]. From 1998 to 2011, there were 21,623 vehicle–pedestrian crashes in Bangladesh, with only 1067 occurring at intersections [11]. These data indicated that most of the pedestrian casualties were either on the roadsides or at mid-block, suggesting that the pedestrians were either crossing the road or walking along the road. A survey conducted by the Bangladesh Institute of Labor Studies reported that the RMG sector accounted for around 70% of accidental deaths [12]. Another study pointed out that pedestrians of urban areas are in a higher risk position than those of rural areas due to the excessive pedestrian and vehicle movements in the urban areas [13].

The above study clearly reveals that the RMG workers in Bangladesh (especially in the Dhaka city and its outskirts) are at safety risk due to the chances of involving pedestrian accidents. Thus, there is a need to better understand not only the crash contributing factors, but also the barriers and facilitators of countermeasures. To date, there has not been much attention on exploring the traffic safety perception of these RMG workers in Bangladesh, or in other developing countries, whereas rigorous attempts have been taken in identifying the factors in influencing the pedestrian risk perception in developed countries [14,15]. Some of these studies have emphasized childhood pedestrian safety, as well as the road safety perception of the parents [16,17], while others have focused on the safety perception and behaviour of the college students [18,19]. In addition, some studies have been examined the safety of construction and maintenance workers in work zones. A comprehensive approach towards managing the interactions among the elements considered as dangerous is needed to minimize the hazards [20]. In one of the few studies in Bangladesh, the available facilities and infrastructure of pedestrian road crossing of Dhaka city was examined [21].

Road safety education, communication and publicity campaigns form one useful approach to reduce traffic collisions [22,23]. The National Road Safety Council, a unit of Bangladesh Road Transport Authority developed a National Road Safety Strategic Action Plan that has a strong emphasis on road safety education and publicity policy [24,25]. It combines formal education and informal education to improve the knowledge, attitudes and behaviour of all road users and disseminate road safety knowledge by adult literacy programmes and mass communication. It broadcasts road safety related programmes by all regional radio stations, conducting talk show and discussion in television on safety education, and production of films on road safety awareness.

Although the research on the effectiveness of road safety publicity and education campaigns are extensive [26–32], few studies have been conducted in developing countries and fewer have dealt with workers' walking to work. The first step to changing road user behaviour through public education is to ensure the message is received by the target audience. Although awareness is only part of the behaviour change process, it is a critical step. Moreover, few studies have identified the different segments of the target audience whom the road safety publicity and education campaigns have succeeded in reaching or failed to reach.

Therefore, the objective of this study is to identify the characteristics of RMG workers who haven't received safety education from those who have received some road safety education from public sources. These workers who are left out of the road safety education programmes can be considered as one of the most vulnerable road user groups. As pedestrians, they are considered as vulnerable road users due to their relatively smaller masses and lack of protection, which often result in more serious injuries in a collision with a vehicle [33–35]. The RMG workers can also be considered as a vulnerable group in society due to their low socioeconomic status. The findings of this study will be helpful to safety policy makers to identify a very vulnerable group of the RMG workers who were left out of the road safety education and needs to be specifically targeted to improve the effectiveness of the education programmes.

2. Methodology

2.1. Survey and Particpants

A simple method to achieve the objective of the study is to gather the required information through a questionnaire survey. The participation of the workers in the survey was voluntary and no incentive was provided for participation. Permissions to conduct the survey among the workers were obtained from the management of the factories. Although no ethics approval is required by the university, the researchers have followed the standard procedures to safeguard the privacy of the respondents and the information provided. No information that can identify the respondents was collected. Consent to participate is assumed by the voluntary completion of the survey.

The participants in the survey were recruited outside eight RMG factories in and around Dhaka. There were about 4000 RMG factories in Bangladesh, among which about two-thirds were in and around Dhaka city [9]. Two sites were situated in Gazipur district along the Dhaka–Mymensingh highway, while the third site was located beside the Dhaka–Ashulia Highway. These three factories were situated beside the most accident-prone highways in Bangladesh. For example, 831 accidents were reported from 1998 to 2010 along the Dhaka–Mymensingh highway. The remaining industries are located inside the Dhaka City in the Tejgaon industrial area, Mirpur, Shamoli and Gulshan area. A significant number of accidents, 9125 from 1998 to 2010, had also been reported in these areas [11].

The survey was in Bengali and administered face-to-face to 1020 RMG workers. The main question of interest in this study is whether the participant had received any safety education from different public sources such as newspaper, television, radio, etc. In this study, the dependent variable is defined as a dummy variable with y = 1 if the participant had not received some safety education and y = 0 if the participant had received safety education. Of the 1020 participants, 68.8% had received some public safety education, while 31.2% had not received any public safety education. In addition, the survey also collected some demographic data of the participants, including age, gender, income, education, marital status, children, living arrangements, any physical disabilities, work experience, commute mode, travel expenditure, weekly walking distance, distance between home and workplace, location and experience with traffic accident. The profile of the respondents is reported in Table 1. Note that since the participants' demographic information was collected using structured categories, one of the categories had to be used as a reference in the regression to avoid perfect collinearity in estimation.

Table 1. Participants' Profile.

Characteristic	Distribution
Gender	
Female	40.2
Male (reference)	59.8
Age	
<18	5.0
18–20	21.9
21–22	23.8
23–24	28.3
>24 (reference)	21.0
Monthly Income (tk per month)	
≤6000	30.3
6001–8000	16.5
8001–10,000	27.7
>10,000 (reference)	25.5
Living with Family Member	
<2	1.0
2–3	33.0
4–5	54.0
≥6 (reference)	12.0
Marital Status	
Married	41.0
Unmarried (Reference)	59.0
Work Experience (yrs)	
≤1 (reference)	5.9
>1–3	29.6
>3–5	35.8
>5–7	12.9
>7–10	9.5
>10	6.3
Physical Disability	
None	88.6
Hearing Problem	4.0
Walking Problem	5.2
Others (reference)	2.2
Mode of Transport	
Car	0.0
Public Transit	36.1
Three Wheelers	0.2
Walk	37.4
Cycle	25.9
Motorcycle (reference)	0.5
Walking (h per week)	
≤1 (reference)	2.5
>1–4	58.1
>4–7	21.6
>7–10	7.5
>10	10.3
Location of Industry	
Ashulia	48.0
Dhaka-Mymensingh	14.8
Gulshan	22.5
Tejgaon (reference)	2.5
Others	12.1

Table 1. *Cont.*

Characteristic	Distribution
Home Distance from workplace (km)	
≤1	40.4
>1–3	40.0
>3–5	15.2
>5 (reference)	4.4
Living in Dhaka City (yrs)	
≤2	9.7
>2–5	37.3
>5–10	39.6
>10 (reference)	13.3
Transport Cost (tk per month)	
≤200	7.5
>200–500	72.1
>500–700	4.7
>700–1000	10.5
>1000 (reference)	5.3
Accident Involvement	
No (reference)	80.0
Yes	20.0
Relative Involved in Accident	
No (reference)	81.2
Yes	18.8

2.2. Data Analysis

The aim of this study is to explore the characteristics of the worker segment who has not received some pedestrian safety knowledge. To achieve this objective, we need to compare the characteristics of workers in this segment with those who have not received any pedestrian safety knowledge. Since the dependent variable is binary, this study will estimate a binary logistic regression model to identify the socioeconomic characteristics that are significant in delineating between the two worker segments. In this study, the binary response variable, y_{in}, is defined as:

$$y_{in} = \begin{cases} 1 & if\ individual\ n\ had\ not\ acquired\ some\ road\ safety\ knowledge \\ 0 & if\ individual\ n\ had\ acquired\ any\ road\ safety\ knowledge \end{cases} \quad (1)$$

In addition, if a logistic distribution is utilized, then the likelihood of Individual n not getting any public education in road safety is provided by the formula:

$$P_n = \frac{exp(\beta x_n)}{1 + exp(\beta x_n)} \quad (2)$$

where x_n is a vector of individual's characteristics, β is a vector of parameters to be estimated.

The optimal estimate of β might be obtained by optimizing the log likelihood function, which is as follows:

$$LL(\beta) = \sum_{i=1}^{n} \{y_{in} \ln(P_n) + (1 - y_{in}) \ln(1 - P_n)\} \quad (3)$$

Since the data were chosen at random, the maximum likelihood estimator that was derived would be consistent and asymptotically efficient [36,37]. In addition to the estimated coefficients, the odds ratio (OR), which ranges from 0 to positive infinity, were also estimated. The odds ratio indicates the proportional change (OR > 1) or decrease (OR < 1) in the odds of the outcome (no safety knowledge) when the value of the corresponding independent variable rises by one unit. Stata version 14 (developed by StataCorp LP,

College Station, TX, USA), which was used for the estimation, was used for the usual logistic model.

3. Results and Discussion

Table 2 presents the results of the estimations from the final model. Overall, the model did well in fitting the data, as shown by the high chi-square statistic and low *p*-value. According to the results of the *t*-tests, 25 variables representing 15 characteristics were determined to be significant at a confidence level of 95% or marginally significant at a confidence level of 90%.

Table 2. Estimation Result.

Variables	Coefficient	Odds Ratio	Standard Error	*p*-Value
Gender				
Female	0.56	1.76	3.22	0.00
Age (yrs)				
18–20	−0.42	0.66	−1.87	0.06
21–22	−0.60	0.55	−2.73	0.01
Income (tk per month)				
<6000	0.36	1.43	1.84	0.07
>6000–8000	0.46	1.59	1.79	0.07
Living with Family Member				
2–3	−0.67	0.51	−3.55	0.00
Marital Status				
Married	0.31	1.36	1.72	0.09
Working Experience (yrs)				
>10	−1.27	0.28	−3.14	0.00
Physical Disability				
None	−0.48	0.62	−1.89	0.06
Mode of Transport				
Public Transit	−0.46	0.63	−2.62	0.01
Walking (h per week)				
>1–4	−1.23	0.29	−4.35	0.00
>4–7	−0.95	0.39	−3.14	0.00
>10	−0.67	0.51	−1.88	0.06
Location of Industry				
Ashulia	0.45	1.56	1.89	0.06
Dhaka-Mymensingh	1.19	3.28	4.22	0.00
Others	2.20	9.01	6.92	0.00
Home Distance from Work (km)				
<1	−1.96	0.14	−5.00	0.00
>1–3	−1.86	0.16	−4.81	0.00
>3–5	−1.45	0.24	−3.50	0.00
Living in Dhaka City (yrs)				
<2	0.65	1.92	2.27	0.02
>2–5	−0.43	0.65	−2.32	0.02
Transport cost (tk per month)				
<200	0.67	1.95	1.82	0.07
>200–500	0.41	1.51	1.86	0.06
Accident involvement				
Yes	0.70	2.01	3.16	0.00

Table 2. *Cont.*

Variables	Coefficient	Odds Ratio	Standard Error	*p*-Value
Relative Involved in Accident				
Yes	−0.98	0.38	−4.62	0.00
Constant	1.62	5.04	2.73	0.01
Number of observations				1020
Log-likelihood				−490.19
Chi-square				285.44
p-value				<0.0001
McFadden Pseudo R-square				0.2255

The odds ratio of female is 1.76 which indicates that females are less likely to have receive safety knowledge relative to their male counterparts. Perhaps, females may have less time and opportunity to gain traffic safety knowledge. In Bangladesh, many female workers have the traditional role of taking care of their families, in addition to working outside to generate income, whereas many male workers are only involved in working outside.

This time constraint may also be applicable to married workers due to family commitments, as evident by the estimated odds ratio of 1.36. This result is consistent with the finding that relative to workers living with more family members (4 or more), workers living with fewer (2–3) family members have an estimated odds ratio of 0.51, implying that workers who reside in smaller family units are more likely to have receive education on road safety than workers who belong to a bigger family unit [38–40].

The odds ratio of younger workers was estimated at 0.66 (18–20 years old) and 0.55 (21–22 years old), which also implies that workers (23 years or older) are less likely to have received road safety education. These workers may also have higher time constraint due to family commitments. This result indicates that the younger workers may be more willing and able to receive safety information relative to their younger and elder counterparts [41–43]. Although workers aged 23 years or older may not be considered as older road users in the general road safety literature, many of them are already married, have children, have worked for several years and are relatively older among the RMG workers.

The result of the study indicates that the workers' physical condition plays an important role in terms of getting road safety education. RMG workers without any physical disability are more likely (OR = 0.62) to have received some road safety education from any of the various sources. This result implies that physically challenged workers, who can be considered as a very vulnerable group, are less likely to receive road safety knowledge. This result may be due to their physical limitations and fewer opportunities. It may also be due to possible emotional issues that may conflict with their receiving such safety education.

The odds ratios for RMG workers with a monthly income of less than equal 6000 Taka (US$71 per month) and 6000–8000 Taka (US$71–95 per month) are estimated at 1.43 and 1.59, respectively. These lower income groups have received less road safety education from different sources compared with the higher income groups. This result is expected as the demand for safety is considered to be normal good that increases with income [44]. This result is also consistent with the finding that lower income road users may be less concerned about gaining traffic safety knowledge [41].

The income effect is also consistent with our finding that workers with more than 10 years of work experience are more likely to have received some road safety education, as demonstrated by the estimated odds ratio of 0.28. The income effect is also consistent with our finding that workers who use public transit as their main mode of transport to work are more likely (OR = 0.63) to have received some knowledge about traffic safety from various sources. As shown in Table 1, within the RMG sector, there are extremely few workers who commute by motorized vehicles. Workers who are able to use public

transport may constitute the more financially well-off segment compared to those who have to walk or cycle.

The finding that workers who spend less on transportation each month are less likely to have received road safety education from a variety of sources is also consistent with the income effect. As shown in Table 2, the estimated odds ratios for workers with a transportation spending of less than or equal to 200 taka per month 1.95, while the estimated odds ratio for workers with a transportation spending of 200–500 taka per month is 1.51. Since both these odds ratios are bigger than one, they imply that workers who spending less on transportation per month are less likely to have received road safety education from different sources.

Relative to workers who walk the least (less than 1 h per week), workers who have to walk more to reach their respective workplaces are more likely to receive knowledge about road safety, as evidenced by the odds ratios being less than one. This finding may be because RMG workers who are walking more on the roads face more hazards, and being more aware of those hazards on the roads, may then be more motivated to gain knowledge on the safety issues [45,46]. Moreover, they may also be more exposed to the various public safety campaigns while walking to and from work.

Relative to workers whose homes are more than 5 km from their workplace, workers with shorter distance between home and workplace are more likely to have received some road safety education. One possible reason may be that workers whose homes are more than 5 km from their workplace are more likely to take public transport instead of walk. This result is consistent with our other findings for walking time per week, mode of transport and cost of transport. This result is also consistent with our finding that workers located at the outskirts of Dhaka city, in Ashulia and the Dhaka–Mymensingh highway, are less likely to have received public road safety education.

Relative to workers who have been living in Dhaka for more than 10 years, workers who have been living in Dhaka city are less than or equal to two years are less likely (OR = 1.92) to have received some road safety education, while those who have been living for 2–5 years are more likely (OR = 0.65) to have received some public road safety education. Dhaka is not the hometown of RMG workers, and they migrated to Dhaka for their jobs. It is likely that they are less exposed to road safety education campaigns because the intensity of these campaigns is lower outside Dhaka city. As they reside in Dhaka for some time, they become more exposed to these campaigns. However, there appears to be a diminishing effect after 5 years.

As expected, workers with a relative who had a traffic accident before are more likely (OR = 0.38) to have received some road safety education since they may be more motivated to acquire some safety knowledge. In contrast, RMG workers who are involved in an accident are less likely to have received road safety education. This statistical association may have simply arisen because workers who have not received road safety education are more likely to be involved in an accident.

4. Conclusions and Recommendations

Walking is one of the most sustainable modes of transportation and the only mode for many RMG workers in Bangladesh. However, the traffic safety of RMG workers has not been given sufficient attention. Although the National Road Safety Strategy has a very strong emphasis on road safety education and publicity campaigns, the road safety knowledge may not have reached the vulnerable road users who most needed them. The aim of the study is to identify the socioeconomic characteristics, travel characteristics and accident experience of RMG workers who did not receive any traffic safety education. We find that almost one-third of the respondents surveyed did not received any road safety education from the public education campaigns. Therefore, more effort should be devoted to increasing the intensity and effectiveness of these public education campaigns in order to reach more of these vulnerable road users.

To our knowledge this is the first study to assess the successful market reach of the road safety education campaigns and the first econometric analysis of the audience. This study helps to identify the group of garment workers who has no knowledge or very little knowledge about safety. The result could be used to identify and select the most vulnerable group of RMG workers who requires traffic safety education on an urgent basis. More specifically, we find that RMG workers having the following characteristics are in urgent need of safety education and should be specifically targeted: female, monthly income less than 8000 Taka, married, working in the Ashulia or Dhaka–Mymensingh area or nearer to any highway, encountered traffic accident before, living in Dhaka for less than two years, and spending less than 500 Taka a month in transport. One approach to consider is using more on-site education materials, such as billboards, posters and variable message signs, along the highway leading to or at the RMG factories since a large proportion of these workers walk to work. In addition to the traditional media like radio and television, the NRSC may also wish to consider reaching out to the younger people through social media. Moreover, use of more persuasive communication should be adopted to increase the effectiveness of the communication. For example, the use of fear appeal can be considered since this type of road safety messages have been shown to be effective among female and married audiences [47].

This study only surveyed 1020 RMG workers, which is not large or representative enough to gauge the penetration of road safety knowledge in the entire national population by different sources of print media and visual media. However, as a pilot study it reveals the importance of the problem adequately and is able to provide appropriate policy recommendations to address the problem, at least within this important segment.

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