# Fear Is Not Enough:

# Testing the impact of risk on pedestrian behavior in Dhaka, Bangladesh

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**Abstract**: This observational study and survey of pedestrians in Dhaka, Bangladesh asks why more pedestrians do not use pedestrian bridges given the high number of pedestrian fatalities and the dangers of crossing Dhaka's chaotic streets. Surprisingly, the research finds that individuals who are very worried about being hit by a vehicle or who report actually having been hit are *no more likely* to use pedestrian footbridges. Instead the convenience of bridges, the extent to which pedestrians are in a hurry, and the age of respondents offer far better predictors of pedestrian bridge use. The findings point to a need for improved infrastructure, law enforcement, and educational campaigns.

## 1. Introduction

One of the most salient aspects of Dhaka, Bangladesh is its unfortunate traffic situation. Even many long term residents cannot help but be shocked by the manner in which drivers jostle for position, cut one another off, lean on their horns, ignore traffic laws, and quite literally fight their way to their destinations. The city's daily newspapers frequently include front page photographs of dramatic tailbacks, deficient road infrastructure, and legal violations. Any Dhaka resident has a host of horror

stories of traffic delays and accidents, and surveys show that -- along with electricity -- traffic problems top the list of citizens' concerns (Democracy Watch, 2001). And yet despite the severity of the problem, traffic laws go largely unenforced, creating an environment whereby drivers and pedestrians can act without concern for legal consequences.

The problem goes far beyond the inconvenience of traffic jams. According to official police statistics over the last ten years, there are approximately 3,000 traffic related deaths every year in Bangladesh (Accident Research Institute, 2011). As this is based on reported cases filled out by midlevel police officers (sub-inspectors), it stands to reason that the actual number is higher. On a per capita basis, the official fatality rate is not comparatively very high, but on a *per vehicle basis*, it is alarming. According to the Accident Research Institute at the Bangladesh University of Engineering and Technology, there are approximately 60 fatalities per 10,000 motor vehicles in Bangladesh. This is compared to 25 in India, 16 in Sri Lanka, 2 in the United States and 1.4 in the United Kingdom (Accident Research Institute, 2011). It is particularly alarming that, almost half of the fatalities (1,488 per year based on a ten year average) are pedestrian fatalities.

Given this high number of pedestrian deaths, one would hope that Dhaka pedestrians would become more cautious, more willing to wait for the legal right of way, and more likely to use the city's pedestrian footbridges. Nonetheless, pedestrians continue to place themselves at substantial risk, frequently pushing themselves through oncoming traffic without waiting for the right of way, at times despite the existence of a pedestrian bridge directly overhead.[1] The challenge of getting pedestrians to use footbridges is in many ways similar to other challenges of safety related, legal compliance, such as convincing drivers to wear seatbelts and motorcyclists to wear helmets. These actions offer enormous potential benefit and are only mildly inconvenient, and yet the empirical evidence suggests that large majorities will not do them absent sustained planning, enforcement and educational efforts. This

[1] As will be discussed in greater detail below, many intersections lack pedestrian bridges or a safe way to cross the street.

research seeks to explain why some Dhaka pedestrians take advantage of safe, pedestrian bridges and why others continue to dangerously cross the city's streets.

The analysis is based primarily on a survey of pedestrians at four key Dhaka traffic intersections at which pedestrian bridges offer the only means to safely cross the street. The research finds that risk assessments have little impact on actual behavior and even individuals who have been hit by a car are no more likely to use pedestrian bridges. While there is some evidence that those who recognize that traffic situation would improve if everyone was less aggressive are more likely to the use the bridges, individuals who express a commitment to the law are no more likely to do so. Instead the convenience of bridges, the extent to which pedestrians are in a hurry, and the age of respondents offer far better predictors of pedestrian bridge use. The findings point to a need for improved infrastructure, law enforcement, and educational campaigns.

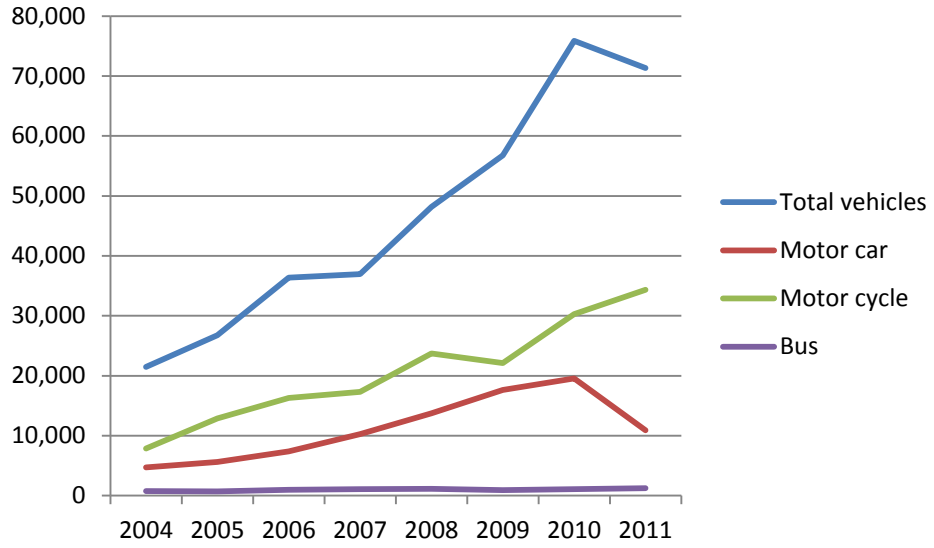
**2. Background: Why is traffic so bad and safe behavior so uncommon?**

The reasons for Dhaka's traffic problems are numerous and diverse. City planners have had to contend with enormous growth rates. At partition in 1947 there were only around 250,000 people in Dhaka, but by the time of independence in 1971, the population had swelled to 1.5 million (Chakma, Hamid, and Oldham, 2012). Today, it is commonly estimated that there are 15 million residents in the greater Dhaka metropolitan area.[2] From 1995-2010, the city added an average of over 400,000 residents every year, a rate of growth that exceeded most other major global cities (with the exception of New Delhi and Shanghai) and this rate is expected to continue for the foreseeable future (The Economist, 2012). Accompanying this increase in the population has been a rise in the number of vehicles on the road. While Dhaka still remains one of the least motorized cities in the world on a per capita basis (Louis Berger Group, 2011), according to data from the Bangladesh Road Transport

[2] I do not offer a more precise number because the Bangladesh Bureau of Statistics has yet to release conclusive numbers from its 2011 census. Furthermore, there is no consensus on the demarcations of the greater Dhaka metropolitan area.

Authority (2012), the total number of registered vehicles in Dhaka grew by 133% over the period from 2004 to mid-2012, from 303,215 vehicles to 708,197 vehicles. Figure 1 shows the number of new buses, cars, motorcycles, and total vehicles registered each year. With the exception of a drop in 2011, the rate of new vehicle registration has steadily increased. Unfortunately, infrastructure has clearly failed to keep up with this dramatic growth; and perhaps more importantly, the existing infrastructure is often poorly planned or introduced after development occurs.

Figure 1: Annual new vehicle registration in Dhaka




*Source:* Bangladesh Road and Transport Authority.
http://www.brta.gov.bd/images/files/motor_v_dhaka_05-08-12.pdf

The problems go beyond road infrastructure. Despite its enormous size, Dhaka lacks any subway, light rail, or metro-bus (dedicated bus lane) services. Buses are the primary means of public transportation, and while (as shown in Figure 1) they have grown in number, they have not kept up with growing demand. In addition, most busing services are provided by private companies, which often exacerbates traffic problems as drivers attempt to overtake competitors and fail to use the city's few dedicated bus stops (Parveen, 2010). Efforts to reform Dhaka's busing system have been prevented by bus owners and beneficiaries of the current system (Junge, Beddies, Ahmad, & Huybens, 2011).

Furthermore, Dhaka launch and rail services into the city are not well integrated into the public transportation system (Asian Development Bank, 2011).

This is not to suggest that governmental actions have not been taken to address these problems; however, they have been insufficient and plagued by delays. For example, promises to construct a metro rail system using a US$2.1 billion soft loan from the Japanese development aid agency JICA were delayed for several years because of disagreement over the potential route. Even if construction proceeds on time -- which seems unlikely -- the first phase of the project is not expected to be complete until 2019 and the entire project would not be finished until 2024 (The Daily Star, 2012). In fact, most seemingly promising initiatives have never gotten off the drawing table or expanded beyond a pilot stage (Islam, 2011). Clearly, existing measures have proven to be insufficient to deal with the extent of the problem.

To make matters worse, enforcement of traffic rules and laws is practically non-existent. While traffic police are numerous in Dhaka (around 3,300), their job is primarily to direct traffic – not to enforce the laws. In fact, line level officers (constables), which make up approximately 75% of the force, lack the authority to enforce the law (Bangladesh Police, 2008). Even if the rules on the books were to be enforced, the fine amounts are based on the 1976 Dhaka Metropolitan Police Ordinance and have not been adjusted for inflation. As such, driving on the wrong side of the road can only be punished with a maximum fine of US$2.50 (Tk 200) and illegal parking or obstructing a footpath only warrants a maximum fine of US$1.25 (Tk 100) (Dhaka Metropolitan Police Ordinance, 1976). As a result, there are effectively no consequences for illegal behavior. This is perhaps most evidenced by the common sight of vehicles, auto-rickshaws, rickshaws, and even buses frequently driving the wrong way down the road despite the ubiquitous presence of traffic police.

In the absence of law enforcement, the formal “right of way” is superseded by an informal rule of “first in time, first in right,” whereby the *de facto* right of way is taken by the first vehicle or

pedestrian to arrive at a given location.[3] As such, it is common and acceptable to cut off other drivers, ignore lane markings or traffic signals, make u-turns, and drive the wrong way down the road. The problem extends to pedestrians, who can be observed pushing their way through traffic and blocking the vehicular flow, often in a large group, without the formal right of way.

This behavior is perhaps understandable and even rational. The unfortunate reality of non-enforcement of traffic laws in a city with too little and inadequately planned infrastructure for the number of vehicles on the road creates an interesting, albeit unfortunate, laboratory to understand traffic and pedestrian behavior. Under these conditions, drivers and pedestrians confront a collective action problem. Given the predominance of aggressive traffic and pedestrian behavior, it is "irrational," in the parlance of game theorists and rational choice scholars, to follow the formal traffic laws in Dhaka. Drivers and pedestrians who respect the laws and the formal right of way must bear the costs of waiting while others cut in front of them and get to their destination faster. Furthermore, there is no tangible benefit to be derived from respecting the law, as law-breakers are no more likely to be punished and law-abiders are too few in number to create a better traffic environment.

This collective action problem is clearly illustrated in Figure 2. The image shows Ramadan holiday shoppers waiting for buses. Individuals might have started waiting close to the curb; however, as more people were waiting than would fit on any individual bus, hopeful passengers pushed out into the street attempting to better position themselves for when a bus arrived. Over time, the crowd of people pushed further and further out until a road that could fit three lanes of traffic was reduced to just one lane.

[3] This expression is often applied to a particular form of water rights, signifying that the first to use the resource has a right to future use.

Figure 2: A collective action problem in waiting for the bus results in blocking the road

**3. Theory and hypotheses: Why use pedestrian bridges?**

Provided the high levels of pedestrian fatalities discussed above, one would expect that those who recognize the risk in crossing the street would be more likely to use pedestrian bridges. Pedestrians need not, however, solely depend on statistics to evaluate the risk in crossing Dhaka's streets. Pedestrians often have to dodge cars, hold out there hand to stop oncoming traffic, or take safety in numbers when crossing the street. While j-walking is not a legal offense in Bangladesh, crosswalks (zebras) are often unmarked, there are no Walk/Don't Walk indicator lights in the city, and in many intersections there is no period of time when it could be considered safe to cross the street. As a result, even in the absence of law enforcement, fear and a concern for one's own safety should remain a strong motivator for the use of pedestrian bridges. Consequently, it is reasonable to hypothesize that those who are very worried of being hit by a vehicle will be more likely to use pedestrian footbridges than those who are less worried.

While this seems intuitive, there is some evidence to suggest that risk is actually a very poor motivator. Since the 1970s, scholars of traffic safety in wealthier countries have puzzled over drivers and passengers' resistance to wearing seatbelts despite the ease and benefits of doing so. The theory of planned behavior used by many of these scholars posits that individuals assess risks and make rational

decisions about their behavior. While research has found that people are quite good at accessing risk, perceived risk is not necessarily a good predictor of reported seat belt use (Calisir & Lehto, 2002). As Brijs et al. (2001) write "…overwhelming proof for the seat belt's effectiveness as a safety promoting device is in sheer contrast with the amount of motorized vehicle occupants who still refrain to make (continuous) use of safety restraints while driving." (p. 600) Instead, other scholars contend that behavior is based on actual outcomes, not risks. Because the overwhelming majority of driving experiences are accident free, past experience does not support the need for wearing a seat belt (Slovic, Fischoff, & Lichtenstein, 1978). If it is actual experience that matters, then one would expect those who have actually been hit by a vehicle to be more likely to use pedestrian bridges than those who have not been hit by a vehicle.

While much of the related research on seatbelt use and motorcycle helmet use has been conducted outside of the far riskier Bangladeshi context, there are some reasons to believe the findings will apply to Bangladesh as well. Using police data, the Bangladesh's Accident Research Institute found that in 97.7% of traffic injuries in 2010, the injured party was not wearing a seat belt or -- in the case of motorcycle -- a helmet (Accident Research Institute, 2011). This is basically the same percentage as in 1998. These are not only horrendously high percentages, but they show that there has been no change or improvement over time. In other words, despite the high number of fatalities, despite the obvious risks, and despite conclusive evidence of the problem, individuals might not take even simple steps that are fully within their control to improve their safety. If drivers are not willing to pull a safety belt across their body for their safety, then why would pedestrians be willing to climb a flight of stairs for theirs?

Instead, other scholars contend that the decision to use a seatbelt, wear a helmet, or use a pedestrian bridge is not so much the product of risk assessments or probabilities, but of simple habit (Sutton and Eiser, 1990). From this perspective, those that have used the bridge in the past are more

likely to use the bridge in the future and those cross the street dangerously in today are more likely to do the same tomorrow. As such, past behavior will be the best predictor of footbridge use.

Other pedestrians might respect the formal traffic rules out of respect for the law. While j-walking is technically not a punishable offense in Bangladesh, interviews suggest that many people perceive it as contrary to a lawful traffic system. While the fear of punishment is an important motivator for law abiding behavior (Becker 1968), even when the probability of punishment is low, the existence of legitimate laws and respected law enforcement agencies has been shown to lead to a moral obligation towards law abiding behavior (Mastrokski, Snipes, & Supina, 1996; McCluskey, 2003; Sunshine and Tyler, 2003; Tyler, 1990). In addition, studies of legal socialization contend that in law abiding contexts, individuals will follow the law out of reputational concerns (Tapp and Levine, 1974). In Ontario, Canada, for example, only 23% of drivers were observed using their lap belt prior to the passage of a law requiring seatbelts in 1975 (Robertson, 1978). Following the passage of the law, usage shot up to 75%. With time and minimal enforcement, usage did regress to 51% five months later; however, this percentage was still considerably higher than the original 35% Robertson, 1978). A similar pattern was observed in other Canadian and U.S. localities (Williams & Wells, 2004). Of course, Canada and the U.S. have a much stronger rule of law than Bangladesh with much higher levels of legal compliance. As such, this analysis will test whether commitment towards the law influences pedestrian behavior.

Still others might use pedestrian bridges out of recognition of the collective action problem described above and what might be considered "enlightened self-interest." While drivers and pedestrians might benefit in the short term from pushing their way through traffic, they might also recognize that everyone would be better off from a more orderly traffic system. As such, they might respect the laws out of a commitment to achieving this improved traffic culture.

Despite the safety benefits, pedestrian bridges are far from a perfect solution to pedestrian safety problems. They are active countermeasures that require an investment of time and energy. A 2005

study conducted by the Center for Urban Studies (2005), interviewed 800 pedestrians nearby Dhaka's footbridges and asked them why people don't use the bridge. Their responses are summarized in Table 1. Many perceived the footbridges as insecure, dirty, subject to criminality, and requiring too much effort.[4]

Table 1: Reasons not to use a footbridge

| Reasons | *Total* | Percent |
|---|---|---|
| Feel uneasy | 215 | 26.9% |
| Looks dirty | 163 | 20.4% |
| Takes more time | 161 | 20.1% |
| Too high | 151 | 18.9% |
| Occupied by hawkers | 116 | 14.5% |
| Lack of security | 107 | 13.4% |
| Takes a long walk | 78 | 9.8% |
| Poor entry access | 78 | 9.8% |
| Congested | 51 | 6.4% |
| Others | 20 | 2.5% |

*Note*: n=800. Respondents could select multiple options
*Source*: Center for Urban Studies (2005).

As such, this analysis controls for those individuals who report that they are in a hurry and for those that are younger, as a proxy for the ease of using the pedestrian bridges. Different aspects of the pedestrian bridges are also considered, including their level of convenience. Other factors, such as education and gender are also included in the analysis. In summary, this research seeks to test the impact of fear of traffic accidents, past experiences with traffic accidents, self-reported past behavior, normative commitment to the law, and a perception that everyone would be better off if they waited for the right of way on the use of pedestrian bridges, while controlling for convenience, those in a hurry, age, gender, and education.

[4] The desirability of a footbridge is expected to vary based on the specific location. For example, people are probably more likely to feel insecure in an *underground* tunnel (such as at Karwan Bazaar just north of the Kazi Nazrul Islam and Pantha Path intersection) than in most over bridges.

**4. Methodology**

The Center for Enterprise and Society at the University of Liberal Arts Bangladesh developed a research design focused on pedestrian behavior to test these different hypotheses. The research focused on four busy intersections, each with a pedestrian bridge and each without a safe means to cross the street without using the footbridges. These are referred to below as Farmgate, Banglamotor, Science Laboratory, and Shamoli.[5] At each of the sites, observational studies were conducted to estimate the percentage of male and female pedestrians using the footbridges and j-walking.[6] Using these estimations, a stratified sampling technique was used to select a representative sample of male and female pedestrians using the bridges or j-walking below. Two-hundred pedestrians were surveyed during weekday afternoons from April to June, 2013 at each of the four research sites for a total sample size of eight-hundred.

Perceptive fear likely to impact risk assessments was measured by asking whether respondents were very worried, worried, not very worried, or not at all worried of being hit by a vehicle when crossing the street. Past experience likely to impact risk assessments was measured by asking respondents if they or a member of their family had been hit by a vehicle. Study participants were also asked if they generally followed the traffic laws when crossing the street, as a self-reported measure of past behavior. Commitment towards the law was measured with the question: "Given the way things are in Bangladesh, would you agree or disagree that it is sometimes justifiable to violate traffic laws." Enlightened self-interest was measured with the question asking respondents to choose between the

[5] The research sites included the north end of the Farmgate area at the intersection of Kazi Nazrul Islam Ave. and Krishi Khamar Rd., the Banglamotor intersection at Kazi Nazrul Islam Ave. and New Eskaton Rd., the Science Laboratory intersection at Mirpur Road and New Elephant Rd., and Shamoli intersection at Mirpur Rd. and Ring Rd.

[6] Observation included three fifteen minute counts at each of the research sites conducted between the hours of 12:00pm and 5:00pm on weekdays. To reduce human error in counting, all counting was done by two or more researchers simultaneously and averaged. The method likely suffers from both measurement error, as there were differences between the counts of the researchers, and sampling error, as three observations is insufficient to adequately measure the true population of bridge users vs. j-walkers.

phrase that they most agreed with: “If you want to get where you are going in Dhaka you have to be an aggressive driver” or “Drivers could get to their destination faster if everyone was less aggressive.”

This research design offers both advantages and disadvantages. Research linking attitudes to seat belt use has traditionally had to rely on asking respondents to self-report if they wear a seat belt or not, producing a social desirability bias in the dependent variable, whereby respondents likely over-report seat belt use. This research suffered from no such bias, as CES researchers were able to directly observe pedestrians actually choosing to use the bridge or to j-walk. By sampling pedestrians based on their behaviors, this research is able to more accurately link attitudes with actual behavior. Furthermore, Dhaka offers an ideal research environment to test the impact of personal safety risk assessments because of the almost complete absence of law enforcement and fear of punishment. The research also benefited from a pilot study of over three-hundred pedestrians conducted in 2012, which helped ensure more rigorous site selection, sampling techniques, and survey questions. Nonetheless, the study is not without its limitations. As the observation was based on researchers counting male and female bridge users and j-walkers at limited points in time, there is likely both human measurement error and sampling error in my estimations. Furthermore, despite improvements to the survey instrument after the pilot study, there is some indication of social desirability biases in some of the responses (e.g. past reported street crossing behavior). Finally, because the research is based on four specially selected research sites, I cannot claim that the attitudes expressed by the study participants are representative of all of Dhaka’s pedestrians.

**5. Results: Descriptive research findings**

Observation conducted at the research sites, reveals that in contrast to conventional wisdom, a majority of pedestrians in three of the four research sites used the pedestrian bridges. The average Dhaka resident would probably be surprised at this finding; however, it is likely that those pedestrians

pushing their way through traffic are far more noticeable than the slim majority that respects traffic laws. The Science Lab intersection was the busiest of the four, with an observed average of 409 pedestrian crossings in a fifteen minute period (See Table 2). Of these crossers, 58.9% used the bridge and another 41.1% j-walked below. The intersection on the north end of Farmgate was the only one where j-walkers outnumbered bridge-users. Here, of 292 average observed pedestrian crossings in a fifteen minute period, 44.0% of pedestrians used the bridge and 56.0% j-walked below. Across the four research sites, 54.3% of observed pedestrians used the bridge. This roughly squares with respondents' reporting of their past pedestrian behavior: 23.1% reported that they always follow traffic rules, 36.1% reported that they usually follow the traffic rules, 33.6% reported that they sometimes follow traffic rules, and 7.1% reported that they rarely follow traffic rules.

Table 2: Estimated average number and percent of pedestrians using footbridges

| | Banglamotor | Science Lab | Shamoli | Farmgate | Average |
|---|---|---|---|---|---|
| J-walkers | 69 | 168 | 137 | 163 | 134 |
| | 39.0% | 41.1% | 45.8% | 56.0% | 45.7% |
| Bridge users | 108 | 241 | 162 | 128 | 160 |
| | 61.0% | 58.9% | 54.2% | 44.0% | 54.3% |
| Total | 178 | 409 | 299 | 292 | 294 |
| | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

It is worth reiterating that this is not representative of all Dhaka pedestrian behavior. Many Dhaka intersections lack a pedestrian bridge, cross-walks, or a dedicated time period to cross the street, offering no safe means to cross the street. In other locations, dedicated times might exist, but they might be infrequent. In one intersection observed as part of the pilot study (the north end of the Karwan Bazar intersection) a pedestrian would have to wait almost ten minutes to cross with the right of way during peak traffic times. In other intersections (such as the Kakoli intersection at New Airport Road and Kemal Ataturk Ave.), the pedestrian bridge is so far away from the intersection that a far lower

percentage of pedestrians make use of it. And in other locations (such as the intersection of Green Rd. and Kazi Nazrul Islam Ave. in Farmgate) barbed wire fencing in the median prevents j-walking, forcing almost all pedestrians to use the pedestrian bridge.

The survey revealed enormous concern for pedestrian safety. 53.4% stated that they were very worried about getting hit by a car, and 36.7% stated that they were worried. Only 9.8% were not very worried or not at all worried (See Figure 3). This concern appears to be well founded. As shown in Figure 4, a high 17.7% reported that they had been hit by a vehicle as a pedestrian; 18.3% reported that someone in their family had been hit by a vehicle; and 31.3% reported that an acquaintance or friend had been hit! Only 32.7% said they knew of no one that had been hit.

Figure 3: Worry among respondents of being hit by a vehicle while crossing the street

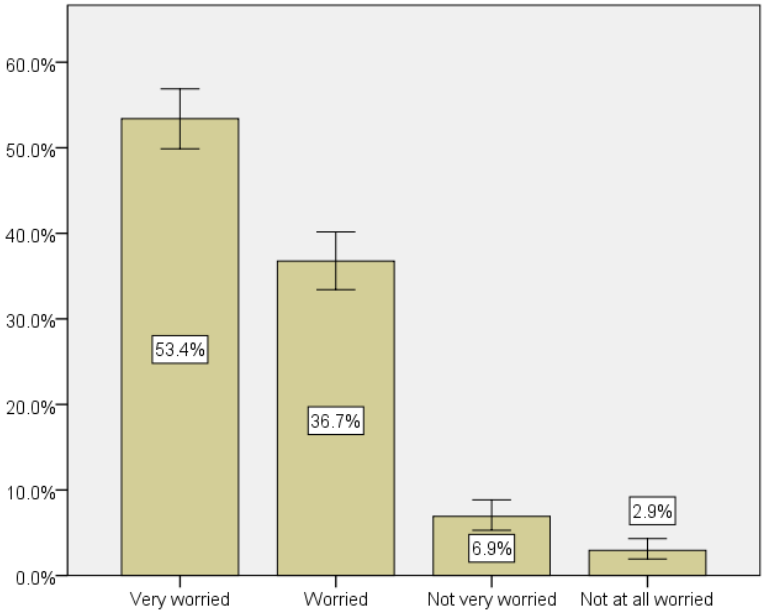
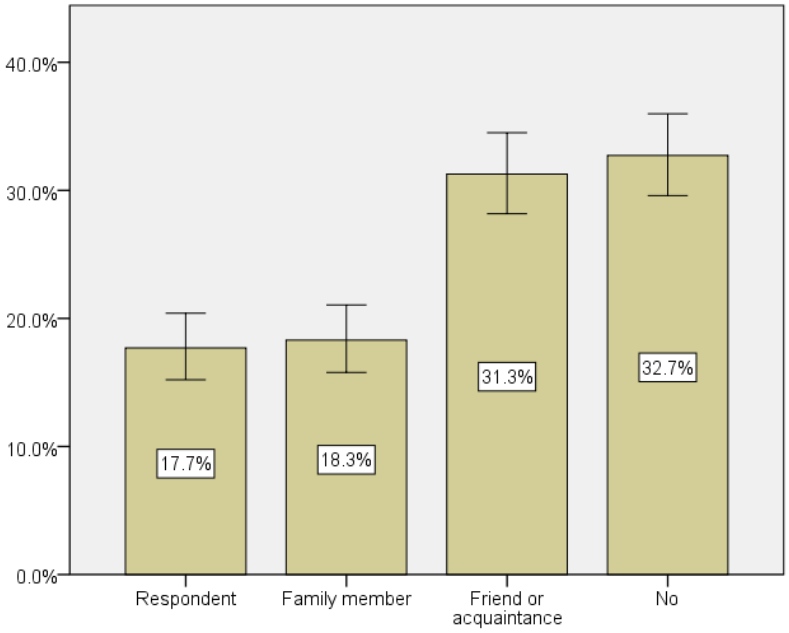


Figure 4: Has the respondent or relation been hit by a vehicle as a pedestrian?




While the measurements might suffer from social desirability biases, respondents report disapproval of traffic law violations and recognition of the collective action problem in Dhaka traffic. When asked if they agreed or disagreed with the statement, "Given the way things are right now in Bangladesh it is sometime ok to violate the traffic laws," only 13.7% agreed or strongly agreed. When asked whether they agreed more with the statement "If you want to get where you are going in Dhaka you have to be an aggressive driver" or the statement "Drivers could get to their destination faster if everyone was less aggressive," 89.9% agreed with the latter and only 10.1% with the former.

**6: Results: Why do people use the pedestrian bridges?**

This analysis asks why some people are more likely than others to use pedestrian bridges when there are no legal consequences for failing to do so. A logistic regression was used to test the impact of fear of being hit by a car (an estimate of the perceived risk), self-reported experiences with actually being hit by a car (expected to impact risk assessments), self-reported past behavior when crossing the street, attitudes towards the law, and recognition of the collective action problem inherent in Dhaka's

traffic problems on use of pedestrian bridges. The results are presented in Tables 3 and 4. Table 3 includes three models. The first contains all relevant variables identified above for the entire sample. The second model offers a reduced sample of 640 respondents. Even though none of the intersections offered a clear pedestrian right of way, there were windows of time at each where it was possible to cross with a greater degree of safety. Researchers made a note of individuals who crossed during these periods and they have been excluded from the second model. As seen in this model, their exclusion had very little impact on the results. The third model contains an interaction variable capturing those pedestrians who are both worried about being hit by a vehicle and not in a hurry. Table four presents a final model of the variables that were found to have an impact on pedestrian behavior with predicted probabilities.

Table 3: Logistic regression models explaining use of pedestrian bridges

| | Model 1: Full sample | | | Model 2: Reduced sample | | | Model 3: Interaction | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | Std. error | Odds ratio | Coefficient | Std. error | Odds ratio | Coefficient | Std. error | Odds ratio |
| Worry about being hit (0/1) | .143 | .155 | 1.154 | .267 | .175 | 1.306 | -.036 | .179 | .965 |
| Been hit by a vehicle (0/1) | .283 | .205 | 1.327 | .191 | .229 | 1.210 | .267 | .206 | 1.306 |
| Always or usually follows law (0/1) | .418** | .158 | 1.519 | .452* | .178 | 1.572 | .434** | .159 | 1.544 |
| Recognize coll. action (0-1) | .462^ | .258 | 1.588 | .529^ | .284 | 1.697 | .403 | .260 | 1.496 |
| Violating laws ok (0/1) | -.173 | .229 | .841 | -.397 | .249 | .673 | -.184 | .230 | .832 |
| Knowledge of the law (1-3) | .190 | .135 | 1.209 | .235 | .152 | 1.265 | .186 | .136 | 1.205 |
| Education (1-4) | .191^ | .102 | 1.211 | .250* | .111 | 1.284 | .199* | .102 | 1.220 |
| Not in a hurry (0/1) | .598*** | .176 | 1.818 | .328^ | .194 | 1.388 | .235 | .252 | 1.264 |
| Under 25 (0/1) | .507** | .161 | 1.661 | .716*** | .182 | 2.045 | .510** | .162 | 1.666 |
| Female (0/1) | -.030 | .182 | .971 | -.043 | .206 | .958 | -.026 | .182 | .974 |
| Farmgate intersection (0/1) | -.397* | .182 | .672 | -.449* | .204 | .638 | -.415* | .183 | .660 |
| Int: Not in a hurry and worried | | | | | | | .699* | .355 | 2.011 |
| Constant | -1.834*** | .514 | .160 | -1.809*** | .566 | .164 | -1.707*** | .519 | .181 |
| n | 749 | | | 640 | | | 749 | | |
| Psuedo $R^2$ | .084 | | | .099 | | | .091 | | |

*Note*: The odds ratio can be interpreted as a respondent who is not in a hurry has 1.818 greater odds of using the pedestrian bridge or crossing the street with the right of way than someone not in a hurry. The reduced model excludes those respondents who did not use the pedestrian bridge, yet were deemed by the researcher to have waited to cross the street. The pseudo $R^2$ is the Nagelkerke $R^2$. ^p<.1;* p<.05; ** p<.01; ***p<.001

Table 4: Logistic regression model excluding irrelevant variables explaining use of pedestrian bridges

| | Coefficient | Std. error | Odds ratio | Predicted probability 1 | Predicted probability 2 | Change in the predicted probability |
|---|---|---|---|---|---|---|
| Always or usually follows law (0/1) | .465** | .153 | 1.592 | 49.2% | 60.7% | 11.5% |
| Recognize coll. action (0-1) | .500* | .253 | 1.648 | 44.9% | 57.3% | 12.4% |
| Education (1-4) | .219* | .098 | 1.245 | 49.1% | 59.9% | 10.8% |
| Not in a hurry (0/1) | .600*** | .172 | 1.821 | 51.9% | 66.3% | 14.4% |
| Under 25 (0/1) | .543*** | .156 | 1.721 | 48.8% | 62.2% | 13.3% |
| Farmgate intersection (0/1) | -.545** | .176 | .580 | 59.4% | 45.9% | -13.5% |
| Constant | -1.526*** | .417 | .217 | | | |
| | | | | | | |
| n | 780 | | | | | |
| Psuedo R2 | 0.089 | | | | | |

*Note*: The odds ratio can be interpreted as a respondent who is not in a hurry has 1.821 greater odds of using the pedestrian bridge or crossing the street with the right of way than someone not in a hurry. Probability changes are based on differences in the probability of using the bridge or crossing legally between those who are in a hurry and those who are not in a hurry while holding other factors at their mean. The pseudo $R^2$ is the Nagelkerke $R^2$. ^p<.1;* p<.05; ** p<.01; ***p<.001

The results of the two tables suggest the following. As shown in Models 1 and 2 of Table 3, those who are very worried about being hit by a vehicle were no more likely to use a pedestrian bridge than those who were less worried. Model 3, however, suggests that those who were both worried and not in a hurry were more likely to use the pedestrian bridges. In other words, the perception of risk only matters when the respondent is not in a rush. Recognition of risk by itself is insufficient.

Perhaps most interestingly and surprisingly, those who report having been hit by a vehicle are no more likely to use the pedestrian bridges than those who have not been hit by a vehicle. The finding is consistent across the regression models; it is consistent regardless of coding or whether or not perceived risk is included in the analysis; and there do not appear to be any statistically significant interactions with other relevant variables. Again, this supports the argument that risk – even empirically supported risk – is an inadequate motivator.

As expected, however, habit does appear to help explain pedestrian bridge use, although the predicted impact of the variable is not perhaps as strong as expected. The model presented in Table

4 predicts that someone who reports sometimes or rarely respecting traffic rules when crossing the street has a 49.2% chance of using the bridge with all other values set to their means and someone who reports usually or always respecting traffic rules has a 60.7% probability of using the bridge, a difference of 11.5 percentage points

There is some support that recognition of the collective action problem, or agreement that drivers would get to their destination faster if everyone was less aggressive, also positively impacts bridge. Those who recognized the collective action problem were 12.4 percentage points more likely to use the pedestrian bridges. Expressed commitment towards the law, however, or disagreement with the statement that given the way things are it is sometimes ok to violate traffic rules, did not help explain pedestrian behavior. This finding is consistent regardless of coding, although there is some indication to suggest that attitudes towards the law might influence the decision to wait before crossing the street, even if they do not impact bridge use.

Other variables that influence bridge use include education levels, not being in a hurry, and being below the age of 25, a proxy for the ability to easily climb the stairs. Gender and knowledge of the law are not found to have an impact. Convenience also appears to be an important predictor. The research site at the north end of Farmgate and Banglamotor intersections are very similar intersections; however, the Farmgate pedestrian footbridge is located slightly further away from the intersection than the Banglamotor pedestrian bridge, perhaps explaining why the Banglamotor bridge had the highest percentage of users and the Farmgate bridge the lowest percentage.

When respondents who did not use the bridge were asked why they did not do so, the largest percentage contended that they were in a hurry, with a similar percentage reporting not wanting to climb the stairs (See Table 5). All respondents were asked why they thought others did not use the bridges. 44% felt it was because they were in a hurry, 25.6% because of the stairs, and 18.2% because everyone else crosses at the street level. Only a small percentage of both groups felt that the main obstacle was insecurity, or the risk of crime, on the bridges.

Table 5: Respondents' explanations for why pedestrian bridges are not used

| | Self-reported reason j-walking respondent didn't use the bridge? | | Perceived primary reason why many people do not use the bridges? | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| I didn't/they don't have time and am/are in a hurry | 134 | 37.5% | 356 | 44.0% |
| It is too difficult to climb all those stairs | 124 | 34.7% | 207 | 25.6% |
| Muggings occur on the bridges | 29 | 8.1% | 65 | 8.0% |
| Everyone else just crosses the road, so why shouldn't I/so they think why shouldn't they? | 40 | 11.2% | 147 | 18.2% |
| Other | 30 | 8.4% | 3 | 0.4% |
| Total | 357 | 100.0% | 778 | 100.0% |

**7. Concluding discussion**

To be sure, there are limitations to this analysis: most notably is the low pseudo-$R^2$s found in the regression models. There are several potential explanations for shortcomings in providing a more complete explanation for pedestrian bridge use. Pedestrians were generally cooperative and the survey response rate was around 30%; however, it is likely that there was some sampling bias in that those individuals who were in a considerable hurry were probably both less likely to stop to take the survey and less likely to use the bridges. In addition, while age is a useful proxy for the ability to easily use the pedestrian bridges, it is an imperfect one. Given lower pedestrian crossings at the less convenient intersection on the north end of Farmgate, it is likely that inconvenience plays an important role. Perhaps most importantly, the analysis lacked an effective way to measure the impact of the collective action problem and the influence of others on respondents' behaviors.

Despite these limitations, the analysis does have considerable strengths: in particular, the ability to link pedestrian attitudes with *actual* behavior – not self-reported behavior. As such, this study is able to provide very strong evidence that neither the perception of risk nor past experiences of being hit by a vehicle have a statistically significant impact on footbridge use. While this is consistent with some research on seatbelt usage, it is nonetheless still surprising in the Bangladeshi

context, where the risks are much higher given the high incidence of pedestrian fatalities and the obvious difficulty in crossing Dhaka's dangerous streets.

While we observed higher pedestrian bridge use than expected, it is nonetheless concerning that there is not a clearer link between risk assessments and behavior. These results suggest that law enforcement will have to play a more active role if pedestrian fatalities are to be decreased. This does not necessarily entail leveling of fines, as under the status quo police officers do not even admonish pedestrians or perform any educating functions. As such, provided widespread acceptance of the informal rule of "first in time and first in right," pedestrians comfortably j-walk directly in front of police officers and the officers themselves do the same.

Well thought out infrastructure is also required. Pedestrian crossings are often not marked and Dhaka does not have a single pedestrian "Walk"/"Don't Walk" indicator light. Anecdotal evidence suggests that fencing along medians and around sidewalks has also proven to be very effective at keeping pedestrians out of the street in China and nearby Kolkata. Interventions can often times be rather simple. For example, the photo in Figure 5, taken in Kolkata, India, shows how traffic personnel keep pedestrians from pushing out in the street with a simple rope.

Figure 5: Traffic personnel in Kolkata, India use a rope to prevent pedestrians from spilling into the street

Nonetheless, if not well designed or maintained, even well-intentioned infrastructure projects often fall far short of their objectives. For example, a newly built, gently rising staircase at one intersection (New Airport Road and Banani Road 11) is designed to make the climb easier; however, the poor placement of the stairs means that most pedestrians have to walk far out of their way to reach the staircase. Figure 6 shows a median fence (near New Market on Mirpur Road), where merchants cut a hole through fencing to permit pedestrian traffic without using the pedestrian bridge directly overhead. In one fifteen minute time period on a busy shopping day, 135 pedestrians were observed crossing through this hole in the fence. Furthermore, Figure 7 shows how fencing designed to keep pedestrians on the sidewalk has actually had the opposite effect, as most pedestrians walk on the road despite the wide sidewalks so as to more easily cross the street.

Figure 6: Pedestrians pass through a hole cut in a fence in the median divider

Figure 7: Pedestrians walk outside fencing designed to keep them on the sidewalk

The third piece of the puzzle is education. While some educational efforts have been undertaken (for example, a speaker at Karwan Bazar exhorts people not to j-walk) they are clearly insufficient. Figure 8, for example, shows a sign encouraging pedestrians to use a pedestrian bridge that was never actually built. The lack of a serious and concerted public education campaigns likely ensures the persistence of the status quo. Educational efforts will also need to make the link clearer between j-walking and the risk of injury or even death. In Bogota, Colombia, for example, a city that

has been highly praised for its efforts to bring down traffic fatalities, the then mayor of Colombia painted stars on the streets at the locations where pedestrians had died in an effort to visually raise awareness of the problem (Singhal & Greiner, 2008). In short, a greater role for law enforcement, infrastructure improvements, and educational campaigns will all be required to alter the status quo on Dhaka's streets.

Figure 8: Example of failed educational effort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