Stress Effects Due to Traffic Congestion: A Case Study on School Going Children of Dhaka City

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Abstract: Traffic congestion in urban streets is a common phenomenon in many cities around the world. Due to congestion and thus long waiting time on roads, people may feel stressed. Stress has many effects on human body, especially for the children. The main purpose of this research is to identify the stress effects on children due to traffic congestion. The depth of the stress effects as well as the stress level of school children due to traffic congestion while travelling to/from school were measured. A total 120 students from class two to five, all are below 12 years old, from three primary schools in Dhaka city were randomly selected and interviewed using a pre-determined questionnaire. The "Perceived Stress Scale" was applied to measure the depth of stress effects and the stress level. The data reveal that the major stress effects due to traffic congestion are: irritability and moodiness, crying tendency, aggressive behavior, school refusal tendency, spending a lot of time alone, trouble to concentrate on school work, changing in eating habits, headaches and stomachaches, anxiety and worry and sleeping disturbance. Almost 21% of the respondents had high stress level and 55% had medium stress level due to congestion. However, it was found that the stress level is related with the travel distance, mode used and travel time for the school trip. The results of this research will be helpful for formulating policy measures to reduce stress whilst the methods and techniques could be applied for measuring stress level due to congestion for other age groups, for people in other cities.

Keywords: congestion, traffic, stress, effects, children.

1. Introduction

Traffic congestion is a very common phenomenon in urban roads of the major cities in Bangladesh. Now-a-days, traffic congestion in major cities, such as Dhaka or Chottogram, is often a common problem. Particularly during the peak hours, the traffic situation becomes worse. Due to congestion, traffic is in gridlock situation and the commuters usually spend hours for travelling a short distance. Different research mentioned that due to traffic congestion everyday around 5 million working hours are lost in Dhaka city. Moreover, the speed of motorized vehicles in Dhaka reduced to about 5 km per hour only (Daily Star, 2018).

Traffic congestion does have several negative externalities on the society and people. Stress is one of those negative effects of congestion on people or the road users. Stress is a feeling of emotion or physical pressure, which is actually mental (or body's) reaction to any unusual happening. In psychological science, stress is a feeling of mental pressure

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and tension (Shahsavarani, et al. 2015), originates from such events that make a person frustrated, angry and/or nervous. Yet, research on driving or congestion associated with stress has received little attention. Rush hour traffic congestion is an event that is frequently experienced and interpreted as stressful by many automobile drivers (Hennessy and Wiesenthal, 1997). For example, in traffic jams about 20% of the highway drivers in the UK experience aggressive behaviors, 50% are irritated and fed-up, while only about 10% experience anxiety (Gulian, et al. 1989).

Dhaka is one of the most stressful cities in Asia (Zipjet, 2017), and for this, probably the traffic congestion is one of the liable factors. Stress and related research are very common in the field of psychology. However, yet there is not much research being done on stress and congestion to provide relevant scientific evidence particularly for the contexts of Bangladesh.

Stress produces different effects on human body, mood and behaviour. Understanding stress and the management techniques is very essential to prevent greater damage that can caused by stress. Therefore, it is important to identify and measure the depth of stress effects and the stress level due to traffic congestion. Moreover, the stress effects of congestion on children might be different than other people. This research is an endeavor to investigate how the congestion effects on stress level of the commuters, particularly for the children of their school trips on motorized traffic.

Next section provides a review of relevant literature. The scope and objectives of this paper are provided in Section 3. Section 4 describes the methodology applied. Section 5 reports on the results from the case study conducted in Dhaka city about the stress effects on children due to traffic congestion. Section 6 provides discussion and conclusions.

2.   Review of Relevant Literature

2.1. Effects of Traffic Congestion

Traffic congestion is a situation when the number of vehicles attempting to use a roadway at any given time exceeds the ability of the roadway to carry the load at generally acceptable service levels (Rothenberg, 1985). Existing literature show that there are many negative effects of traffic congestion. Major effects of traffic congestion, according to Victoria Transport Policy Institute (VTPI, 2018), are:

i.   Time waste of motorists and passengers, thus opportunity cost;

ii.   Motorists become stressed and frustrated, therefore encourage road rage or reduce health of motorists;

iii.   Produces stress on road user, especially for children and drivers;

iv.   Reduces regional economic health for most of the people;

v.   Inability to forecast travel time accurately, thus late arrival in work or meetings resulting in loss in business or disciplinary action or other personal losses;

vi.   Time reduce for productive activities;

vii. More fuel combustion due to car idling and frequent acceleration and braking resulting increased air pollution and carbon dioxide emissions;

viii. Wear and tear on vehicles as a result of idling in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements;

ix. Blocked traffic may interfere with the passage of emergency vehicles traveling to their destinations where they are urgently needed;

x. Spillover effects from congested main arteries to secondary roads and side-streets as the alternative routes are attempted, which may affect neighborhood amenity or real estate prices;

xi. Higher chance of collisions due to tight spacing and constant stopping-and-going.

Besides the above-mentioned effects, the other possible effects of traffic congestion could be: create short-term and localized problems such as smog or sound pollution; increase respiratory problem in a community; increase depression and headache of people; increase moodiness of people; weaken immune system of residents; short tempered of people; reduce peoples' attention in work.

2.2. Typology of Stress

Stress is an ambiguous and wide concept which is attributed to varied phenomena and definitions (Shahsavarani, et al. 2015). Stress can be defined as a situation in which an individual is forced to act but (s)he cannot bear the received mental tension. Stress is a normal psycho-physiological response to events which result in the sense of threat, sadness, dysphoria and imbalance in people (Shalev, et al. 2000). Behnoudi (2005) explained stress means re-adjustment of individual with the new situations and conditions; whenever a change occurs in life, the individual confront with stress. Stress can be categorized in three types: acute stress, episodic acute stress, and chronic stress (Miller et al. 1994). Each type has its own characteristics and symptoms, discussed below.

Acute Stress

Acute stress is a common form of stress, usually comes from demands and pressures of the recent past and anticipated demands and pressures of the near future; and it is thrilling and exciting in small doses, but too much is exhausting (Miller et al. 1994). Acute stresses are short-time event that causes stress and because of short term it cannot do extensive harm to human. According to Miller et al. (1994), the most common symptoms of acute stress are:

i. Emotional distress (some combination of anger or irritability, anxiety and depression).

ii. Muscular problems (tension, headache, back pain, jaw pain and the muscular tensions that lead to pulled muscles and tendon and ligament problems).

iii. Stomach, gut and bowel problems (heartburn, acid stomach, flatulence, diarrhea, constipation and irritable bowel syndrome).

iv. Transient over arousal (blood pressure, rapid heartbeat, sweaty palms, heart palpitations, dizziness, migraine headaches, cold hands or feet, shortness of breath and chest pain).

Episodic Acute Stress

Episodic acute stress take place if a person frequently suffers from acute stress (Legg, 2016). The person who is suffering from episodic acute stress is always seem to be in tension or crisis. People who are pessimistic or who tend to see the negative side of everything also tend to have episodic acute stress; they are often short-tempered, irritable, and anxious (Legg, 2016). The symptoms of episodic acute stress are similar to the symptoms of acute stress. According to Freshwater (2018), the most common symptoms of episodic acute stress are:

i. Emotional distress (anger or irritability, anxiety and depression, short-tempered, impatient, tense).

ii. Muscular problems (tension, headache, back pain, jaw pain, pulled muscles, tendon, ligament problems).

iii. Cognitive distress (compromised attention or concentration, compromised processing speed, compromised new learning and new learning memory consolidation and retrieval, mental fatigue).

iv. Impersonal relationships deteriorate (hardly maintain personal relationship, workplace becomes a very stressful place for them).

v. Stomach, gut and bowel problems (heartburn, acid stomach, flatulence, diarrhea, constipation, irritable bowel syndrome).

vi. Extended arousal (blood pressure, rapid heartbeat, sweaty palms, heart palpitations, dizziness, migraine headaches, cold hands or feet, shortness of breath, insomnia, chest pain, heart disease).

vii. Immune system compromise (frequent cold or flu, allergies, asthma, immune system compromise illness).

Chronic Stress

Chronic stress are the stresses that last for a longer period of time. If chronic stress is left untreated over a long period of time, it can significantly and irreversibly damage physical health and deteriorate mental health (Freshwater, 2018). Chronic stress can also appear when someone feel hopeless or cannot find any solution to get rid from the causes of stress. Therefore, chronic stress is the most dangerous types of stress and harmful for human health. People with chronic stress have the symptoms and signs mentioned for acute stress and episodic acute stress, however, could be chronic/acute and can result in a physical or mental breakdown that can lead to suicide, violent actions, homicide, psychosis, heart attacks and strokes (Freshwater, 2018). Chronic stress is the stress of poverty, dysfunctional families, violence, abuse, trauma, despised job, ethnic rivalry, war; which can destroy the lives, bodies and minds.

2.3. Types of Stress Effects

Stress has diverse effects on human; particularly on body, mood and behavior. Table 1 shows different types of stress effects.

Table 1: Different types of stress effects on human

Types of Effects	Symptoms of Effects
Effects on Human Body	Headaches, pounding heart increase depression, high blood pressure, heartburn, fertility problem, insomnia, stomachache, rapid breathing, erectile dysfunction, weakened immune system, low sex drive, risk of heart attack, missed period, high blood sugar, tense muscles.
Effects on Human Mood	Anxiety, restlessness, lack of motivation or focus, feeling overwhelmed, irritability or anger, sadness or depression.
Effects on Human Behavior	Overeating or under eating, angry outbursts, drug or alcohol abuse, tobacco use, social withdrawal exercising less often.

Source: Legg, 2017; Mayo clinic, 2016.

Children may have some special symptoms of stress effects. Stress can manifest itself through changes in behavior of children. Some of those behavioral symptoms may include following (Rowe, 2018):

i. Irritability and moodiness;

ii. Withdrawing from activities that used to give them pleasure;

iii. Clinging, being unwilling to let parents out of sight;

iv. Crying tendency;

v. Aggressive behavior;

vi. Regression to earlier behaviors (e.g. thumb-sucking or bed-wetting);

vii. School refusal;

viii. Unwillingness to participate in family or school activities.

Besides the above-mentioned effects, stress may have some other effects on children. These are**:** spend a lot of time alone; over-reacting on minor issues or problems; trouble to concentrate school work; begin to lie and reduce self-regulation; radical change in academic performance; changes in eating habit; headaches and stomachaches; anxiety and worry; sleep disturbance and nightmares; new or recurring fare (e.g. fare of the dark or strangers or fear of being alone).

2.4. Methods of Measuring Stress

There are some tools and techniques that help measure and understand the level of stress. Measuring or assessment of stress can be done using different methods. The common methods are: physiological measure, self-report scale or psychological questionnaire, and perceived stress scale (PSS) (UKEssays, 2015); been discussed below.

Physiological Measurements

Physiological measurement of stress is done by monitoring heart rate variability, breath frequency, blood pressure and also by measuring different stress hormones (Haapanen, 2018). These variables can also be influenced by some other factors besides stress;

therefore, without having a detailed and thorough investigation it is often difficult to measure stress. Measuring cortisol, a hormone that plays significant role in the wellbeing of human's health (known as 'stress hormone'), in a particular human body and analyze the obtained data helps to understand the physical stress (Haapanen, 2018). Cortisol can be found in blood, urine, saliva and hair. Stress measurement with cortisol will deliver the best result through regular monitoring, however, this process is difficult and expensive as it requires a laboratory to analyze.

Self-report Scale or Psychological Questionnaire

Psychological questionnaire is an instrument for in-depth investigation of stress level. There are some established assessment methods that helps to understand the level of stress and also other important information if it is required and considered while designing the questionnaire. The questionnaire can be designed differently as per case subject. These questionnaires are highly dependent on the assessment scale used for measuring the stress level. There are some different scales used in various studies by researchers those are mainly stressor oriented. Stressors like traumatic events, perceived stress, occupational or work stress, relationship conflict, emotional stress, financial tension, daily experienced stress are often being considered for analysis.

Perceived Stress Scale (PSS)

Besides the above-mentioned methods, 'Perceived Stress Scale (PSS)' is another method for measuring stress. The PSS method is usually used to measure the depth and level of stress effects. It is a classic instrument or tool developed by Sheldon Cohen in 1984 for assessing stress. The PSS is most widely used method for assessing stressfulness of events, physical and psychiatric diseases and stress management programs (Andreou, et al. 2011). This includes several simple investigations about current levels of stress that are experienced. The PSS can be used as an outcome variable by measuring people's experienced levels of stress as a function of objective stressful events, coping resources and personality factors (Cohen, et al. 1983). This tool was originally developed as a 14-item scale that asses the perception of stressful experiences by asking the respondent to rate the frequency of his/her feelings and thoughts related to events and situations that occurred over the previous month (Andreou, et al. 2011). Extracting the answer of the queries will lead to measure the degree of stress. In short, the PSS is a brief and easy to administer measure the degree to which situation one's life is appraised as stressful (Cohen, et al. 1983).

The PSS tool is a popular choice for understanding how different situations affect feelings and perceived stress of people. In this scale, ten questions are needed to prepare and respondents are asked to express his/her feelings and thoughts during last month. Although some of the questions are similar, there are differences between them and each one should be treated as a separate question. In each case, respondents are asked to indicate how often felt or thought a certain way; should not try to count up the number of times felt a particular way rather indicate the reasonable estimate. To measure the depth of stress, the answer for each of the questions should have five indicators (0 to 5) where 0 stand for 'no', 1 is 'low', 2 is 'medium', 3 is 'high', and 4 is 'very high'. Therefore, the total score on PSS can range from 0 to 40 where higher the score indicates higher perceived stress. The overall measurement of stress is:

i.   Low stress: the scores ranging from 0-13.

ii.   Moderate stress: the scores ranging from 14-26.

iii.   High stress: the scores ranging from 27-40.

3. Scope and Objectives

The main purpose of this research is to understand the stress effects on children due to traffic congestion in Dhaka city. The specific objectives are: (i) to identify the stress effects and measure the depth of stress effects of children due to traffic congestion; and (ii) to measure the stress level of children due to traffic congestion.

The scope of this research is limited to the primary school children only. That means, children of age group between 5 and 12 years old were considered for this study and their stress effects analyzed only for the school trips.

4. Methodology

A case study was done in Dhaka city. This research is qualitative in nature. Required data related to congestion and associated with stress effects were collected from both primary and secondary sources. Relevant secondary data were collected from books, reports and journals.

For primary data collection, a total 120 students of class two to five or their guardians were interviewed in 2018 at school using a pre-determined questionnaire. The sample respondents were selected from following three different schools:

i.   Viqarunnisa Noon School in Azimpur,

ii.   Willes Little Flower School in Kakrail, and

iii.   New Model Multilateral High School in Dhanmondi.

Around 40 respondents were selected from each of the schools. The respondents were selected randomly from the school, at the gate either before starting or after closing the school, during weekdays. Table 2 shows the data collected from questionnaire survey.

Table 2: Required data and source

Purpose	Required Data	Source of Data
Identify effects of stress	Major types of effects	Questionnaire survey, books, journals, websites
Measuring depth of stress effects	Travel distance between home and school Travel mode daily used Travel time: actual, with congestion, extra time	Questionnaire survey
Measuring level of stress	Travel distance between home and school Travel mode daily used Travel time: actual, with congestion, extra time	Questionnaire survey

The survey was conducted during normal sunny days in August and September 2018. The "Perceived Stress Scale (PSS)" was suitable method for this study to measure stress effects depth and stress level. The collected data were analyzed to fulfil the research objectives.

5.   Results from Case Study in Dhaka

5.1.   Socio-demography and Stress Effects

Of the 120 respondents, 42% are 5 to 8 years old and the remaining 58% are 9 to 12 years old. Usual travel mode of school trips for the majority of the respondents are public bus (27.5%) and rickshaws (33%), as shown in Figure 1, though several of them use private car or bike (motorcycle), other travel modes including school transport and walk. Travel distance of school trips for almost half of the respondents (45%) are 1-3 km, for the17.5% this is less than one km and for the remaining 37.5% this distance is more than 3 km (see in Figure 2).
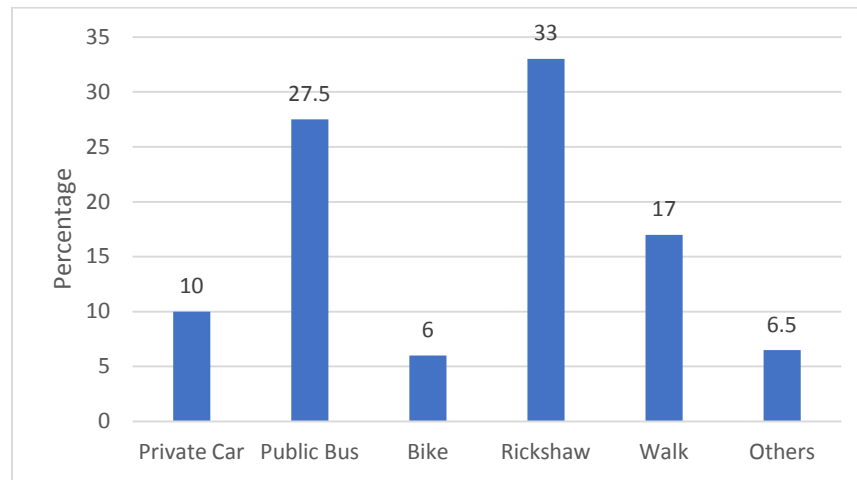
Figure 1: Usual travel mode for school trips.
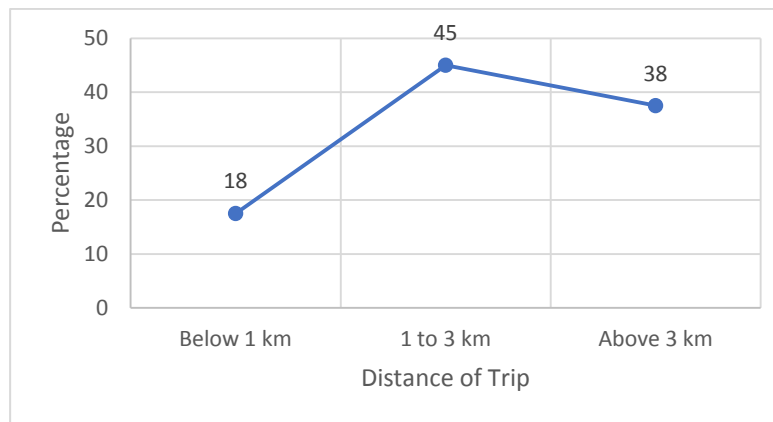Source: Field Survey, 2018.

Figure 2: Distances of school trips.
Source: Field Survey, 2018.

Usual travel time for school trips as well as trip time with congestion and the delayed time for congestion are shown in Table 3. Travel time for 36.5% of the respondents is 11-20 minutes, for 15% is less than 10 minutes, for 32.5% it is 21-30 minutes, and for a few it is 31-40 minutes (14%) or 41-50 minutes (2%). If travel time is considered including

the delay due to congestion, many of the respondents spend longer time (e.g. for 24% it is 21-30 minutes, 18% it is 31-40 minutes, 14% it is 41-50 minutes and 18% it is 51-60 minutes) and a few spend over 60 minutes (6%) or 11-20 minutes (8%) or less than 10 minutes (12%) for school trips. The delay (or extra) time due to congestion was calculated by deducting general travel time from travel time with congestion. About 30% of the respondents spend additional time up to 10 minutes for congestion whilst 25% spend additional 11-20 minutes and 29% spend additional 21-30 minutes and 16% spend additional 31-40 minutes for congestion.

Table 3: Usual travel time, trip time with congestion and delayed time for congestion

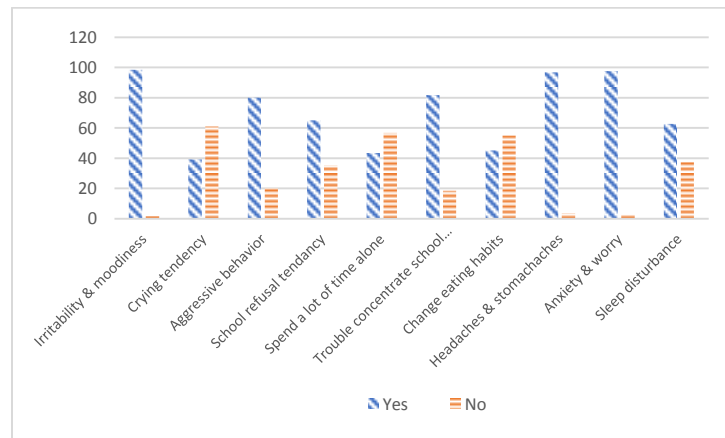| Time Range (Minute)	General Travel Time		Travel Time with Congestion		Extra time	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Less than 10	18	15	14	12	36	30
11 to 20 min	44	36.5	9	8	30	25
21 to 30 min	39	32.5	29	24	35	29
31 to 40 min	17	14	22	18	19	16
41 to 50 min	2	2	17	14	-	-
51 to 60 min	-	-	22	18	-	-
More than 60	-	-	7	6	-	-
Total	**120**	**100**	**120**	**100**	**120**	**100**

Source: Field Survey, 2018.

Figure 3: Proportion of respondents feel different stress effects due to traffic congestion

Source: Field Survey, 2018.

The respondents were asked ten different types of effects of stress due to traffic congestion during school trips whether they feel or not. The results are shown in Figure 3. Almost all the respondents reported that they feel irritability and moodiness, headaches

and stomachaches, and anxiety and worry. More than half of the respondents do not feel crying tendency, spending a lot of time alone, and change in eating habits; however, a large portion mentioned they feel those. With few exceptions, the majority of the respondents reported that they feel aggressive behavior, school refusal tendency, and trouble to concentrate in school works due to traffic congestion.

5.2. Depth of Stress Effects

The major stress effects of children in Dhaka city due to traffic congestion reported by the sample respondents are: irritability and moodiness, tendency of crying and school refusal, aggressive behavior, spend alone time longer, trouble to concentrate school work, change in eating habits, headaches and stomachaches, anxiety, worry and sleeping disturbance. Table 4 shows the summary of depth of stress effects due to traffic congestion in Dhaka city. Of the 120 respondents, 32% feel very high whilst 32% feel high and 18% feel medium irritation and moodiness due to traffic congestion. Even though 61% of the respondents had no crying tendency, 20% have low and 15% have medium whilst 4% have high tendency of crying. Aggressive behavior was reported medium by 38%, high by 20% and very high by 10% of the respondents. Only 4% mentioned very high school refusal tendency whilst high and medium is 12% and 32% respectively.

Table 4: Depth of stress level (in percentage)

Effects of Traffic Congestion	Depth of Stress Effects					Total (%)
	No (Scale 0)	Low (Scale 1)	Medium (Scale 2)	High (Scale 3)	Very High (Scale 4)	
Irritability and moodiness	2	16	18	32	32	100
Crying tendency	61	20	15	4	-	100
Aggressive behavior	20	12	38	20	10	100
School refusal tendency	35	17	32	12	4	100
Spend a lot of time alone	56	12	28	4	-	100
Trouble to concentrate school work	18	17	26	18	21	100
Change in eating habit	55	17	22	5	1	100
Headaches and stomachaches	3	9	16	13	59	100
Anxiety and worry	3	14	23	20	40	100
Sleeping disturbance	37	15	31	14	3	100

Source: Field Survey, 2018.

Regarding spending a lot of time alone, the majority (56%) of the respondents said 'no' and 12% mentioned low whilst 28% mentioned medium and only 4% mentioned high. About 21% of the respondents feel very high trouble to concentrate school work while 26% and 18% mentioned medium and high trouble respectively. The majority of the respondents mentioned no change (55%) in their eating habit or very low change (17%), however, moderate change is reported by 22% whilst high change and very high change is 5% and 1% respectively. The majority of the respondents (59%) had very high headaches and stomachaches whilst moderate and high was reported by 16% and 13%

respectively. Due to traffic congestion, a large portion of the respondents feel very high (40%) or high (20%) anxiety or worry while 23% feel moderate anxiety. A significant portion mentioned no (37%) or very low (15%) sleep disturbance whilst 31% mentioned moderate and a few mentioned high (14%) and very high (3%) disturbance in sleeping.

5.3. Level of Stress Effects

Calculated stress level from 120 sample, as shown in Figure 4, reveal that 24% of the respondents have low stress level while medium and high stress level is reported by 55% and 21% of the respondents respectively. Stress level is highly depended on travel mode, distance and travel time.
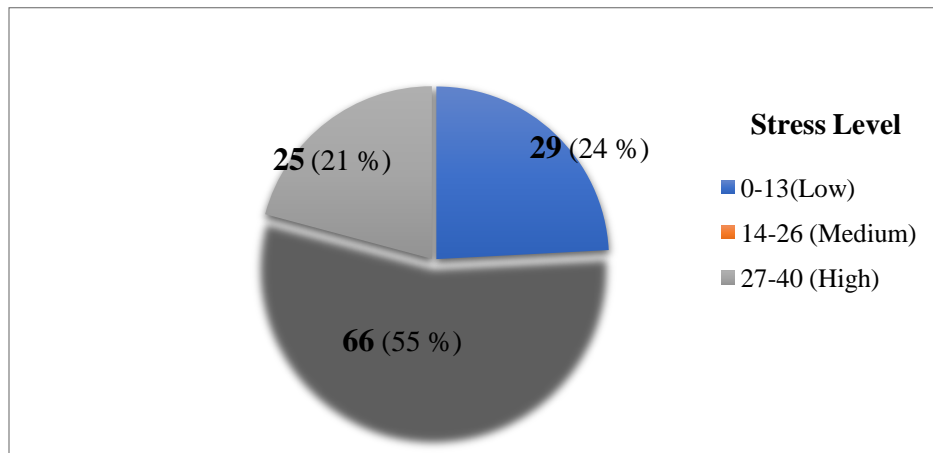

Figure 4: Stress level of children due to traffic congestion in Dhaka city.

Source: Field Survey, 2018.

Figure 5 shows the stress level of respondents with respect to different travel modes being used for school trips. A variety of travel modes such as private car, public bus, bike, rickshaw, and other modes (e.g. school transport vans) are used along with walking for school trips in Dhaka city. Among the respondents, only 10% use private car as the regular travel mode for school trips; they had low, medium and high stress level by 1%, 6% and 3% respectively. About 27% of the respondents use public bus to school of which 13% feel medium and 14% feel high stress level. On the other hand, only 6% use bike who feel low or medium stress level respectively by 1% and 5%. None of the bike users found for high stress level. The highest portion (33%) of the respondents use rickshaws as the regular mode for school trips. Among them, low stress, medium and high stress levels are found for 6%, 24% and 3% respectively. Only 7% of the respondents use other travel modes such as school provided transport for school trips; none of them found with low stress level but 6% and 1% are found with medium and high stress levels respectively. Only 17% of the respondents usually walk for school trips and all of them are found with low stress level due to traffic congestion.
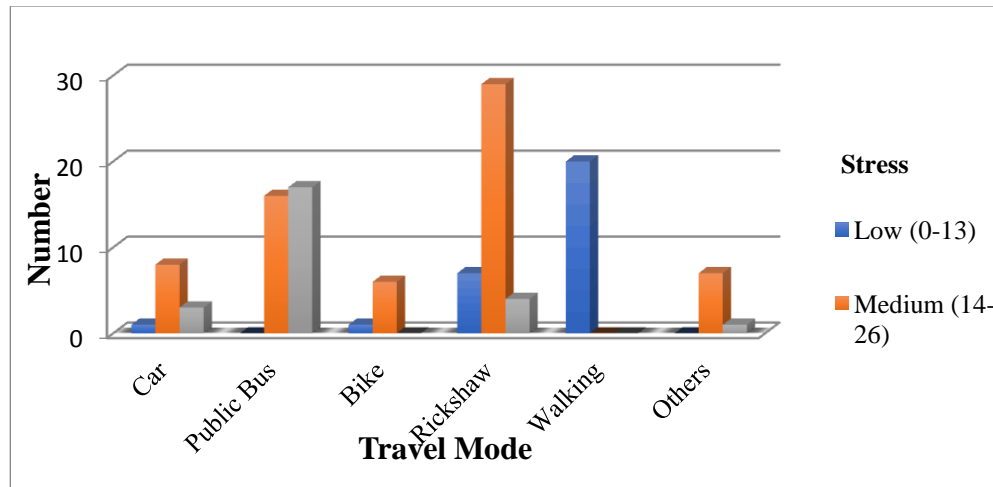
Figure 5: Stress level and travel mode.

Source: Field Survey, 2018.

Travel distance to school reveal, as shown in Figure 6, that school trips for only 17.5% of the respondents are less than 1 km and all of them have low stress level. No respondent was found who travel within 1 km for school trips with medium or high stress level. Travel distance between home and school is 1 km to 3 km for 45% of the respondents who had low, medium and high stress level by 6%, 35% and 4% respectively. On the other hand, 37.5% of the respondents travel more than 3 km and 1% of them had low stress level whilst 20% have medium and 16.5% have high stress level.
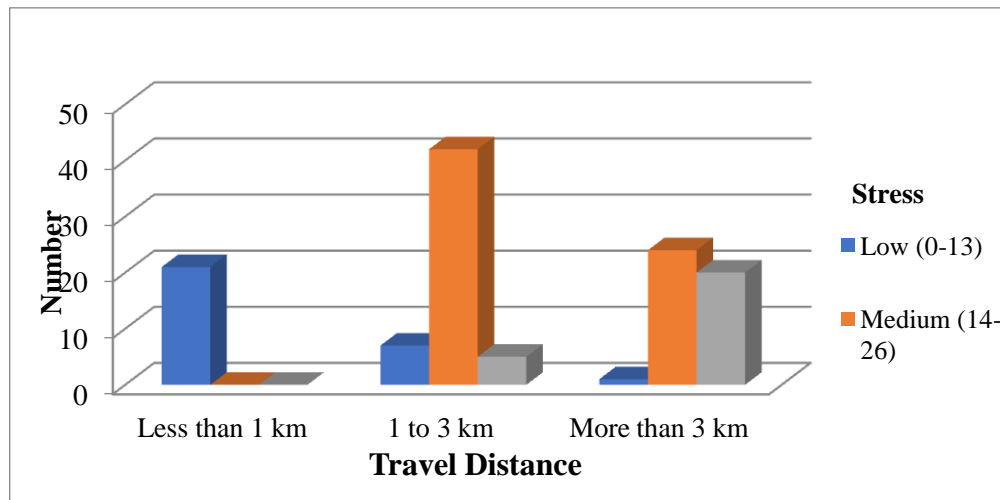

Figure 6: Stress level and travel distance
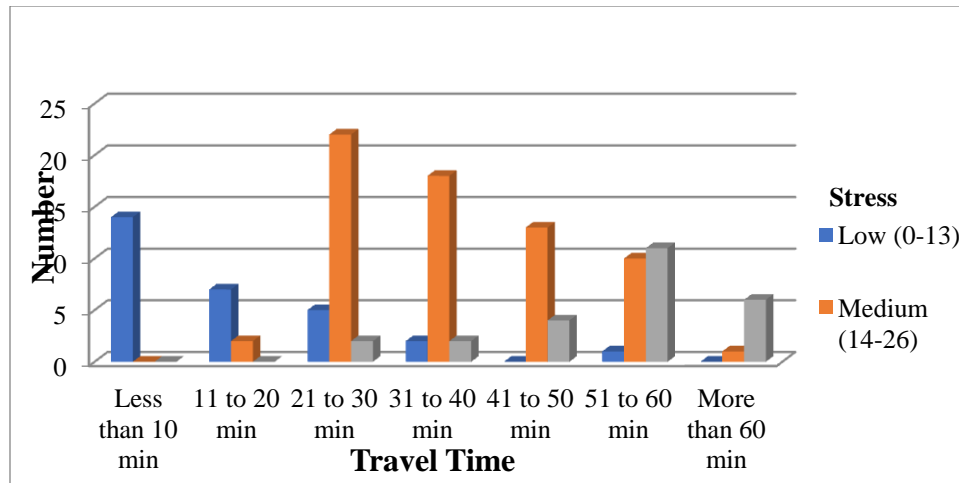
Source: Field Survey, 2018.

Figure 7: Stress level and travel time

Source: Field Survey, 2018.

Of the 120 respondents, as shown in Figure 7, travel time for school trips is less than 10 minutes for 12% of the respondents; all of them have low stress level and none with medium or high stress level. Travel time 11-20 minutes is only for 8% of the respondents of which 6% have low and 2% have medium stress level but none with high stress level. About 24% of the respondents' travel time for school trips is 21-30 minutes and they have low, medium and high stress respectively by 4%, 18% and 2%. On the other hand, travel time 31-40 minutes is for 18% of respondents of which low, medium and high stress level is for 2%, 14% and 2% respectively. About 14% of the respondents' travel time is 41-50 minutes and 11% of them have medium but 3% have high stress level whilst none with low stress level. Travel time 51-60 minutes is for 22 respondents of which half have medium and half have high stress level but none with low stress level. Only 6% of the respondents' travel time of school trips is more than 60 minutes; of them 1% have medium and 5% have high stress level whilst none with low stress level.

5.4. Comparison of Stress Level with Travel Mode, Distance and Time

Table 5 shows the respondents have different stress levels in terms of their different travel mode and the distance of school trips. A large portion of trips on car and buses are for longer distance (over 3 km) and also have high or medium stress levels. School trips on bike are for distance both 1-3 km and more than 3 km and mostly have medium stress level. A significant portion of the respondents' school trips are on rickshaws, mostly for the distance 1-3 km (and some are for more than 3 km) have medium and some have high or low stress level. All the walking trips are for short distance (less than 1 km) and the respondents have low stress level. Several respondents use other mode such as school transport mostly for distance 1-3 km and with few exceptions they have medium stress level.

Table 5: Stress level with travel mode and travel distance (% of the respondents)

Travel Mode	Trip Distance												Grand-Total (%)
	Less than 1 km				1 to 3 km				More than 3 km				
	Stress Level			Sub-total	Stress Level			Sub-total	Stress Level			Sub-total	
	L	M	H		L	M	H		L	M	H		
Car	-	-	-	-	1	2.5	-	**3.5**	-	4	2.5	**6.5**	**10**
Public Bus	-	-	-	-	-	6	2	**8**	-	6	14	**20**	**28**
Bike	-	-	-	-	-	3	-	**3**	1	2	-	**3**	**6**
Rickshaw	1	-	-	**1**	5	17	2	**24**	-	6	2	**8**	**33**
Walk	16	-	-	**16**	-	-		**-**	-	-	-	**-**	**16**
Other	-	-	-	-	-	6	1	**7**	-	-	-	**-**	**7**
Total	17	0	0	**17**	7	42	5	**45.5**	1	24	20	**37.5**	**100**

Note: Service level denotes L = Low, M = Medium and H = High

Source: Field Survey, 2018.

Table 6 shows the respondents' stress level with respect to their different travel mode and trip time. About 12 (10%) respondents use car for school trips; of which 6 (5.1%) need 50-60 minutes, 3 (2.55%) need 40-50 minutes, 2 (1.79%) need 30-40 minutes, and 1 (0.85%) need more than 60 minutes. Among them, 8 (6.8%) respondents have medium stress level, 3 (2.55%) respondents have high and only 1 (0.85%) respondent have low stress level. Around 33 (27.5%) respondents use public bus and all of their trip time was 21-30 minutes or more. Only 17 (14.45%) of them have high and 16 (13.6%) have medium stress level but none with low stress level. Around 7 (6%) respondents use bike and their time ranges 21-30 minutes (5 respondents or 4.25%) and 50-60 minutes (2 respondents or 1.7%); 6 (5.1%) of them have medium and the rest 1 (0.85%) have low stress level. Around 40 (34%) respondents use rickshaw; require less than 10 minutes travel time for 1 (0.85%) respondent, 11-20 minutes for 2 (1.7%) respondents, 21-30 minutes for 16 (13.6%) respondents, 31-40 minutes for 11 (9.35%) respondents, 41-50 minutes for 8 (6.8%) respondents and 51-60 minutes for 2 (1.7%) respondents. Among then 40 (34%) respondents, 29 (24.65%) of them have medium, 4 (3.4%) have high and 7 (6%) respondents have low stress level. Only 8 (6.8%) respondents use other vehicles (e.g. school transport or van); require 21-30 minutes for 5 (4.25%) respondents, 31-40 minutes for 1 (0.85%) respondent, and 41-50 minutes for 2 (1.7%) respondents. Among them none with low stress level but 7 (6%) respondents have medium and 1 (0.85%) respondent have high stress level. Around 20 (17%) respondents walk for school trips; usually take less than 10 minutes for 13 (11.05%) respondents and 11-20 minutes for 7 (6%) respondents whilst stress level for all of the 20 (17%) respondents is low.

Table 6: Stress level of the respondents with travel mode and trip time (% of respondents)

Travel Mode	Stress Level	Trip Time (minutes)							Total
		Below 10	10-20	21-30	31-40	41-50	51-60	60+	
Car	**L**	-	-	-	0.85	-	-	-	10
	M	-	-	-	0.85	1.70	4.25	-	
	H	-	-	-	-	0.85	0.85	0.85	
Bus	**L**	-	-	-	-	-	-	-	27.5
	M	-	-	1.70	6	2.55	2.55	0.85	
	H	-	-	0.85	0.85	0.85	7.65	4.25	
Bicycle	**L**	-	-	-	-	-	0.85	-	6
	M	-	-	4.25	-	-	0.85	-	
	H	-	-	-	-	-	-	-	
Rickshaw	**L**	0.85	-	4.25	0.85	-	-	-	33.35
	M	-	1.70	9.35	7.65	5.10	0.85	-	
	H	-	-	-	0.85	1.70	0.85	-	
Walk	**L**	11.05	5.95	-	-	-	-	-	17
	M	-	-	-	-	-	-	-	
	H	-	-	-	-	-	-	-	
Others	**L**	-	-	3.40	-	-	-	-	6.8
	M	-	-	0.85	0.85	1.70	-	-	
	H	-	-	-	-	-	-	-	

Note: Service level denotes L = Low, M = Medium and H = High
Source: Field Survey, 2018.

Table 7: Stress level with trip distance and travel time (% of the respondents)

Travel Time (Minute)	Trip Distance												Grand-Total (%)
	Less than 1 km				1 to 3 km				More than 3 km				
	Stress Level			Sub-total	Stress Level			Sub-total	Stress Level			Sub-total	
	L	M	H		L	M	H		L	M	H		
Below 10min	12	-	-	**12**	-	-	-	-	-	-	-	-	**12**
11-20 min	6	-	-	**6**	-	2	-	**2**	-	-	-	-	**8**
21-30 min	-	-	-	-	4	18	2	**24**	-	-	-	-	**24**
31-40 min	-	-	-	-	2	6	1	**9**	-	8	1	**9**	**18**
41-50 min	-	-	-	-	-	8	1	**9**	-	2.5	2.5	**5**	**14**
51-60 min	-	-	-	-	-	1	1	**2**	1	7	8	**16**	**18**
Above 60min	-	-	-	-	-	-	-	-	-	1	5	**6**	**6**
Total	18	-	-	**18**	6	35	5	**46**	1	18.5	16.5	**36**	**100**

Note: Service level denotes L = Low, M = Medium and H = High
Source: Field Survey, 2018.

Table 7 shows the respondents' stress level with their trip distance and travel time. The trip distance for 18% of the respondents is less than 1 km and they need less than 10 minutes (12%) or 11-20 minutes (6%) for school trips have low stress level. Trip distance 1-3 km is for 46% of the respondents; of which trip time 11-20 minutes is for 2%, 21-30 minutes is for 24%, 31-40 minutes for 9%, 41-50 minutes for 9% and 51-60 minutes for 2% of the respondents. Of the 46% respondents, 35% have medium, 5% have high and 6% have low stress level. Trip distance more than 3 km is for 36% of the respondents; of which travel time for 9% is 31-40 minutes, for 5% it is 41-50 minutes, for 16% it is 51-60 minutes and for 6% it is more than 60 minutes. Among 36% of the respondents, less than 1% have low stress level while 18.5% have medium and 16.5% have high stress level.

6.   Discussion and Conclusions

Urban traffic congestion is a very challenging issue to solve. The scenario of traffic congestion in developing country cities is often more complicated. Traffic congestion is one of the common problems in major cities of Bangladesh. In Dhaka city, now-a-days traffic congestion creates a high level of stress for people. The common stress effects of children due to congestion during school trips are: irritability and moodiness, crying tendency, aggressive behavior, school refusal tendency, unwillingness to participate in family or school activities, spend a lot of time alone, trouble to concentrate school work, change in eating habit, headaches and stomachaches, anxiety and worry, sleep disturbance. Among them, irritability and moodiness, headaches and stomachaches and anxiety and worry are acute and commonly all are affected.

This research identified the stress effects on primary school children (aged 5 to 12 years) due to traffic congestion in Dhaka city. The level and depth of stress effects were identified and analyzed. About the stress level, it was found that 21% of the respondents have high stress level whilst 55% have medium and 24% have low stress level. Stress level is very closely related with travel mode. For example, stress level was low for the majority of children who usually walk compared to those who use private car or other vehicles for school trips. Stress level is also found to be closely related with trip distance; higher or medium stress level for those who travel longer distance for school trips whilst less stress for short distance. The stress level of children also increases with the increase of travel time for school trips and vise-a-versa. For example, stress level was low for the majority who need less than 10 minutes for school trips, medium or high who needs 20 minutes to more than 60 minutes for school trips.

This research provided a clear scenario about the stress level of primary school children in Dhaka city. Stresses due to traffic congestion could be minimized if the degree of traffic congestion is reduced. Therefore, reducing growth of traffic and thus reducing congestion required high-level (large-scale) planning. The basic strategies of stress prevention are: eliminate or modify the stress-producing situation or remove the individual from it; adapt with work organization or work station to fit individual characteristics of the employee; and strengthen the person's resilience to stress e.g. through physical exercise, meditation or relaxation techniques and social support (Kompier, 1996).

This research could be helpful for other researchers in conducting further research on this topic. The policymakers may also be benefited from the findings of this study. Proper

connection of stress (due to congestion) related topics with urban planning may require finding suitable solutions. Furthermore, the results of this research would be helpful as a guiding principle for preparing policy guidelines for the school authority and the residents having children of Dhaka city.

7. Reference

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