



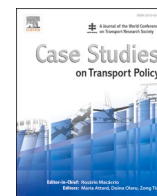
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

Case Studies on Transport Policy

journal homepage: www.elsevier.com/locate/cstp

Transport preferences and dilemmas in the post-lockdown (COVID-19) period: Findings from a qualitative study of young commuters in Dhaka, Bangladesh

Shaila Jamal^{a,*},¹, Sadia Chowdhury^b, K. Bruce Newbold^a

^a School of Earth, Environment and Society, McMaster University, Canada

^b Dhaka Transport Coordination Authority, Government of the People's Republic of Bangladesh

ARTICLE INFO

Keywords:

COVID-19
Travel mode
Perceived safety
Bangladesh
Global south
Qualitative study

ABSTRACT

At the start of the pandemic in early 2020, many cities went to complete or partial lockdown to minimize the mass transmission of COVID-19. Consequently, personal travel patterns have changed throughout the world. This study explores the transport mode preferences and associated dilemmas that commuters face in Dhaka, Bangladesh, in the post-lockdown period. We conducted in-depth semi-structured interviews of 20 young commuters residing in Dhaka. We followed a deductive reasoning approach, and the transcriptions were analyzed following thematic analysis. Findings suggest that despite the perceived high risk of COVID-19 transmission in certain modes, all commuters don't have the ease and flexibility to switch to their preferred safer mode, with commuters trading-off between health risk, affordability and availability of suitable modes, along with other challenges. However, the country's sustainable goals can still be achieved if proper actions, such as removing the challenges commuters face while switching to a sustainable and safe mode during COVID-19 are taken.

1. Background

The start of the pandemic in early 2020 saw governments enact a number of different policies ranging from complete to partial lockdowns to slow the spread of the virus responsible for COVID-19. In terms of public transit, capacity limits were often put in place and use was limited to essential travel only (Abdullah et al., 2020; de Haas et al., 2020), impacting the travel patterns of the public. While transport authorities often moved to limit capacity and use, personal fears of infection also led individuals to avoid using public transit, with a greater preference toward individual travel modes (Das et al., 2021), including walking, cycling, motorcycles and the personal car, all of which were perceived as safer travel options during the pandemic compared to shared transportation modes (Dingil and Esztergár-Kiss, 2021; Ozbilen et al., 2021). Conversely, public transportation was perceived as the most unsafe mode, with a higher risk of virus transmission (Marsden and Docherty, 2021; Ozbilen et al., 2021; Shakibaei et al., 2021; Arellana et al., 2020; Pawar et al., 2020; Kolarova et al., 2021). Additionally, COVID-19's economic impacts may have forced commuters to rely on less costly

mode options (Litman, 2020; Zafri et al., 2021a).

During the pandemic, initiatives were undertaken to promote sustainable transportation among city dwellers around the world. These included the installation of temporary/ dedicated bike lanes, expanding existing cycling networks, shared roads, and pedestrianized streets, among other examples (Budd and Ison, 2020; Taylor, 2020; City of Toronto, 2020; Buehler and Pucher, 2021). In this regard, cities in the global north expect to see an increase in cycling and walking as people started to avoid crowded and shared transport due to the perceived risk of virus transmission and the inability to maintain physical distancing in public modes (De Vos, 2020; Gutiérrez et al., 2020; Shamshiripour et al., 2020). Although studies are ongoing, the available evidence supports an increase in active transportation. For example, Ding et al. (2020) found that COVID-19 had created a population-level increase in engagement in physical activity in Australia, UK and USA. Bicycle use has, for example, increased significantly due to COVID-19 in different cities (Bucszy, 2020; Buehler and Pucher, 2021; Dunning and Nurse, 2021; Hensher et al., 2021). Similarly, micro-mobility services for longer duration and distance of trips have increased during COVID-19 in Zurich, Switzerland

* Corresponding author at: School of Earth, Environment & Society, McMaster University, 1280 Main St. West, Hamilton, ON L8S 4K1, Canada.

E-mail addresses: jamals16@mcmaster.ca (S. Jamal), sadiac707@gmail.com (S. Chowdhury), newbold@mcmaster.ca (K.B. Newbold).

¹ 0000-0002-3628-4346

<https://doi.org/10.1016/j.cstp.2022.01.001>

Received 6 January 2021; Received in revised form 22 December 2021; Accepted 4 January 2022

Available online 7 January 2022

2213-624X/© 2022 World Conference on Transport Research Society. Published by Elsevier Ltd. All rights reserved.

(Li et al., 2020). A study in three USA cities (New York, Houston, and Seattle) saw a significant increase in bicyclists and pedestrians during the stay-at-home order compared to the period before (Doubleday et al., 2021). While active transit modes have increased, public transport ridership has decreased in countries including Hungary, Australia and Sweden (Bucsky, 2020; Hensher et al., 2021; Jenelius and Cebeacauer, 2020). Studies also reported a decrease in overall mobility (Borkowski et al., 2020; Bucsky, 2020; Pullano et al., 2020) and increased use of personal modes such as a car (Bucsky, 2020).

However, experiences could differ depending on the cities (Nurse and Dunning, 2020; Dunning and Nurse, 2021), especially between the global north versus south and developed versus developing countries. Compared to the global north, affordability, infrastructure, and cultural practices greatly influence the transportation preferences of the global south cities. Thus, switching to a safer mode to avoid COVID-19 transmission might not be a straightforward choice in cities in the global south. Income is also an important determinant of transportation choice in developing countries, where the large low-income group rarely spend their income on transportation (Ahmad and Puppim de Oliveira, 2016). Still, transit users in the developing world have similar risk perceptions to their counterparts in the developed world, with fear of exposure decreasing public transit use (e.g., Arellana et al., 2020; Dzisi and Dei, 2020; Tirachini and Cats, 2020). However, evidence is still lacking on whether individuals located in developing countries will switch to private modes and keep avoiding public transport in the post-lockdown period and/or during relaxed stay-at-home orders.

For the megacity Dhaka, Bangladesh, maintaining physical distancing and hygiene while commuting is difficult because of the population density (46,000 per square kilometre) (Bangladesh Bureau of Statistics, 2014), crowding and congestion at public transport hubs, and lack of health consciousness at the general level (Hossain et al., 2020; Anwar et al., 2020). Until November 2021, there have been 1,576,566 confirmed cases of COVID-19 with 27,983 deaths in Bangladesh (World Health Organization, 2021). With the origin of the first three confirmed cases in March 08, 2020, Dhaka had become the epicentre of COVID-19 in Bangladesh with 5,842 confirmed cases and 103 deaths in April 2020, which increased to 16,922 confirmed cases by June 1, 2020 and 21,717 by June 08, 2020 (The Humanitarian Data Exchange, 2021).

In the neighbouring country, India, Pawar et al. (2020) concluded that although commuters perceive public transport as unsafe compared to private transport modes, the perceived risk of virus transmission did not influence the actual commute pattern during the COVID-19 period. According to the authors (Pawar et al., 2020), the underlying reason could be the unavailability of alternative modes; however, they were unable to provide any concrete evidence supporting their claim. De Vos (2020) also mentioned that modal choices during COVID-19 would vastly depend on available options. Bhaduri et al. (2020) reported an increase in virtual activities (e.g. telework, online shopping, etc.) and use of private modes (e.g. car, motorized two-wheelers) instead of modes that need to be shared with strangers (e.g. bus and ride-share options) due to COVID-19 in India. Jamal and Paez (2020) reported similar findings in Bangladesh - a decline in overall mobility with more avoidance of crowded and shared transport modes and increased walking frequency because of COVID-19. Another study by Zafri et al. (2021a) suggested increased use of active transportation in the post-pandemic period in Bangladesh.

After 66 days of complete lockdown (March–June 2020), followed by a partial lockdown (June–December 2020), workplaces were allowed to re-open in Bangladesh. Although teleworking has become popular and recognized as keeping individuals safe from virus transmission during COVID-19 in many developed countries (Beck et al., 2020; Kunzmann, 2020), it is not popular in a developing country like Bangladesh. The reason behind this is that only a few categories of jobs can adopt teleworking considering the available technologies and both employers' and employees' attitudes towards telework (Hossen et al., 2018). Thus, depending on their job nature, many people had to return to their

regular commute after the resumption of economic activities from June 2020. This situation raised several critical questions involving safety perception regarding virus transmission, preference and willingness to use safer transport modes, availability and affordability of safer transport options – something we will be exploring in this study through a qualitative approach in the context of the megacity Dhaka, Bangladesh.

This study contributes to the growing body of literature related to COVID-19's impact on transport mode choice behavior by focusing on a city in the global south context, evidence of which unfortunately remains scarce. Countries in the global south are mostly developing countries that contain a large portion of the world's population with prominent income inequalities who rarely can adjust to the transportation-related changes due to COVID-19 (Arellana et al., 2020; Astroza et al., 2020; Huynh, 2020; Lou et al., 2020; Saha et al., 2020). Many of them are captive to their commute modes, and due to affordability and other issues, they can't switch to alternatives modes even though they don't prefer their current modes (Lucas et al., 2016).

Based on in-depth interviews of 20 young and employed commuters, this study explores whether any change has occurred in transportation preferences and associated dilemmas of the commuters due to COVID-19. The objectives of the study are twofold: First, to understand how the commuters have transitioned from the pre-lockdown to the post-lockdown period. Second, to identify the preferences of the commuters and dilemmas they face in terms of mode choice in the post-lockdown period.

2. Study area, methods and data

Dhaka is one of the most rapidly growing megacities in the world, with a population of approximately 21 million and an average population density of 46,000 per square kilometers in 2019 (World Population Review, 2020). About 18 % of Dhaka's urban residents are 'moderate poor' which is measured based on the expenditures for a basic food basket and 'non-food' allowance with 0.45 urban Gini coefficient (national-level), suggesting high income inequality among the residents (Bangladesh Bureau of Statistics (BBS), 2011; Zegras et al., 2015). From the context of transportation, commuters have several mode options, including bus, tempo (i.e., low-cost paratransit), private car, rickshaw (i.e., a two-wheeled hooded non-motorized vehicle), CNG auto-rickshaw (i.e., motorized version of rickshaws that run on compressed natural gas), taxi, personal motorized two-wheeler, car and motorized two-wheeler based ride-hailing services (e.g., Uber, Pathao, etc.), bicycle, and walking (Enam and Choudhury, 2011; Wadud, 2020). In terms of ensuring sustainability in the transport sector, under its National Integrated Multimodal Transport Policy (NIMPT) 2013, Bangladesh has initiated its 'Pedestrian First' program to ensure road safety and reduce accident rates, with the program recommending separate lanes for bicycles and non-motorized transport, improved energy efficiency, and ensuring social equity in terms of cost and accessibility (Government of the People's Republic of Bangladesh, 2013).

The density and limited space for new transport infrastructure development have caused high congestion levels in Dhaka (Zegras et al., 2015). Its travel pattern is mostly human-powered, with the majority (63 %) of trips made by walking. Other mode shares include 20 % by rickshaw, 10 % by bus, 3 % by car, 2 % by CNG auto-rickshaw, and 1 % by bicycles (Hossain and Susilo, 2011). However, there is some evidence that walking as the main travel mode has decreased, while the use of the rickshaw has increased over the past decade (40 % of the trips were made by walking and Rickshaw together) (JICA & DTCA, 2015). It is worth noting that in recent years, the number of motorized vehicles, especially motorized two-wheelers, has increased rapidly in Dhaka because of the initiation of ride-hailing services in 2016 (Wadud, 2020), which is creating a burden for the transport sector in implementing the country's sustainable transport strategies. For example, according to the Bangladesh Road Transport Authority (BRTA), the number of newly registered motorized vehicles in Dhaka was 95,743 in 2015 compared to

21,471 in 2004 indicating a 4.5-fold increase in 11 years (Siddique and Choudhury, 2017).

We explored the research questions through in-depth semi-structured interviews of commuters residing in Dhaka. The reason for choosing a qualitative approach over a quantitative approach is that although quantitative methods can capture the behavior and related shifts in travel behavior, they fail to recognize the underlying reasons and subjective experiences behind the behavior or the changes and why those changes have occurred (Chatterjee et al., 2012; Chatterjee et al., 2013). On the other hand, qualitative approaches encourage respondents to uncover the causalities behind their change in travel behaviour and helps the researcher understand the underlying context (Feng, 2017), which ultimately allows theory to be developed or refined. As we are interested in understanding travel mode choice and associated preferences and dilemmas during COVID-19, we chose to conduct qualitative interviews as this a suitable approach for answering questions like “what are the concerns of people about an event [in this study’s context, COVID-19]? What reasons do people have for using or not using a service or procedure [in this study’s context, transportation modes]? What factors hinder or facilitate recovery from an event?” (Sandelowski, 2000, p 337) which is similar to our research questions.

We interviewed 20 young employed persons who were regularly commuting during the post-lockdown period in Dhaka with a description of their commute mode during and in the pre-pandemic situation (Table 1). Recruitment of the study participants and the interviews took place between July and August 2020. During that period, the city moved from a complete to partial lockdown. Partial lockdown meant that essential services were open, offices were running on either a rotation

basis or at full capacity with government mandates of following health guidelines, while all educational institutes were closed for in-person classes. During the partial lockdown, transit services were required to run at 50 % of their passenger occupancy. In the context of this study, the post-lockdown period means the partial lockdown period in Bangladesh (June–December 2020).

Participants were recruited through social media (e.g., Facebook advertisements), personal networks, and snowball sampling (Johnson, 2014) which was the most effective recruitment method in this study. We continued to recruit respondents until thematic saturation (i.e., “when further observations and analysis reveal no new themes”) was reached (Green and Thorogood, 2004). Participation in this study was voluntary, and no incentive was provided to the interviewees.

The interview guide included various questions to explore commuters’ preferences and dilemmas of transport mode choice in the post-lockdown period. Respondents were provided with the consent form to sign and were informed about the study’s purpose, information to be collected, the confidentiality of the information collected, and associated risks and benefits of participating in the study before beginning the interview. Respondents were asked about their travel patterns and mode choice during the pre- and post-lockdown periods. For example: “Please tell us about your day-to-day travel, and what mode of transport do you usually use?”. If there was a change in travel patterns or transport mode, participants were asked how they transitioned to the new travel pattern, whether they perceived modes as unsafe, and the underlying reasons for the change. For example, participants were asked “Is there any change in your travel pattern due to COVID –19? If yes, what are those changes?”, “Can you please tell us more about it?”, “Are these changes going to

Table 1
Description of the respondents of the in-depth interviews.

Participant ID	Description	Commute mode before the pandemic	Commute mode during the post-lockdown
U1	26 years old, male, private sector employee. Income (monthly): BDT 30,000–35,000	Bus	Bicycle (bought new due to COVID-19)
U2	39 years old, male, private sector employee. Income (monthly): BDT 35,000–40,000.	Bus	Bus and Rickshaw
U3	25 years old, male, government employee. Income (monthly): BDT 50,000–55,000.	Motorized two-wheelers	Motorized two-wheelers (also has office transport)
U4	29 years old, female, government owned company employee. Income (monthly): BDT 35,000–40,000.	Walk	Walk
U5	28 years old, female, researcher. Income (monthly): BDT 50,000–55,000.	Bus	CNG
U6	28 years old, female, NGO worker. Income (monthly): BDT 35,000–40,000.	CNG or Bus	CNG
U7	29 years old, female, private sector employee. Income (monthly): BDT 30,000–35,000.	Bus	Office transport
U8	27 years old, male, NGO worker. Income (monthly): BDT 20,000–25,000.	Bicycle	Walk (as bicycle got stolen)
U9	29 years old, male, government owned company employee. Income (monthly): BDT 30,000–35,000.	Bus or Formal ride-hailing (e.g., Uber, Pathao, etc.)	Informal ride-hailing (see section 3 for details)
U10	33 years old, male, government owned company employee. Income (monthly): BDT 65,000–70,000.	Motorized two-wheelers	Motorized two-wheelers
U11	29 years old, female, private sector employee. Income (monthly): BDT 25,000–30,000.	Bus or CNG	Office transport
U12	35 years old, female, household assistant. Income (monthly): less than BDT 15,000.	Bus	Walk
U13	39 years old, male, cleaner. Income (monthly): less than BDT 15,000	Walk	Walk
U14	26 years old, male, private sector employee. Income (monthly): BDT 30,000–35,000.	Bicycle	Bicycle
U15	27 years old, male, private sector employee. Income (monthly): BDT 40,000–45,000.	Bus	Motorized two-wheelers
U16	33 years old, male, private sector employee. Income (monthly): more than BDT 100,000.	Bicycle (family also owns a car)	Motorized two-wheelers (family also owns a car)
U17	35 years old, male, NGO worker. Income (monthly): BDT 25,000–30,000.	Motorized two-wheeler based formal ride-hailing services	Motorized two-wheeler based informal ride-hailing services
U18	21 years old, male, student, part-time employee and does business. Income (monthly): BDT 50,000–55,000.	Bus	Office transport and personal car owned by family
U19	29 years old, male, private sector employee. Income (monthly): BDT 30,000–35,000.	Bus	Rickshaw or CNG
U20	30 years old, male, private sector employee. Income (monthly): BDT 40,000–45,000.	Bus	Rickshaw or CNG

* 1 USD ~ 84 BDT.

Table 2
Translation of codes into themes.

Themes	Subthemes	Thematic codes (Frequency of the codes)	
1. Perceived safety of different transport modes	Transportation mode	- (no) Change in commute mode (20). - Previous travel pattern: rickshaw for short distance, CNG for long distance travel (5). - Stopped non-essential travel (9). - Try to use (perceived) safe transport (7).	
	Health risk consciousness	- Remain conscious while traveling (8). - Carry hygiene products while going outside of home (9).	
	Perceived risk	- Difference in perceived risk by transport mode (20). - Higher risk is perceived in modes with confined spaces (13). - Higher risk is perceived in modes that need to be shared with unknown people (18). - Air-conditioned vehicles are perceived risky (4). - Bus is perceived as the most risky (17). - Motorized two-wheelers are perceived safe for individual use (8). - Motorized two-wheeler based ride-hailing services are perceived unsafe (10). - Can't trust unknown parties regarding their hygiene practices (21). - Lack of awareness on health guidelines/ hygiene practices among the public (24). - Unreliability on transport operators regarding disinfecting the vehicle (13).	
	Trust issue	- Impossible to maintain physical distancing in public transport (18). - Sometimes, buses operator don't follow health and government mandates on social distancing (9). - Increased number of pedestrians and hawkers in roads (7). - Change in office time table to avoid pedestrian crowd (2). - No way to maintain physical distancing in motorized two-wheelers based ride-hailing services (8).	
	2. Preferences and dilemmas while using or switching to a different transport mode	Affordability, Increased fare	- Increase of bus fare (13). - Can't afford CNG fare (10). - Job loss among the general public (4). - Salary reduction (7). - Increase in daily expenses (12). - Spending on (perceived) safe transport seems luxury / unaffordable (10). - Currently using (perceived) safer modes, but not sure how long they can afford (9). - 60 % increase in bus fare during post-lockdown (6).
		(Un) Availability of transport modes	- Rickshaw is not allowed in the office route (4). - Can't ride in the bus due to disability (2). - Commute route is accident prone for cyclists (4). - No way to go to the job location by walking due to distance (13) - Lack of proper infrastructure (14) - Private modes are safer and convenient, but comparatively expensive (24).
		Aspire to use private transport	
		Office transport	- (no) Office transport facility due to COVID-19 (9). - Feel comparatively safe while traveling while using office transport (4) - Provision of office transport has reduced the cost of transportation for some employees (9).
		Reduced capacity	- 50 % capacity in buses is allowed (11).
		Informal transport	- Unavailability of app-based ride-hailing services during the post-lockdown (8). - Motorized two-wheeler based informal ride-hailing services were available (13).
Interest in motorized two-wheelers		- Emphasis on the benefits of motorized two-wheelers (e.g., speed, convenience, parking) (6). - Conscious about motorized two-wheelers related accidents (6). - Safety features on motorized two wheelers (2). - Expensive to purchase (9). - Personal motorized two-wheelers can provide protection from getting infected (by the virus) while traveling (5).	
License		- Licensing and training to ride (7). - High vehicle registration cost (7).	
Increase in walking		- Started walking for longer distance (commute or non-commute) compared to the pre-pandemic situation (7). - If distance can be covered through walking, prefer walk rather than using shared modes of transport (5). - Pedestrian crowd in side-walks (5). - Lack of proper pedestrian facilities (11). - Bicycle is environment friendly but not suitable for Dhaka's road (13). - Bicycle is not convenient considering Dhaka's weather (e.g., hot, humidity, rain) (15). - Bicycle can be used for short distance travel (5). - Gender differences in cycling because of the cultural acceptance (3). - Number of female motorized two-wheeler and bicycle users are very low in Bangladesh (3).	
Bicycle as a commute mode			
Bicycle storage	- Lack of shower facility (7). - No bicycle parking on streets (4). - No bicycle storage at workplaces (7). - Bicycle got stolen (2).		

(continued on next page)

Table 2 (continued)

Themes	Subthemes	Thematic codes (Frequency of the codes)
	Unsafe bicycle infrastructure	- Need bicycle infrastructure (e.g., lane, interconnected network) to use them (11). - Bicycle is perceived as safe from the disease perspective, but not safe from the traffic accident perspective (4).

Note: The total number of times the thematic codes arise from the interviews are noted inside ‘()’.

continue after lockdown and in the post-pandemic period?”, “If there was no change, do you perceive your current mode (un) safe?. They were also asked about their concerns regarding hygiene practices, risk perceptions and health consciousness while travelling, their perception of safety concerning different modes during the COVID-19 phase and the opportunities and challenges in adopting a new transport mode for the commute. For example, “What is your opinion regarding the spread of COVID-19 while using different transport modes?”, “In your opinion, in what aspects the current pandemic situation is affecting your travel behavior?”, “Are you facing any dilemmas in terms of transportation preferences?” please explain”, “What is your opinion about using individual means of transport (e.g., motorized two-wheelers, bicycle, walk) considering the COVID-19 transmission risks?”, “Are you considering individual means of transport as your regular transport mode in the post lockdown and post-pandemic considering the COVID-19 transmission risks? If yes, why? If no, why?”.

The interviews lasted from 25 to 60 min and were audio recorded with respondents’ consent. The interviews took place in Bengali (native language) and then translated into English by the researchers (SJ and SC). This study followed a deductive reasoning approach, and the transcriptions were analyzed through thematic analysis. Thematic analysis provides an entirely qualitative, detailed, and nuanced account of data (Braun and Clarke, 2006) and reflections of the actual behaviour, attitudes, or real motives of the people by exploring what exactly happened/ happening (Ten Have, 2003), which serve the two objectives of the study by developing an understanding of commuters’ transportation preferences and associated dilemmas due to COVID-19. We preferred thematic analysis over content analysis as many of the words in Bengali can’t directly be converted into English with the same meaning and therefore counting the word frequencies wouldn’t reflect the true intentions/ feelings shared during the interviews by the respondents. Instead, we provided the frequencies of thematic codes that arise from the transcripts in Table 2.

The authors followed a rigorous process to analyze the data. First, two of the authors (native language: Bengali) reviewed the interview transcripts through a qualitative data analysis strategy called the Rigorous and Accelerated Data Reduction (RADaR) technique (Watkins, 2017). RADaR is a systematic data reduction technique to transform raw, textual data into a more manageable and user-friendly format (Watkins, 2017). Second, we followed the thematic analysis process by exploring interview texts, field notes and reflections. Initial codes were generated by line-by-line coding. Then, thematic categories were generated based on the interrelated codes. Finally, two overarching themes emerged from the coding and categories of the interviews that is related to the focus of the study: the perceived safety of different transport modes in the post-lockdown period and preferences and dilemmas while using or switching to a different transport mode. The process has been shown in Table 2. To maintain the rigour of the data analysis, authors worked independently to generate the initial codes, focused codes and categories and finally translated the findings into themes by working together.

3. Results

Table 1 includes a description of the characteristics of the interviewees and their mode shifts during the post-lockdown period. We made our sample as diverse as possible by recruiting respondents from private sectors, public sectors, informal sectors, female employees,

employed individuals with low income (monthly income < 15,000 BDT, 1 USD ~ 84 BDT), full-time and part-time employees.

The interviewees aged between 21 and 39 years. The sample was collected from the young commuters intentionally as different age group usually show different behaviors. Therefore, focusing only on a specific age group will contribute to a more robust understanding of preferences and dilemmas during the post-lockdown for this group of young commuters. There were 14 males and 6 females which is expected in the context of Bangladesh as female participation in the workforce is comparatively low (only 30.6 %) (World Bank, 2021). Being a traditional Muslim country, females are also not comfortable in sharing their information to unknown individuals (see Jamal et al., 2020 for details). Interviewees were recruited from various income groups: starting from less than BDT 15,000 to more than BDT 100,000 per month. It is to be noted that average individual monthly income of Dhaka is around BDT 55,000 (Power and Participation Research Centre, 2016).

In terms of transportation mode shifts, except users of motorized two-wheelers and walking, a mode shift occurred during the post-lockdown period for all other mode users; especially for bus users. For example, ten interviewees were using the bus before the pandemic, however, only one of them was using it for commuting in the post-lockdown period. Four of the interviewees were provided office transport by their employers. Among those who shifted their modes, two of them started walking, two started using bicycles, four started using Rickshaw or CNG, and two started using motorized two-wheelers in the post-lockdown period.

Analysis of the transcript revealed two main themes: (1) perceived safety of different transport modes, and (2) preferences and dilemmas while using or switching to a different transport mode. A synthesis of these two themes arise through the RADaR technique and a description of the findings are presented in the following sections.

3.1. Perceived safety of different transport modes

Prior to the pandemic, commuters were using transportation modes that can be shared with other unknown individuals (e.g., bus, rickshaw, CNG, ride-hailing services, etc.) given their affordability, availability and convenience. With the onset of the pandemic, respondents became risk conscious and practiced basic public health hygiene measures to reduce the risk of transmission, including wearing masks, gloves, and using sanitizer and avoiding non-essential trips. Further, their risk perceptions of different transport modes varied by mode type, with the bus perceived as the most unsafe means of transport. More broadly, modes that need to be shared with unknown parties, such as ride-hailing services (e.g. Uber, Pathao, etc.), rickshaws, and CNG auto-rickshaws were perceived unsafe by the respondents. Participants also lacked confidence about the hygiene practices of other passengers along with the proper cleaning and disinfection of the public vehicle:

“Although I was using bus for my commute before the pandemic, [I believe that] bus operators lack awareness in general and are not hygiene conscious.....[I believe that] they don’t have the proper knowledge, equipment to disinfect the vehicle. [I consider the bus as an unsafe mode as] I don’t know the hygiene practice and origin–destination of the fellow passengers.” – U1.

“Maintaining social distancing in public transport, especially during office hours, is not possible in Dhaka...I can see that people, in general, don’t maintain the health-related precautions and hygiene practices.....I can’t

control the transmission risk in public transports, but in case of private modes, I have some control over the virus transmission risks” – U15.

“I perceive public transport as the riskiest [in terms of virus transmission]. People from different age and income groups are using it and we don’t know about the precautions they are maintaining. Even though after maintaining highest precautions, I may get affected.At the initial stage of the pandemic, me and my husband were using bus for our commute. Although we are not sure about the exact source, both of us got affected by COVID-19 at that time.” – U7.

Commuters often expressed concerns over the operation of shared transit services. For example, they noticed that bus operators were carrying passengers at regular capacity with no measure to ensure physical distancing and other health guidelines, as expressed by participants:

“They [buses] don’t maintain the two seats for one policy [referring 50 % occupancy], which makes me disappointed and unsatisfied. Many passengers don’t use face masks.” - U6.

Consequently, individual means of transport such as personal motorized two-wheelers, bicycles and walking were perceived as safer than shared modes. While participants spoke of the potential risk of infection from a previous passenger when using a rickshaw, the open environment of these modes was seen as safer:

“Rickshaw has less number of passengers and it is not suffocated; it seems to be less risky” - U3.

“Bicycle makes the rider separated from other people on the road. The rider has less risk of virus transmission” – U3.

From a risk perspective, participants distinguished between the CNG auto-rickshaws and rickshaws. In the former, although there is a barrier between the driver and passenger, the space is confined, and riders were concerned that the virus could be sustained inside for a long time. Similar concerns were noted with other ride-hailing services (i.e., Uber, Pathao), with the added concern of sharing helmets between riders for the motorized two-wheeler-based ride-hailing services. In the case of rickshaws, free air circulation is possible because of the open environment. CNG auto-rickshaw were seen as comparatively safer than the public bus and air-conditioned vehicles.

Those who can afford a private mode (not for ride-hailing) such as cars, motorized two-wheelers, and bicycles and are willing to use them have switched to these modes considering the virus transmission risks:

“Long before the pandemic, I was using bicycles for travel. I started using bus after my bicycle got stolen. However, I love to bike. Therefore, when the pandemic started, I bought a new bicycle and started using it every time I travel.” – U1.

“My family owns a personal car, and [before the pandemic] I was either using the car or the bicycle for my commute. During the pandemic, other family members were also using the car for the safety concern [due to COVID-19], therefore, [due to schedule mismatch], I had to buy a motorized two-wheelers for my commute [as using bicycle for commute has become inconvenient in my new office].” – U16.

Those who already own a private individual means of transport such as motorized two-wheelers or was walking, did not change their transport mode as that was the safest travel option for them:

“[There is] No change in my travel pattern. I used to go by walking and now I also go by walking as I feel that is the safest way to commute during the pandemic” – U4.

“My travel pattern remains almost unchanged [during the post-lockdown period]. I have been using my personal motorized two-wheelers since 2010. Sometimes, it is not convenient when it rains. Previously, I used rickshaw or bus for such 1 % case when using motorized two-wheelers is inconvenient. Now, I use motorized two-

wheelers for all types of daily travel, and if any inconvenience rises, I prefer not to travel on such cases”. – U10.

However, switching to a suitable and safe mode becomes challenging for those who have affordability issues:

“[Before the pandemic] I used bus for my commute. CNG and Rickshaw is never affordable to me. Previously, I used to cycle in my home-office route. For some financial reasons, I sold my bicycle. After that, no transport mode is convenient and affordable to me except the bus. Although, there is a health risk, I was still willing to commute by bus. However, due to the absurd increase of bus fare [during the post-lockdown period], I have no other choice but walking for my commute which takes almost 2 hours each way” - U12.

3.2. Preferences and dilemmas while using or switching to a different transport mode

Although the perceived risks have made them interested towards safe (also perceived) modes, affordability, and availability were causing them dilemmas while switching to their preferred modes.

In some cases, organizations provided office transport for their employees (total 4 cases), with commuters sharing the ride with work colleagues. Despite this option being a shared mode and trusting that their employer cleaned and disinfected the vehicle appropriately, passengers felt more comfortable given that other passengers were known to them. Moreover, this arrangement reduced their commute cost, which had increased for many of the commuters in Dhaka during the post-lockdown period:

“Right now, the office transport is free of cost... I don’t know how long they will keep providing this service. If they stop the service, I am not going to use bus for my commute as before. I will have to use CNG [auto-rickshaw] for my daily commute. Although I can bear the cost while considering my safety, that will be an expensive choice for me and for this, I have to cut budget from my other expenses.” – U11.

“Although I am using my personal transport, I think the office transport has become a cost saving options for many employees as [transport] fare has increased a lot during the COVID-19” – U3.

“Those with office transport can save the commute cost, however; someone like me without that support from the employer have to bear the extra cost of travelling during the pandemic” – U17.

“Overall, my transport cost has increased as I have started to use CNG regularly instead of bus” – U6.

“[Instead of bus,] I started using CNG auto-rickshaw for my commute [during the pandemic]. Now, after two months of the post-lockdown period, I cannot afford to continue it longer because of the cost. I am afraid that I may need to start commuting by bus again” – U20.

In addition to perceived risk, availability and affordability of transit alternatives were common barriers to shifting to a preferred mode. While some participants wanted to shift modes to avoid shared transit options, the bus system was often more affordable or the only available option in some cases, especially during the post-lockdown period. While the bus may have initially been a relatively affordable option, bus operators were permitted to increase their fares by 60 % (Shovon and Foaisal, 2020) to offset the loss caused by the government-mandated 50 % passenger occupancy in the post-lockdown period. Bus users, however, complained that buses continued to run at full capacity, and were sometimes even over capacity at the same time operators were charging passengers the increased fare. In some cases, when buses were running by carrying passengers at 50 % capacity, passengers had to travel two or more stations backward to get a seat inside the bus. Thus, bus users face health risks, economic challenges and other hassles while commuting during the post-lockdown period:

“In my home-office route, bus operators follow the government’s mandate of 50 % capacity. Previously [before the pandemic], I used to get on the bus from ‘X’ Station; now I cannot get in as by the time the bus reaches this station, it is already on 50 % capacity. Now I go to ‘Y’ station by rickshaw [travelling backwards] to take the bus.... Previously, I had to pay BDT 20 [only bus] and now [in the post-lock down] I have to pay a total of BDT 65 to arrive my workplace [bus: BDT 40, rickshaw: BDT 25]” – U2 (‘X’ and ‘Y’ has been used instead of the exact name of the bus station for anonymity).

Two respondents started using informal ride-hailing services. One of the respondents (U17) was a visually impaired person who used motorized two-wheelers-based ride-hailing services before the pandemic for their commute. During the post-lockdown, app-based formal ride-hailing services were unavailable, and rickshaw was not available on their home-office route:

“Though app-based ride-hailing services [formal ride-hailing services like Uber, Pathao, etc.] are not available, I can find shared-ride informally from random motorized two-wheeler users on the road [In this paper, we are referring it as ‘informal ride-hailing/ ride-sharing’]. If I can understand that they are interested in carrying passengers, I go to them and ask them about their destinations. If their destination matches mine, I have to negotiate the fare with them. The entire system is informal.” – U9.

In terms of accessibility, buses in Bangladesh are not disabled-friendly, and the perceived risk of virus transmission is higher. Taxis and CNG auto-rickshaws were beyond the affordability of the respondent. Thus, even though they perceive informal ride-hailing services as highly risky, they have no other option than to use them:

“At the initial days of the lockdown, I was staying home and was not working. The type of work I do can’t be done from home. When the offices were re-opened after the lockdown, I had to go to my office... There is no shift in transport mode use for me. The only change I have is that previously I was using the formal two-wheelers-based ride-hailing services, and now I am using the informal ride-hailing [/ride-sharing] services....I do perceive these modes highly risky; there is no way to maintain social distancing between the rider and the driver in motorized two-wheelers; however, I don’t have any choice.” – U17.

Commuters spoke of switching modes and preference for using personal modes, especially motorized two-wheelers because of the pandemic. For instance, one participant noted:

“I recently bought a motorized two-wheeler considering the COVID –19 situation. Due to the physical labour and sweating, it is challenging to walk or use bicycles wearing PPE [Personal Protective Equipments], masks and gloves, especially for long distances. Considering this situation, using a motorized two-wheeler is an appropriate choice for me.” – U15

Another participant noted:

“I have shared transport from my office; however, I don’t use it. I use [my personal] motorized two-wheelers. I did not change my mode...I was using my motorized two-wheeler before the COVID-19 pandemic. I am used to it, and I love it. Although bicycles are environment friendly, I chose to use the motorized two-wheeler. It is easy to drive. It reduces travel time. It only takes 40 min to reach my office whereas if I use a bicycle, it will be more than 2 hours” – U3.

Those who switched to using or previously used motorized two-wheelers for commuting were typically able to own the vehicle, afford the cost of fuel and licensing. Other participants noted a desire to use motorized two-wheelers, but were unable to due to costs of owning and operating or the higher risk of traffic collisions and injury:

“From the traffic safety and virus transmission perspective, car would be the safest option. I personally prefer to buy motorized two-wheelers for the convenience and speed. [However,] both are unaffordable to people within my income range.....it’s not only the purchasing cost, but operating and maintenance can be a burden.” – U19.

“If you look into the motorized two-wheelers related accidents in Bangladesh, you will see that most of them are fatal. [Although I wish to buy it and I have the affordability,] [my] family will not allow me to buy and use a motorized two-wheeler.” – U18

“Right now [during the post-lockdown period], many [motorized two-wheelers manufacturing] companies are offering EMI payments and 0 % interest rate options and conducting promotional activities focusing on the speed and convenience of the motorized two-wheelers in the lockdown period. This may make many of the non-users interested in motorized two-wheeler ownership. I have a friend who works for ‘X’. ‘X’ company has made highest sales [of motorized two-wheelers] in April 2020. – U16 (‘X’ represents a prominent motorized two-wheeler manufacturing company. ‘X’ is used for anonymity).

Active transportation modes such as walking and biking remain another option for commuting, although multiple respondents noted that neither option was popular given the country’s weather and infrastructure conditions. The weather condition was mentioned by 15 respondents, with respondents noting the physical labour needed for cycling and warm and humid weather conditions in Dhaka dissuading people from commuting by bike. Moreover, people in Bangladesh are not culturally accustomed to active travel on a regular basis (Flavia and Choudhury, 2019; Sarker et al., 2020). Due to the pandemic, only 2 respondents started using bicycles for their commute. One commuter has bought a bicycle for commute purposes in the post-lockdown period. Another bicycle commuter already owned a bicycle and was accustomed to riding bicycles for (non-) commute purposes:

“I regularly use bicycle for recreational purposes. Previously, I used to commute by bicycle as my workplace had facilities to take a shower. After cycling, I become very sweaty. I need to take a shower for my comfort and to feel fresh before I start my work. After joining my current job, I stopped commuting by bicycle as there is no shower facility in my new office. Although my current job location is quite nearer to my home than the previous office, I still don’t bike as by the time I reach my office, I will be completely sweating. Rather, I use personal motorized two-wheelers for convenience and comfort.” – U16.

“Previously I used to travel by bus; now my mode got shifted; I bought a bicycle because of the pandemic. It is affordable and has health benefits....The fare of the buses has been doubled. If I cycle regularly for two months, it will recover my purchasing cost of the bicycle.” – U1.

For short commutes (2–4 km), commuters smoothly transitioned into using bicycles during COVID-19. Previously, short-distance commuters (1–2 km) were using rickshaws, ride-hailing services, or buses. The perceived transmission risks of COVID-19 have made them inclined towards walking and biking as they considered those modes safe.

“Before COVID-19, I took a rickshaw for 5–10 min journey from home to the major road. But now I feel that rickshaw is unsafe; thus, I walk in such cases.” – U9

While there was some evidence of the increased use of bicycles during the pandemic, use was still limited and reinforced by a number of factors. First, the heavy traffic, lack of bicycle infrastructure in the city, and secure storage, parking and maintenance of bicycles are considered as hassles to many commuters, decreasing the likelihood of using a bike to commute:

“My office-home route is almost 11 km. If the route was short, let’s say around 5 km and there is a separate bicycle lane along the route, I would use bicycle for my commute.” – U2.

“I always use my bicycle. I only take a rickshaw when I go to the kitchen market. There is a severe [bicycle] storage crisis in the kitchen market and carrying grocery bags is challenging on a bicycle. I don’t have a carrier... [Moreover,] my bicycle may get stolen in the kitchen market [as there is no secure parking/ storage facility].” – U1.

“I was a bicycle user before COVID-19, but now I have to walk [to my office] because I lost [got stolen] the bicycle. I don’t want to face this again, so I am not interested in buying a bicycle. [as there is no safe place to store them]” – U8.

Walking provides another option for commuters, although respondents who were walking during the post-lockdown period mentioned that it was hard to maintain physical distancing in Dhaka’s crowded sidewalks, especially during office hours. One of the commuters who started walking shifted their office timetable to avoid the pedestrian crowds during the peak commuting hours.

“I don’t feel safe [while walking]... safe physical distance cannot be maintained in the sidewalks of Dhaka. People are getting unemployed. Maybe because of this, the number of street hawkers has increased... Previously [before the pandemic], I used to see two hawkers on my way to the office, but now I see at least 7 hawkers in the same space, and they also don’t wear masks.” – U4.

4. Discussion

COVID –19 has created a consciousness of risks of virus transmission in different transport modes among commuters and thus can affect commuting behaviour. The key research question in the cities of the global north is whether COVID –19 has resulted in a long-lasting shift away from sustainable, public transit options and toward personal commuting modes. Conversely, in Dhaka’s case, a city from the global south, commuters are dealing with many obstacles in the post-lockdown period, creating new challenges for the transportation planning sector.

The current study indicates that commuters typically need to make choices between health risks, affordability, and the availability of alternative modes. Even those who switched to safer modes (opting for a perceived lower risk option) may return to using their previous transport mode due to lack of affordability and unavailability. Those who have alternative options available and can afford the option have already abandoned the bus. On the other hand, the bus fare has been increased. For many commuters, the bus is the only viable option for travel. Therefore, to address the issue of affordability of bus services, the transport cost should be minimized. The government could compensate bus operators with financial relief to overcome their loss so that the public does not need to bear the extra burden of increased fare during the pandemic. Critical thinking would be how the service can be sustained and improved with limited transmission risks and how public confidence can be restored (Jenelius and Cebecauer, 2020; Orro et al., 2020) while keeping the bus service available and affordable (Tirachini and Cats, 2020). Interventions can be made in terms of strategic planning such as redesigning the network, systematic changes such as change in frequencies and timetables of service, real time service information, and managing overcrowding through operational planning (Gkiotsalitis and Cats, 2021; Cho and Park, 2021). A study on bus service improvement during the pandemic in the state of Kerala, India, Cheraichery et al. (2021) suggested to intervene in the cleanliness, crowding level, real time information availability and pedestrian environment as awareness regarding virus transmission has increased among the bus riders in India.

As the car is beyond the affordability of most commuters, an interest in buying motorized two-wheelers to remain safe from contact

transmission has been noticed. Prices of two-wheelers are comparatively high and are not affordable to a larger segment of Dhaka’s population (Wadud, 2020). However, the sales of motorized two-wheelers have increased recently, and manufacturers in Bangladesh have taken this pandemic as an opportunity to increase ridership by giving lucrative promotional offers such as 0 % interest, monthly installments, and others (Business Wire, 2020). Before the pandemic started, registration fees for motorized two-wheelers were reduced from BDT 20,000 to BDT 5,000 (~USD 240 to USD 60) to encourage the demand (Wadud, 2020). Although many consider motorized two-wheelers as an accident-prone vehicle, greater affordability could mean that a greater number of commuters will adopt this private mode as it allows them to remain distanced from others during the commute along with being able to commute longer distances and save time commuting. A recent study by Zafri et al. (2021b) also found an increased desire to purchase motorized two-wheelers during the post-lockdown and post-pandemic periods among the Dhaka dwellers. Bangladeshi culture also considers motorized two-wheelers as an attractive transport mode, especially among the younger generation and as compared to walking and cycling, both of which are usually regarded as low-status modes (i.e. the symbol of poverty) in many developing countries of the global south (e.g., Acheampong, 2017; Jamal and Mohiuddin, 2020). Thus, if options are made available, many could possibly be inclined towards motorized two-wheelers. However, policymakers should be cautious about the uptake of motorized two-wheelers as this may reduce bus ridership, increase congestion, the number of motorized private modes and transport related GHG emissions in the post-pandemic period. Policies and strategies should address how to prevent this transformation towards motorized two-wheelers and provide suitable, sustainable and affordable alternatives and encourage sustainable transportations for commuting.

Reflecting recent work by Jamal and Paez (2020), there is some evidence that walking as a commuting choice had increased in Bangladesh during COVID-19. Consequently, this should be taken as an opportunity to change behaviours by promoting active travel. The advantages of active travel such as safety, environment-friendly, cost-effectiveness, and health benefits need to be highlighted, especially at the mass level and break the social stigma (low-status mode) associated with active travel. If people see other people including political representatives, celebrities, high-ranking government officials using active modes for their day-to-day purposes, they will be more likely to change their travel behaviour toward sustainable options. This is the strategy that Amsterdam, Netherlands adopted along with strong grass-root level advocacy on social homogeneity while promoting cycling at the mass level during 1975–1995s (Kuipers, 2013; Oldenziel and de la Bruhère, 2011). As the respondents have mentioned a lack of storage and shower facilities, employers should be encouraged to provide their employees with active travel-friendly facilities such as bicycle storage, shower facilities and, if possible, incentives for active commuting. The study by Spotswood et al. (2015) found that the lack of showering and bicycle storage facilities at the workplace is the leading cause of not using bicycles for commuting. Workplace active travel interventions have proven to be effective and increase the number of active commuting in different parts of the world (Goodman et al., 2013; Petrunoff et al., 2016). Guzman et al. (2020) proposed increasing motorized vehicle parking charges at workplaces as an effective strategy to encourage active commuting. We expect that these workplace policies will be adopted and implemented, and therefore, increase the number of active commuters in Dhaka.

Several factors influence the adoption of cycling and walking at the user level. Bicycle use among females is also limited due to cultural norms, with Bangladesh’s conservative society often not accepting of female bicyclists (e.g., Jamal et al., 2020; Sarker et al., 2020). From the policy perspective of the developing countries, there is a lack of understanding at the decision-making level on the gender imbalance in cycling culture, negative societal views, local needs and priority,

weather conditions, interconnected and appropriate infrastructure, and road safety and security (Koehl, 2020). The current study also identified similar barriers and challenges that commuters face while switching to an active mode. Thus, our suggestion would be to recognize these mass-level diverse challenges at the decision-maker level and then implement problem-specific strategies to solve the issues. It would be more effective in addressing and removing commuters' barriers and challenges in switching to active modes and increasing the number of active commuters in Dhaka in the post-lockdown and post-pandemic periods.

5. Conclusion

This paper has explored the transport mode preferences and associated dilemmas that commuters face in Dhaka, Bangladesh, in the post-lockdown period. Although this analysis is based on a city in the global south, our findings may be generalizable to other cities with similar socio-cultural structures, economic profiles and mobility behaviours. Our study indicates that commuters lack confidence about maintaining physical distancing in public transport which echoes the findings by Thomas et al. (2022) in Mumbai, India. This study has three key takeaways regarding preference and associated dilemmas in commute mode choice. First, commuters tried to avoid modes that are perceived to put them at greater risk of exposure to COVID-19 during the early stages of the pandemic and lockdown. However, after a few months, they may return to use those (perceived) unsafe modes because of financial burden and service unavailability. Our analysis suggests that it is not easy for them to switch to a safer transport mode mainly because of unaffordability and unavailability of alternative modes in their commute route. Also, in terms of office transport, interviewees are not sure how long the service will be provided. Second, there is a frequent dilemma and trade-off among health risk, affordability and unavailability while choosing commute mode in the post-lockdown period. Third, the study highlights additional challenges, including commute distance, inconvenience, lack of cycling and walking infrastructure, street crowds, bicycle storage, cultural acceptance, the public image of active commuting, perceived risk of traffic accidents, weather conditions, etc. as limitations to the uptake of other modes of transport.

Finally, limitations of the current study are noted. First, the study only focuses on the young commuters and their commute mode choice. It would be valuable to explore the mode choice of other specific demographic groups such as students, businessmen, women, children, older adults and for other purposes except for work. The study indicates that no substantial shift towards sustainable modal choice in terms of commute will occur in the post-lockdown period unless effective policy measures are taken. However, our sample consists of a small number of commuters. Although many qualitative studies with an approximately similar number of respondents reflected the realism (e.g., Beirão and Sarsfield Cabral, 2007; Guell et al., 2017; Nguyen-Phuoc et al., 2018; Zarabi et al., 2019), quantitative study is necessary to explore the extent of modal shift and factors that could influence this change during the post-lockdown period – which can be a direction for future research.

Shifting towards sustainable commute modes in Dhaka may not be as promising as in global north cities. It might take time to reach a sustainable transport system considering the status quo. However, the country's sustainable transport goals can still be achieved if proper actions are taken to address the diverse needs, such as removing the challenges commuters face while switching to a sustainable and safe mode during this COVID – 19. Besides, policymakers need to be cautious about the bus ridership and take necessary measures to regain public confidence so that the ridership doesn't go down in the post-pandemic period because of perceived contagion risks.

CRedit authorship contribution statement

Shaila Jamal: Conceptualization, Data Collection, Data Analysis, Writing – preparing main draft, review & editing. **Sadia Chowdhury:**

Data Collection, Data Analysis, Writing – review & editing. **Bruce Newbold:** Writing – review & editing.

Acknowledgement

The authors would like to thank House of Volunteers Foundation, Bangladesh and Transcope for their support while conducting the study and acknowledge the cooperation and contribution of the interviewees.

References

- Abdullah, M., Dias, C., Muley, D., Shahin, M.d., 2020. Exploring the Impacts of COVID-19 on Travel Behavior and Mode Preferences. *Transp. Res. Interdiscip. Perspect.* 8, 100255. <https://doi.org/10.1016/j.trip.2020.100255>.
- Acheampong, R.A., 2017. Towards sustainable urban transportation in Ghana: Exploring adults' intention to adopt cycling to work using theory of planned behaviour and structural equation modelling. *Transp. Dev. Econ.* 3 (2), 18–29.
- Ahmad, S., Puppim de Oliveira, J.A., 2016. Determinants of urban mobility in India: Lessons for promoting sustainable and inclusive urban transportation in developing countries. *Transp. Policy* 50, 106–114.
- Anwar, S., Nasrullah, M., Hosen, M.J., 2020. COVID-19 and Bangladesh: Challenges and how to address them. *Front. Public Health* 8. <https://doi.org/10.3389/fpubh.2020.00154>.
- Arellana, J., Márquez, L., Cantillo, V., 2020. COVID-19 Outbreak in Colombia: An Analysis of Its Impacts on Transport Systems. *J. Adv. Transp.* 2020, 1–16. <https://doi.org/10.1155/2020/8867316>.
- Astroza, S., Tirachini, A., Hurtubia, R., Carrasco, J. A., Guevara, A., Munizaga, M., Figueroa, M., Torres, V., 2020. Mobility Changes, Teleworking, and Remote Communication during the COVID-19 Pandemic in Chile. *Findings*, July. Doi: <https://doi.org/10.32866/001c.13489>.
- Bangladesh Bureau of Statistics (BBS), 2011. *Report of the Household Income & Expenditure Survey 2010*. Ministry of Planning, Statistics Division, Dhaka, Bangladesh.
- Bangladesh Bureau of Statistics. (2014). *Population and Housing Census 2011 - National volume 2: Union Statistics*. Dhaka. Accessed from: <http://203.112.218.65:8008/WebTestApplication/userfiles/Image/National%20Reports/Population%20%20Housing%20Census%202011.pdf>.
- Beck, M.J., Hensher, D.A., Wei, E., 2020. Slowly coming out of COVID-19 restrictions in Australia: Implications for working from home and commuting trips by car and public transport. *J. Transp. Geogr.* 88, 102846. <https://doi.org/10.1016/j.jtrangeo.2020.102846>.
- Beirão, G., Sarsfield Cabral, J.A., 2007. Understanding attitudes towards public transport and private car: A qualitative study. *Transp. Policy* 14 (6), 478–489.
- Bhaduri, E., Manoj, B.S., Wadud, Z., Goswami, A.K., Choudhury, C.F., 2020. Modelling the effects of COVID-19 on travel mode choice behaviour in India. *Transp. Res. Interdiscip. Perspect.* 8, 100273. <https://doi.org/10.1016/j.trip.2020.100273>.
- Borkowski, P., Jazdzewska-Gutta, M., Szmelter-Jarosz, A., 2020. Lockdown: Everyday mobility changes in response to COVID-19. *J. Transp. Geogr.* 90, 102906.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* 3 (2), 77–101.
- Bucsky, P., 2020. Modal share changes due to COVID-19: The case of Budapest. *Transp. Res. Interdiscip. Perspect.* 8, 100141. <https://doi.org/10.1016/j.trip.2020.100141>.
- Budd, L., Ison, S., 2020. Responsible Transport: A post-COVID agenda for transport policy and practice. *Transp. Res. Interdiscip. Perspect.* 6, 100151. <https://doi.org/10.1016/j.trip.2020.100151>.
- Buehler, R., Pucher, J., 2021. COVID-19 Impacts on Cycling, 2019–2020. *Transp. Rev.* 41 (4), 393–400. <https://doi.org/10.1080/10141647.2021.1914900>.
- Wire, B., 2020. Bangladesh Two-Wheeler Market Insights and Growth Opportunities to 2025 - COVID-19 Adjusted. Accessed from: <https://www.businesswire.com/news/home/20200624005525/en/Bangladesh-Two-Wheeler-Market-Insights-and-Growth-Opportunities-to-2025-COVID-19-Adjusted-ResearchAndMarkets.com>.
- Cho, S.-H., Park, H.-C., 2021. Exploring the Behaviour Change of Crowding Impedance on Public Transit due to COVID-19 Pandemic: Before and After Comparison. *Transp. Lett.* 13 (5-6), 367–374.
- City of Toronto, 2020. COVID-19: ActiveTO – Expanding the Cycling Network. Accessed from: <https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-reduce-virus-spread/covid-19-activeto/covid-19-activeto-expanding-the-cycling-network/>.
- Chatterjee, K., Sherwin, H., Jain, J., Christensen, J.o., Marsh, S., 2012. Conceptual model to explain turning points in travel behavior: Application to bicycle use. *Transp. Res. Rec.* 2322 (1), 82–90.
- Chatterjee, K., Andrews, G., Ricci, M., Parkhurst, G., 2013. Qualitative insights into the effect on travel behavior of joining a carshare. *Transp. Res. Rec.* 2359 (1), 76–84.
- Cheranchery, M.F., Krishnan, M.G., Asif Navas, K.R., Mohamed Shahid, P.A., Suresh, R., 2021. Investigating the Impact of COVID-19 on User Perception for Deriving Policies and Intervention Areas for Urban Bus Service in India. *Case Stud. Transp. Policy* 9 (4), 1965–1973. <https://doi.org/10.1016/j.cstp.2021.11.007>.
- Das, S., Boruah, A., Banerjee, A., Raoniari, R., Nama, S., Maurya, A.K., 2021. Impact of COVID-19: A radical modal shift from public to private transport mode. *Transp. Policy* 109, 1–11.
- de Haas, M., Faber, R., Hamersma, M., 2020. How COVID-19 and the Dutch 'intelligent lockdown' change activities, work and travel behaviour: Evidence from longitudinal data in the Netherlands. *Transp. Res. Interdiscip. Perspect.* 6, 100150.

- De Vos, J., 2020. The effect of COVID-19 and subsequent social distancing on travel behavior. *Transp. Res. Interdiscip. Perspect.* 5, 100121. <https://doi.org/10.1016/j.trip.2020.100121>.
- Ding, D., del Pozo Cruz, B., Green, M.A., Bauman, A.E., 2020. Is the COVID-19 lockdown nudging people to be more active: a big data analysis. *Br. J. Sports Med.* 54 (20), 1183–1184.
- Dingil, A.E., Esztergár-Kiss, D., 2021. The Influence of the Covid-19 Pandemic on Mobility Patterns: The First Wave's Results. *Transp. Lett.* 13 (5–6), 434–446.
- Doubleday, A., Choe, Y., Busch Isaksen, T., Miles, S., Errett, N.A., Stimpson, J.P., 2021. How did outdoor biking and walking change during COVID-19?: A case study of three US cities. *PLoS ONE* 16 (1), e0245514. <https://doi.org/10.1371/journal.pone.0245514>.
- Dunning, R., Nurse, A., 2021. The surprising availability of cycling and walking infrastructure through COVID-19. *Town Plann. Rev.* 92 (2), 149–155. <https://doi.org/10.3828/tpr.2020.35>.
- Dzisi, E.K.J., Dei, O.A., 2020. Adherence to social distancing and wearing of masks within public transportation during the COVID 19 pandemic. *Transp. Res. Interdiscip. Perspect.* 7, 100191. <https://doi.org/10.1016/j.trip.2020.100191>.
- Enam, A., Choudhury, C.F., 2011. Methodological issues in developing mode choice models for Dhaka, Bangladesh. *Transp. Res. Rec.* 2239 (1), 84–92.
- Feng, J., 2017. The influence of built environment on travel behavior of the elderly in urban China. *Transp. Res. Part D: Transp. Environ.* 52, 619–633.
- Flavia, A., Choudhury, C., 2019. Temporal transferability of vehicle ownership models in the developing world: case study of Dhaka, Bangladesh. *Transp. Res. Rec.* 2673 (3), 722–732.
- Gkiotsalitis, K., Cats, O., 2021. Public transport planning adaption under the COVID-19 pandemic crisis: literature review of research needs and directions. *Transp. Res.* 41 (3), 374–392.
- Goodman, A., Panter, J., Sharp, S.J., Ogilvie, D., 2013. Effectiveness and equity impacts of town-wide cycling initiatives in England: a longitudinal, controlled natural experimental study. *Soc. Sci. Med.* 97, 228–237.
- Government of the People's Republic of Bangladesh, 2013. National Integrated multimodal transport policy (NIMPT) 2013. Government of the People's Republic of Bangladesh, Roads Division, Ministry of Communication.
- Green, J., Thorogood, N., 2004. *Qualitative Methods for Health Research*. Sage, London.
- Guell, C., Mackett, R., Ogilvie, D., 2017. Negotiating multisectoral evidence: a qualitative study of knowledge exchange at the intersection of transport and public health. *BMC Public Health* 17 (1), 17.
- Gutiérrez, A., Miravet, D., Domènech, A., 2020. COVID-19 and urban public transport services: emerging challenges and research agenda. *Cities Health* 1–4.
- Guzman, L.A., Arellana, J., Alvarez, V., 2020. Confronting congestion in urban areas: Developing Sustainable Mobility Plans for public and private organizations in Bogotá. *Transp. Res. Part A: Policy Pract.* 134, 321–335.
- Hensher, D.A., Wei, E., Beck, Matthew J., Balbontin, C., 2021. The impact of COVID-19 on cost outlays for car and public transport commuting—the case of the Greater Sydney Metropolitan Area after three months of restrictions. *Transp. Policy* 101, 71–80.
- Hossain, M., Susilo, Y.O., 2011. Rickshaw use and social impacts in Dhaka, Bangladesh. *Transp. Res. Rec.* 2239 (1), 74–83.
- Hossain, M.A., Jahid, M.I.K., Hossain, K.M.A., Walton, L.M., Uddin, Z., Haque, M.O., Kabir, M.F., Arafat, S.M.Y., Sakel, M., Faruqui, R., Hossain, Z., Pakpour, A.H., 2020. Knowledge, attitudes, and fear of COVID-19 during the Rapid Rise Period in Bangladesh. *PLoS ONE* 15 (9), e0239646. <https://doi.org/10.1371/journal.pone.0239646>.
- Hossen, M.M., Begum, M., Zhixia, C., 2018. Present Status of Organizational Work-Life Balance Practices in Bangladesh: Employees Expectation and Organizational Arrangements. *J. Eastern Eur. Central Asian Res. (JEECAR)* 5 (1). <https://doi.org/10.15549/jeeecar10.15549/2018v5i110.15549/jeeecar.v5i1.199>.
- Huynh, T.L.D., 2020. Does culture matter social distancing under the COVID-19 pandemic? *Saf. Sci.* 130, 104872. <https://doi.org/10.1016/j.ssci.2020.104872>.
- Jamal, S., Paez, A., 2020. Changes in trip-making frequency by mode during the COVID-19 emergency: evidence from an online survey in Bangladesh. *Findings*. <https://doi.org/10.32866/001c.17977>.
- Jamal, S., Mohiuddin, H., 2020. Active transportation indicators and establishing baseline in a developing country context: A study of Rajshahi, Bangladesh. *Growth and Change* 51 (4), 1894–1920. <https://doi.org/10.1111/grow.12420>.
- Jamal, S., Mohiuddin, H., Paez, A., 2020. How do the perceptions of neighborhood conditions impact active transportation? A study in Rajshahi, Bangladesh. *Transp. Res. Part D: Transp. Environ.* 87, 102525.
- Jenelius, E., Cebeacauer, M., 2020. Impacts of COVID-19 on public transport ridership in Sweden: Analysis of ticket validations, sales and passenger counts. *Transp. Res. Interdiscip. Perspect.* 8, 100242. <https://doi.org/10.1016/j.trip.2020.100242>.
- Johnson, T.P., 2014. *Snowball Sampling: Introduction*. Statistics Reference Online. John Wiley & Sons Ltd, Wiley StatsRef.
- Koehl, A., 2020. Urban transport and COVID-19: challenges and prospects in low-and middle-income countries. *Cities Health* 1–6. <https://doi.org/10.1080/23748834.2020.1791410>.
- Kolarova, V., Eisenmann, C., Nobis, C., Winkler, C., Lenz, B., 2021. Analysing the impact of the COVID-19 outbreak on everyday travel behaviour in Germany and potential implications for future travel patterns. *Eur. Transp. Res. Rev.* 13 (1), 1–11. <https://doi.org/10.1186/s12544-021-00486>.
- Kuipers, G., 2013. The rise and decline of national habitus: Dutch cycling culture and the shaping of national similarity. *Eur. J. Social Theory* 16 (1), 17–35.
- Kunzmann, K.R., 2020. Smart Cities After Covid-19: Ten Narratives. *disP-Plann. Rev.* 56 (2), 20–31.
- JICA, DTCA, 2015. Revised Strategic Transport Plan for Dhaka. Government of Bangladesh.
- Li, A., Zhao, P., He, H., Axhausen, K.W., 2020. Understanding the variations of micro-mobility behavior before and during COVID-19 pandemic period. Working Paper. Arbeitsberichte Verkehrs-und Raumplanung, 1547.
- Litman, T., 2020. Pandemic-resilient community planning. Victoria Transport Policy Institute. Accessed from : <https://www.vtpi.org/PRCP.pdf>.
- Lou, J., Shen, X., Niemeier, D., 2020. Are stay-at-home orders more difficult to follow for low-income groups? *J. Transp. Geogr.* 89, 102894. <https://doi.org/10.1016/j.jtrangeo.2020.102894>.
- Lucas, K., Mattioli, G., Verlinghieri, E., Guzman, A., 2016. Transport poverty and its adverse social consequences. *Proceedings of the institution of civil engineers-transport*, 169(6). Thomas Telford Ltd., UK, pp. 353–365.
- Marsden, G., Docherty, I., 2021. Mega-disruptions and policy change: Lessons from the mobility sector in response to the Covid-19 pandemic in the UK. *Transp. Policy* 110, 86–97.
- Nguyen-Phuoc, D.Q., Currie, G., De Gruyter, C., Young, W., 2018. How do public transport users adjust their travel behaviour if public transport ceases? A qualitative study. *Transp. Res. Part F: Traffic Psychol. Behav.* 54, 1–14.
- Nurse, A., Dunning, R., 2020. Is COVID-19 a turning point for active travel in cities? *Cities Health* 1–3. <https://doi.org/10.1080/23748834.2020.1788769>.
- Oldenziel, R., de la Bruhèze, A.A., 2011. Contested spaces: Bicycle lanes in urban Europe, 1900–1995. *Transfers* 1 (2), 29–49.
- Orro, A., Novales, M., Monteagudo, Á., Pérez-López, J.B., Bugarín, M.R., 2020. Impact on city bus transit services of the COVID-19 lockdown and return to the new Normal: The case of A Coruña (Spain). *Sustainability* 12 (17), 7206.
- Ozbilen, B., Slagle, K.M., Akar, G., 2021. Perceived risk of infection while traveling during the COVID-19 pandemic: Insights from Columbus, OH. *Transp. Res. Interdiscip. Perspect.* 10, 100326. <https://doi.org/10.1016/j.trip.2021.100326>.
- Pawar, D.S., Yadav, A.K., Akolekar, N., Velaga, N.R., 2020. Impact of physical distancing due to novel coronavirus (SARS-CoV-2) on daily travel for work during transition to lockdown. *Transp. Res. Interdiscip. Perspect.* 7, 100203. <https://doi.org/10.1016/j.trip.2020.100203>.
- Petrunoff, N., Rissel, C., Wen, L.M., 2016. The effect of active travel interventions conducted in work settings on driving to work: a systematic review. *J. Transp. Health* 3 (1), 61–76.
- Power and Participation Research Centre, 2016. Bangladesh 2016: Politics, Governance and Middle Income Aspirations: Realities and Challenges: An Empirical Study. Accessed from : <https://www.undp.org/content/dam/bangladesh/docs/Publications/Pub2016/policy%20brief.pdf>.
- Pullano, G., Valdano, E., Scarpa, N., Rubricchi, S., Colizza, V., 2020. Evaluating the effect of demographic factors, socioeconomic factors, and risk aversion on mobility during the COVID-19 epidemic in France under lockdown: a population-based study. *Lancet Digital Health* 2 (12), e638–e649.
- Saha, J., Barman, B.B., Chouhan, P., 2020. Lockdown for COVID-19 and its impact on pupil mobility in India: an analysis of the COVID-19 Community Mobility Reports, 2020. *Children Youth Serv. Rev.* 105160.
- Sandelowski, M., 2000. Whatever happened to qualitative description? *Res. Nurs. Health* 23 (4), 334–340.
- Sarker, R.I., Morshed, G., Sikder, S.K., Sharmeen, F., 2020. In: *Urban Ecology*. Elsevier, pp. 163–183. <https://doi.org/10.1016/B978-0-12-820730-7.00010-0>.
- Shakibaie, S., de Jong, G.C., Alpkökin, P., Rashidi, T.H., 2021. Impact of the COVID-19 pandemic on travel behavior in Istanbul: A panel data analysis. *Sustain. Cities Soc.* 65, 102619. <https://doi.org/10.1016/j.scs.2020.102619>.
- Shamshirpour, A., Rahimi, E., Shabanpour, R., Mohammadian, A.C., 2020. How is COVID-19 reshaping activity-travel behavior? Evidence from a comprehensive survey in Chicago. *Transp. Res. Interdiscip. Perspect.* 7, 100216. <https://doi.org/10.1016/j.trip.2020.100216>.
- Shovon, F.R., Foisal, M.H., 2020, May 31. Commuters Furious about 60% Hike in Bus Fares. Accessed from : <https://www.dhakatribune.com/bangladesh/dhaka/2020/05/31/commuters-furious-about-60-hike-in-bus-fares>.
- Siddique, M.A.B., Choudhury, C.F., 2017. Modelling the behavioural response to congestion pricing in Dhaka, Bangladesh. *Transp. Dev. Econ.* 3 (2), 23.
- Spotswood, F., Chatterton, T., Tapp, A., Williams, D., 2015. Analysing cycling as a social practice: An empirical grounding for behaviour change. *Transp. Res. Part F: Traffic Psychol. Behav.* 29, 22–33.
- Ten Have, P., 2003. *Understanding qualitative research and ethnomethodology*. Sage Publications, London.
- Tirachini, A., Cats, O., 2020. COVID-19 and public transportation: Current assessment, prospects, and research needs. *J. Public Transp.* 22 (1), 1.
- Taylor, M. The Guardian, 2020. Large areas of London to be made car-free as lockdown eased. Accessed from <https://www.theguardian.com/uk-news/2020/may/15/large-areas-of-london-to-be-made-car-free-as-lockdown-eased15th>.
- Exchange, T.H.D., 2021. Bangladesh: District Wise Quarantine for COVID-19. Data and Resources, Accessed from <https://data.humdata.org/dataset/district-wise-quarantine-for-covid-19>.
- Thomas, N., Jana, A., Bandyopadhyay, S., 2022. Physical distancing on public transport in Mumbai. *Transp. Policy* 116, 217–236. <https://doi.org/10.1016/j.tranpol.2021.12.001>.
- Wadud, Z., 2020. The effects of e-ridehailing on motorcycle ownership in an emerging-country megacity. *Transp. Res. Part A: Policy Pract.* 137, 301–312.
- Watkins, D.C., 2017. Rapid and rigorous qualitative data analysis: The “RADaR” technique for applied research. *Int. J. Qual. Methods* 16(1), 1609406917712131.
- World Bank, 2021. Bangladesh Labor Force-Female. Accessed from <https://tradingeconomics.com/bangladesh/labor-force-female-percent-of-total-labor-force-wb-data.html>.

- World Health Organization, 2021. WHO Coronavirus (COVID-19) Dashboard: Bangladesh. Accessed from <https://covid19.who.int/region/searo/country/bd>.
- World Population Review, 2020. Dhaka Population 2020. Accessed from <https://worldpopulationreview.com/world-cities/dhaka-population>.
- Zafri, N.M., Khan, A., Jamal, S., Alam, B.M., 2021a. Impacts of the COVID-19 Pandemic on Active Travel Mode Choice in Bangladesh: A Study from the Perspective of Sustainability and New Normal Situation. *Sustainability* 13 (12), 6975.
- Zafri, N.M., Khan, A., Jamal, S., Alam, B.M., 2021b. Impact of COVID-19 Pandemic on Motorcycle Purchase in Dhaka, Bangladesh. *Front. Future Transp.* 646664 <https://doi.org/10.3389/ffutr>.
- Zarabi, Z., Manaugh, K., Lord, S., 2019. The impacts of residential relocation on commute habits: A qualitative perspective on households' mobility behaviors and strategies. *Travel Behav. Soc.* 16, 131–142.
- Zegras, P.C., Eros, E., Butts, K., Resor, E., Kennedy, S., Ching, A., Mamun, M., 2015. Tracing a path to knowledge? Indicative user impacts of introducing a public transport map in Dhaka, Bangladesh. *Cambridge J. Regions Econ. Soc.* 8 (1), 113–129.