Palacký University
Olomouc

Transactions on Transport Sciences
Peer-Reviewed Open Access Journal
Vol. 2/2023 DOI: 10.5507/tots.2023.008
journal homepage: www.tots.upol.cz

COVID-19 Safety Protocols: Do Commuters Prefer Public Transport after Relaxation of Safety Protocol Enforcement?

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ABSTRACT: There is a current discourse on how COVID-19 will impact future use of public services by people. At the time of writing this paper, most countries around the globe had relaxed safety protocol enforcement. This may change individual use of public transport, and policy implementations. The study mainly used Multinomial Logistic Regression (MLR) to examine the use of public transport ridership after the relaxation of COVID-19 safety protocol enforcement. A survey was used to collect data from 1692 respondents across Ghana partly online and partly face-to-face interviews from April 20th, 2022 to June 5th, 2022. The preliminary findings show that the use of private cars declined during the enforcement of safety protocols. However, after relaxation of safety protocol enforcement, the use of private transport increased more than public transport. The Relative Importance Index revealed that 'facemask wearing covering both nose and mouth', 'reduction in the number of occupants per vehicle', 'the use of alcohol-based hand sanitizer', and 'vehicles cleaned after every trip' were the most important safety protocols perceived to prevent infection of the virus. However, the MLR model shows that largely, relaxation of mandatory facemask wearing, social distancing, hand hygiene, and disinfection of transport could decrease public transport ridership. These findings suggest that the COVID-19 infection anxiety had not faded and could decrease public transport ridership. To relieve the anxiety regarding virus infection through the use of public transportation, the government needs to take appropriate measures to lower the perceived risk of infection.

KEYWORDS: COVID-19; Safety Protocol Enforcement; Public Transport; Multinomial Logistic Regression

1. INTRODUCTION

Transport policies have always held out public transport as the best option for travelling because of its economic, social, and environmental sustainability benefits (May, 2013; Miller, de Barros, Kattan, & Wirasinghe, 2016). However, the COVID-19 pandemic has had a significant impact on public transport systems across the globe (Budd & Ison, 2020; De Haas, Faber, & Hamersma, 2020; Vickerman, 2021; Zhang, Hayashi, & Frank, 2021). When the COVID-19 was declared a pandemic, the Government of Ghana (GoG) on March 22, 2020, instituted restriction measures. The restriction measures together with perceptions of the high risk of being infected in public spaces reduced the movement of people which in turn declined demand for public transport and to some extent, a shift toward non-motorized transport (Abdullah, Dias, Muley, & Shahin, 2020; De Haas et al., 2020; Gao, Rao, Kang, Liang, & Kruse, 2020; Yıldırım & Güler, 2022b).

Adherence to COVID-19 safety protocols was among the means proved to reduce the transmission of the virus (Abeya et al., 2021). As part of these protocols, the use of facemasks, hand washing, physical distancing, and avoidance of crowded places were recommended (Amgain, Neupane, Panthi, & Thapaliya, 2020; Sajed & Amgain, 2020). To reduce the spread of COVID-19 and increase ridership of public transport, the Ministry of Transport in Ghana enforced safety protocols in public transport operations and directed passengers and drivers at bus stations to wash their hands before boarding vehicles, regularly clean buses, reduce the number of occupants per vehicle, observe physical distancing in vehicles, and open windows to allow aeration within vehicles. The Ministry of Transport also directed transport operators to collect cell phone numbers of passengers to enhance contact tracing in the event of a suspected case. During the period, the general public was assured that when passengers and transport operators adhered to safety protocols, public transport would remain one of the safest ways of travelling. According to studies, the enforcement of safety protocols increased the use of public transport (Abdullah et al., 2021).

However, on Monday, 28th March 2022, the GoG relaxed the enforcement of safety protocols in public spaces and indicated that the wearing of facemasks was no more mandatory and encouraged all citizens to continue to maintain hand hygiene practices, and avoid overcrowded gatherings. This implied that adherence to virus preventive measures became a matter of choice for individuals. The relaxation of safety protocol enforcement may change people's risk perceptions and travelling behaviour which could decline the use of public transport. This is because during the time safety protocols were not enforced, individuals found public transport or shared mode as a high-risk area of contracting the virus (Ozbilen, Slagle, & Akar, 2021). As the enforcement of COVID-19 safety protocols was relaxed and became a matter of choice, some passengers may be afraid of being infected with the virus in the shared-mode (public transport) compared to private transport. Therefore, the study aims to examine the effect of COVID-19 safety protocol perceptions on the use of public transport after relaxation of safety protocol enforcement.

Given that people reduced their travel significantly when safety protocols were not mandatory, we hypothesise that people who perceived safety protocols as safe to protect them from being infected with the virus are less likely to travel in public transport after relaxation of safety protocols in public spaces. Understanding individuals' choice of public transport in this era can help come up with strategies that could serve

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as a guide for transport policy makers and operators in Ghana and beyond in the design of mobility plans in a more resilient way to sustain public transport operations in the era of the virus outbreak.

1.1 The State of COVID-19 in Ghana

When the COVID-19 pandemic started as a flu outbreak in Wuhan, in the Hubei Province in China, the general perception was that the disease would only remain in China and probably some Asian countries (Khanna, Cicinelli, Gilbert, Honavar, & Murthy, 2020). However, the disease spread and had a significant impact on the health, livelihoods, economies, and mobility behaviour of people in almost every country around the globe, including Ghana.

As of June 29th, 2022, the number of people who were infected with the COVID-19 disease stood at 165,749 out of which 1,449 lost their lives in Ghana (Ritchie et al. 2022). On the world front, the Coronavirus cases stand at 545,455,677 with 6,332,579 deaths.

When Ghana recorded the first two imported cases on 12 March 2020, the government of Ghana, upon the advice from the Ghana Health Service directed all educational institutions, universities, beaches, nightclubs, and hotels to be closed. Restaurants were only allowed to serve take-away food and beverages or render home delivery services. All public gatherings including conferences, workshops, funerals, festivals, political rallies, church and mosque activities and other related events were banned to reduce the spread of the virus. During the period, the contact tracing process was initiated which helped to detect many cases within a short time. Upon discovering that the virus had started spreading in Ghana, borders (land and sea) were closed together with the closure of the main international airport in Accra to limit the importation of the virus into the country. Persons entering the country during the time of the closure of the borders were quarantined for 14 days.

Later in March 2020, a three week partial lockdown was placed on Greater Accra, Tema, Kasoa and Greater Kumasi. These cities were identified as epicentres of the pandemic (Owusu & Wilson, 2020; Sarkodie et al., 2021). At that time the rule was enforced rigorously, and people were allowed to leave home only for shopping, and jogging or going for a walk. Workers were advised to work from home to limit the spread of COVID-19 cases. As a result of these measures, people stayed at home and the number of travels reduced drastically (Bucsky, 2020) because people were scared to travel out of the fear of catching the virus.

The government of Ghana upon the advice from health professionals lifted the partial lockdown in April 2020 and instituted safety protocols for people to move around or travel safely. These protocols included physical distancing, facemask wearing, washing of hands under running water and the use of hand sanitizer. This also included limiting the number of available public transport vehicles. In July 2020, the safety protocols were vigorously enforced by the state security and in September 2020, some of the restrictions including the ban on travelling were eased, though gradually. People were able to move much more freely between cities with strict adherence to safety protocols.

On the 24th of March 2022 the President of Ghana announced an update on the measures taken to limit the spread of the virus. The President's address indicated that Ghana as of 24th March 2022, had 72 active cases of COVID-19 and that there were no severely or critically ill persons. The President's address also indicated that over 13.1 million people had received a single dose of the vaccine with 5 million people being fully vaccinated. Against the background of recording very low levels of infections, and having a significant number of people vaccinated, and on the advice of the national COVID-19 Taskforce and health experts, COVID-19 restrictions enacted under executive Instrument 64 were revised. The wearing of facemasks was declared no longer mandatory. Private parties, religious activities, conferences, workshops, cinemas, theatres, sporting events, entertainment centre activities, rallies, and funerals were to resume at full capacity as long as the audience and/or participants were fully vaccinated. The sea and land borders were also opened.

1.2 COVID-19 and Public Transport

The public transportation system in Ghana is mainly run by the informal sector (Hart, 2013), usually with seats between 5 to 60 passengers (Tetteh, Bowen-Dodoo, & Kwofie, 2017). There are different forms of public transport which includes, station-based and chartered taxi cabs, motorcycle taxis, on demand ride-hailing (Acheampong, Siiba, Okyere, & Tuffour, 2020; Dzisi & Dei, 2020) and bus transit services (Vermeiren et al., 2015). In Ghana, "Trotro" is one of the popular public transports with cheaper fare structures. This form of transportation is usually overcrowded where passengers sit close to each other. In an attempt to reduce infection associated with use of public transport, social distancing was one of the important measures enforced by ensuring appropriate queuing at the stations and deliberately reducing the number of passengers on-board to promote systematic spacing seating arrangements. The passengers waiting in queues to board vehicles were screened by checking their temperatures using a temperature gun (thermometer).

The significant impact of COVID-19 pandemic on mobility has been clearly demonstrated in available literature (Bucsky, 2020; Echaniz et al., 2021; Jenelius & Cebecauer, 2020; Wielechowski, Czech, & Grzęda, 2020) with varying views on the risk of COVID-19 infection associated with the use of public transport. For instance, a study conducted in Canada indicated that the reduction in the use of public transportation was used as a strategy to reduce the spread of the infection, particularly in major cities such as Toronto (Vaz, 2021). A study conducted in Ghana by Dzisi & Dei, (2020) revealed that in the early days of the COVID-19 pandemic, public transportation was seen as a possible health hazard for the spread of the virus, particularly in major cities such as Accra and Kumasi. On the other hand, another study indicated that the use of public transportation was an essential service for populations at greater risk of COVID-19 infection (Ahangari, Chavis, & Jeihani, 2020).

Others have also indicated that the restrictions in mobility and vehicle occupancy have led to a substantial decline in the use of public transport (Aloi et al., 2020; Jenelius & Cebecauer, 2020; Tirachini & Cats, 2020). A report revealed that the pandemic has greatly affected people's mobility and the number of public transport trips taken in African cities decreased by an average of 40 percent in April 2020 compared to trips before the outbreak of COVID-19 (African Transport Policy Programme, 2020).

Majority of these studies on the COVID-19 and public transport were conducted during the pandemic and as to whether relaxation of safety protocols enforcement affected passenger perception on risk of infection when travelling on public transport has not yet been established. Again, unlike previous studies, the current study has widened the scope by considering almost all the safety protocols and guidelines issued by WHO regarding the use of public transport. The understanding of transport choice behaviour of people after relaxation of COVID-19 virus preventive measures can help transport operators to better understand the mode choice behaviour and plan for transportation operations in the future. Therefore, the evidence on the use of public transportation after relaxation of safety protocols enforcement must be examined.

2. METHODOLOGY

2.1 Sampling and data collection

The survey for the study was conducted among the Ghanaian general public. A simple random sampling method was used in conducting the survey because it is simple, easy to use, aids in hypothesis generation, fast and cheap (Dudovskiy, 2016). Based on Ghana's population of 31,072,940, with 95% confidence interval and 5% margin of error, a minimum sample size of 400 respondents was calculated. The study ultimately sampled 1692 individuals who indicated in the various modes of surveys that they owned a car.

To avoid ambiguity and improve the validity of the items in the questionnaire, a pre-test was conducted. During this stage, it was identified that few items were not clear to the respondents. However, most of the respondents found the items in the questionnaire relevant and comprehensible. The ambiguous items were refined, and the final questionnaire administered partly online and partly through face-to-face interviews between April 20th, 2022 and June 5th, 2022.

The Google Forms was used to design the online survey after which it was shared by the researchers on various social media platforms such as Twitter, Facebook, and WhatsApp and through email. Two thousand questionnaires were distributed and out of these one thousand six hundred and thirty (1,630) participants completed and submitted the online form. Out of the online questionnaire returned, 422 participants indicated that they did not own cars.

During the face-to-face session, the questionnaire was administered in person at various locations such as stations, offices, shops, restaurants, and University campuses in the Ghanaian cities of Ho, Accra and Kumasi. Eight hundred and twenty-five (825) questionnaires were distributed face-to-face. Of the 825 questionnaires returned, 24 were incomplete and 317 indicated they did not own cars. At the end of the survey, the incomplete responses and the respondents who indicated they did not own cars were removed from the study, leaving a total of 1208 and 484 valid online and face-to-face responses of participants who owned cars respectively. Generally, valid responses to the total survey administered were 1962.

Respondents who did not own cars were removed from the analysis based on the following reasons: Most people in Ghana use public transport (Trotro), thus to examine the likelihood of mode switch from private to public transport, it is expedient that the analysis is done only on individuals who owned cars and had the option to use their private cars when they feel at risk of being infected in public transport. Again, it has been established that individuals who did not own cars had no choice but to rely on public transport, despite the anxiety of contracting COVID-19 (Park & Kim, 2021) and therefore including them in the study will lead to confounding results.

Each participant took an average of 30 minutes to complete the face-to-face questionnaire. To control for any kind of biases, participants were allowed to answer the questionnaire after their consent was sought and the objective of the study explained to them. The questionnaire was anonymous and there were no personal details linked to any responses. The meaning of safety protocols and public transport were defined in the introductory part of the questionnaire to ensure accurate responses.

2.1.1 Measurement

The content of the survey questionnaire was categorised in three sections: the first section comprised demographic information such as age, gender, educational background, employment, personal monthly income, and car ownership.

As indicated earlier, during the peak of the pandemic the Government of Ghana temporarily suspended majority of socio-economic activities to control the spread of the disease. The government in some few months lifted the ban and introduced safety protocols to be enforced and observed. In March 2022, the enforcement of safety protocols was relaxed in public spaces, and this was likely to increase or decrease people's confidence of being protected which in turn may significantly influence mode choice. Hence, the second section of the questionnaire was related to the mode choice (public transport, private car both public transport and private car and non-motorized) during the enforcement of safety protocols and after relaxation of safety protocol enforcement. It is worth noting that the non-motorized mode of travel is a combination of walking and cycling.

Most importantly, to measure the extent to which participants used public transport after relaxation of COVID-19 safety protocols in public spaces, the participants were asked to respond to a single item in the third section. The response was rated as 1-*do not use public transport*, 2- *moderately use public transport* and 3-*regularly use public transport*.

The fourth section consists of 5 key constructs related to COVID-19 safety protocols such as **facemask wearing**, **screening**, **hand hygiene**, **ventilation/physical distancing**, and **cleaning/disinfection** of public transport. The items assessed how safe the respondents felt from being infected with COVID-19 in public transport when the safety protocols were enforced in public spaces. As indicated in Table 2, facemask wearing and screening constructs were each measured with 2-items. The construct of hand hygiene and cleaning/disinfection were each measured with 3-items. Ventilation/physical distancing construct was measured with 6-items. The items in each of the safety protocol constructs were ranked using a 3-point Likert scale ranging from 1-not safe to 3-very safe. Furthermore, the Cronbach Alpha coefficient was used to assess the reliability of the items in each construct. As indicated in ***Table 2, the*** Alpha coefficient for each construct was above the recommended threshold of 0.7 (Pallant, 2020).

2.2 Multinomial Logit Model

Multinomial logit model can best be used when the choice consists of more than two alternatives. Studies have used multinomial logit to model travel choice behaviour (Miskeen, Alhodairi, & Rahmat, 2013). In this study, how often commuters use public transport mode was modelled using the multinomial logit (MNL) model. Hensher & Johnson, (2018) presented a detailed explanation of this technique. Briefly, in the multinomial logit model there is one set of parameters for each category of Y. The probabilities of the different outcomes of Y are expressed as:

$$[1] \quad P_r\left(Y = {}^{j}\!/\!_{X}\right) = \frac{\exp\left(X\beta_J\right)}{\sum_{i=1}^{J}\exp\left(X\beta_i\right)}$$

Where β is set to zero for one of the outcomes. The outcome for which the β vector is set to zero is called the "base outcome" or the "reference category".

The parameter estimates of the multinomial Logit model therefore expresses differences compared to the base outcome.

The odds of outcome j versus outcome k are expressed as follows:

$$[2] \quad \frac{P_r\left(Y = {}^{j}\!/\!_{X}\right)}{P_r\left(Y = {}^{k}\!/\!_{X}\right)} = \frac{P_j}{P_k}$$

$$[3] \quad \frac{\exp\left(X\beta_j\right)}{\sum_{i=1}^{j}\exp\left(X\beta_i\right)} \div \frac{\exp\left(X\beta_k\right)}{\sum_{i=1}^{j}\exp\left(X\beta_i\right)}$$

$$[4] \quad \frac{\exp\left(X\beta_j\right)}{\exp\left(X\beta_k\right)}$$

Taking the logarithm yields

[5] $$\ln\left(\frac{P_j}{P_k}\right) = X\left(\beta_j - \beta_k\right)$$

In this study, there are three responses with regards to the use of public transport such as: do not, moderately and regularly use public transport. The dependent variable Y represents the three values:

Y_a = 1, representing do not use public transport, Y_b = 2 means moderately use public transport with Y_c = 3 standing for regularly use public transport. For instance, in this type of model, two logit functions are required therefore, Y_a = 1 can be used as the baseline outcome to form logits to which Y_b = 2 and Y_c = 3 can be compared. The two logit functions can be stated as follows:

[6] $$\log it\left(P_2\right) = \ln\left(\frac{P\left(Y_b = 2/X\right)}{P\left(Y_a = 1/X\right)}\right) = \alpha_2 + \sum_{i=1}^{n}\beta_{2i}X_i$$

[7] $$\log it\left(P_3\right) = \ln\left(\frac{P\left(Y_c = 3/X\right)}{P\left(Y_a = 1/X\right)}\right) = \alpha_3 + \sum_{i=1}^{n}\beta_{3i}X_i$$

Where X_i is the value of the ith independent variable, α_2 is the intercept of the first logit function, α_3 is the intercept of the second logit function, β_{1i} is the corresponding coefficient of the number of variables.

The condition probability of the z^{th} outcome category can then be given as follows:

[8] $$P\left(Y = Z/X\right) = \frac{\exp\left(\alpha_z + \sum_{i=1}^{n}\beta_{Zi}X_i\right)}{1 + \sum_{Z=1}^{Z-1}\exp\left(\alpha_z + \sum_{i=1}^{n}\beta_{Zi}\right)}$$

Where α_2 is the intercept of the zth logit function, β_{zi} is the corresponding coefficient of the i^{th} independent variable in the z^{th} logit function with z being the number of outcomes categories.

2.3 Data analysis

The data collected was edited, coded, and analysed in STATA version 15.0. Graphs and tables were generated to partly present the preliminary results. The reliability of the data was also checked. A Relative Importance Index (RII) was also used to determine the safety protocols commuters perceived as important to prevent infection of the virus. Finally, the effect of COVID-19 safety protocols on the use of public transport after relaxation of safety protocols was estimated using the Multinomial Logistic Regression Model. Although ordinal logistic regression could be the best approach for analysing the data given that the dependent variable considered was ordered and categorical, we found that the proportional odds assumption was violated and as such, MLR was selected as the best approach (Crowson, 2020; Osborne, 2015). It is important to note that the analysis was done for individuals who indicated in the survey that they own a car and/or commute using a car.

3. RESULT AND DISCUSSION

The study examined the effect of COVID-19 safety protocols on the use of Public Transport (PT) after relaxation of safety protocols using multinomial logistic regression (MLR). To estimate the model, the dependent variable, 'the extent to which participants use public transport after relaxation of the COVID-19 safety protocols enforcement in public spaces', was coded 1= do not use PT, 2= moderately use of PT, 3= regularly use PT. The independent variables in the model assessed how safe the respondents felt protected from COVID-19 when safety protocols such as facemask wearing, screening, hand hygiene, ventilation/social distancing, and cleaning/disinfection of transport interior were imposed in public spaces. The responses were coded 1= 'not safe', 2= 'safe', and 3= 'very safe.

3.1 Result and Discussion of Preliminary Analysis

3.1.1 Summary of Demographic Characteristics

The result in Table 1 shows that out of the total number of 2431 participants who responded to all questions, more than half of them 1,692 (69.60%) owned cars. Of the 1692 valid respondents who own cars, 1,366 (80.73%) were males and 326 (19.27%) females. Majority (32.91%) of the participants who were included in the study were within the age group of 30-39. Most of them 571 (33.73%) hold post-graduate qualifications, suggesting that majority of the respondents who qualified to partake in the study could read and understand the content of the data collection instrument and can give valid responses. They had different occupations with 989 (58.44%) being public workers. Furthermore, the monthly income for most (48.09%) of them was above 3000 Ghana cedis (the equivalent of 390 US dollars).

Variables	Category	Frequency	Percent
Gender			
	Male	1,366	80.73
	Female	326	19.27
Age			
	20-29 years	446	26.37
	30-39 years	557	32.91
	40-49 years	396	23.41
	50-59 years	195	11.52
	60 years and above	98	5.80
Education			
	Basic	118	6.99
	Secondary	139	8.23
	Vocational/Tech.	446	26.37
	HND/Diploma	418	24.68
	Post Graduates	571	33.73
Occupation			
	Public worker	989	58.44
	Private worker	211	12.44
	Self-employed/Business owner	140	8.30
	Unemployed	352	20.82
Income			
	<GH₵1000	321	18.96
	GH₵1000-2000	182	10.74
	GH₵2000-3000	376	22.21
	Above GH₵3000	813	48.09
Car ownership			
	Yes	1,692	69.60
	No	739	30.40

Table 1. Demographic Characteristics of the Respondents.

3.1.2 Transport Mode Choice

The result of the study shows that when the safety protocols were mandatory, more people who own private cars travelled with public transport ***(Figure. 1a).*** In Ghana everyone was obliged to observe the safety protocols before embarking on a trip and it was mandatory for all public transport operators to observe safety protocols. These measures may have influenced the participants' perception that they were less exposed to the risk of being infected with the disease when travelling in public transport, hence the increase in the use of public transport. Logically, people may want to travel over long distances in public transport instead of private cars for economic reasons. However, commuters may want to use their own vehicles for long journeys if travelling in public transport would expose them to the COVID-19 disease. This result agreed with another study conducted by Park & Kim, (2021) in South Korea, which showed that the social distancing policy, ventilation system installation, passenger number reduction in a vehicle, and seat distribution strategies were effective for reducing the risk of being infected.

However, according to previous study by Abdullah et al., (2020), it was also observed from ***Figure 1b*** that generally, as the safety protocol enforcement is relaxed, most participants (690) preferred to travel in their own private transport than the public transport. This confirmed the fact that people generally may have been avoiding public transport after relaxation of safety protocol enforcement (Kim, Chung, Park, & Choi, 2017). This could be attributed to the fact that people perceived the use of private vehicles as safer than the public transportation modes (Abdullah et al., 2020), as the adherence to safety protocols was no more mandatory.

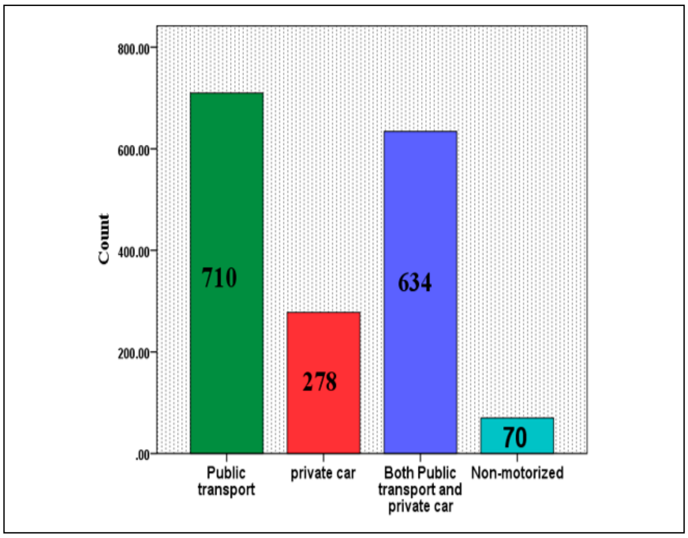

Figure 1a: Mode choice during the enforcement of COVID-19 safety protocols.

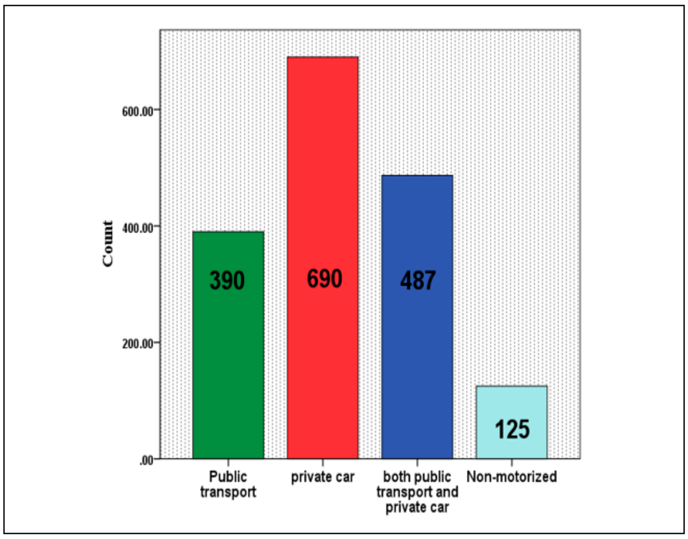

Figure 1b: Mode choice after the relaxed of COVID-19 safety protocols enforcement.

3.1.3 Safety Protocols that Influenced Public Transport Ridership

The Relative Importance Index (RII) was employed to determine the relative importance of COVID-19 safety protocols that participants perceived to protect them from being infected with the disease when they travel in public transport. This index computation was used to rank the factors. The higher the RII, the more important the participants perceived that a particular safety protocol would protect them from being infected with the disease in public transport (Kassem, Khoiry, & Hamzah, 2020). According to the result in Table 2, 'wearing a mask covering both nose and mouth' was ranked as the most important factor commuters perceive to protect them from being infected with the disease in public transport (RII=0.704) followed by 'the use of alcohol-based hand sanitizer' (RII =0.621). Similar to a previous study (Abdullah et al., 2020), the result implied that commuters placed more importance on the usage of facemasks and alcohol-based hand sanitizer during transportation as the key safety factors to prevent or minimise the risk of contracting the COVID-19 disease. This is not surprising since these were among the main safety protocols recommended by WHO for the prevention of the spread of the disease. Furthermore, the COVID-19 disease is known to be an upper respiratory disease caused by a virus that is transmitted from an infected person to another through coughs, saliva during speaking, sneezes, and handshake contacts (Bonful et al., 2020).

The result further revealed that 'reduction in the number of occupants per vehicle' (RII =0.617), 'alcohol-based hand sanitizer available for use before and after transactions' (RII =0.616), "vehicles cleaned after every trip' (RII =0.614) and 'assigning seat to each passenger' (RII =0.611) were rated third, fourth, fifth and sixth respectively to be among the most important factors commuters perceived to protect them from being infected with the disease in public transport. Studies have considered various factors making public transportation stations and vehicle environments high risk for COVID-19 infection. Literature indicated that public transportation is a potential source for transmission of the COVID-19 disease because of the nature of sitting arrangements in vehicles (Borkowski, Jażdżewska-Gutta, & Szmelter-Jarosz, 2021). Another study (Borkowski et al., 2021), also indicated that there is a greater risk of contracting diseases during public transportation. Another related study regarding public transportation and the COVID-19 pandemic shows that the closed environment of vehicles makes public transportation a potential contagion source for the COVID-19 disease (Tirachini & Cats, 2020). These perceptions have impacted on the travelling behaviour of people leading to a decline in public bus ridership, mainly influenced by public perception about being at risk of being infected while using public transport. However, the findings of the current study revealed that passengers are likely to use public transport during pandemics, if transport operators strictly adhere to preventive measures such as wearing a mask covering both nose and mouth, reduction in numbers of passengers in the public transport, the use of alcohol-based hand sanitizers and vehicles are cleaned during a pandemic. On the contrary, people place significantly less importance on temperature checks upon arrival at stations and passengers of the same household made to sit together. This indicates that passengers do not consider all the safety protocols as important when choosing a travel mode during a pandemic.

3.2 Model Estimation.

To examine the impact of COVID-19 safety protocols on the use of public transport after relaxation of safety protocols, three levels on extent to which participants used public transport (1= do not use PT, 2=*moderately use PT*, and 3=*regularly use PT*) after relaxation of COVID-19 safety protocol enforcement in public spaces were considered, and '*do not use public transport'* was treated as the reference category. As a result, the independent variables used in the model were on how

COVID-19 Safety Protocols in Transport Operations.	Completely protect (n*3)	somehow protect (n*2)	do not protect (n*1)	Total	Total number of Respondents	A*3	RII (Total/A*3)	Rank	α
1. Facemask wearing									**0.78**
All occupants wearing a mask covering both the nose and mouth throughout the trip.	2379	586	606	3571	1692	5076	0.704	**1**	
All drivers and conductors wear a mask.	1461	728	841	3030	1692	5076	0.597	9	
2. Screening									**0.82**
Temperature check upon arrival at the station.	1086	862	899	2847	1692	5076	0.561	15	
Pre-screening of all passengers before entering the station and boarding the bus.	1212	724	926	2862	1692	5076	0.564	14	
3. Hand hygiene									**0.86**
Washing of hands with soap under running water.	1296	696	912	2904	1692	5076	0.572	11	
Alcohol-based hand sanitizer is available for use when soap and running water are not available	1836	474	843	3153	1692	5076	0.621	**2**	
Alcohol-based hand sanitizer available for use before and after transactions	1755	532	841	3128	1692	5076	0.616	**4**	
4. Ventilation/physical distancing									**0.89**
Vehicles windows open to promote fresh-air circulation	1620	612	846	3078	1692	5076	0.606	7	
Adherence to social/physical distancing in stations.	1485	468	963	2916	1692	5076	0.574	13	
Assigning seat to each passenger	1719	524	857	3100	1692	5076	0.611	**6**	
Passengers seated using the recommended distance between all passengers	1377	586	940	2903	1692	5076	0.572	11	
Passengers of the same household are made to sit together	804	864	992	2660	1692	5076	0.524	16	
Reduction in the number of occupants per vehicle	1815	456	859	3130	1692	5076	0.617	**3**	
5. Cleaning/disinfection									**0.75**
Vehicles are disinfected with a highly efficient fogger	1509	698	840	3047	1692	5076	0.600	8	
Vehicles are cleaned after every trip.	1701	582	834	3117	1692	5076	0.614	**5**	
Wiping down door handles, seat backs, and window controls with alcohol-based hand sanitizer after each passenger transfer.	1497	616	885	2998	1692	5076	0.591	10	

Note**:** **n** (number of respondents), **A** (Highest weight), **RII** (Relative Important Index), α (Cronbach alpha)

Table 2. Relative Important Index of COVID-19 Safety Protocols and Reliability test.

safe the respondents felt protected from COVID-19 disease when safety protocols were imposed in public spaces. The responses were coded 1= '*not safe*', 2= '*safe*' and 3= '*very safe'.* The '*not safe*' was treated as the baseline category. The study used the unstandardized regression slopes and associated significance tests as well as odds ratios (OR) to interpret the result. The result of the regression slope is interpreted as the predicted change in log odds of belonging to the baseline group per unit increase on the predictor.

It is important to note that if a slope is positive, it indicates that with increasing values on a predictor, the likelihood of using Public Transport (PT) increases after relaxation of COVID 19 safety protocol enforcement, whereas the possibility of 'not using the public transport' category decreases. If a coefficient is negative, it indicates that with increasing values on a predictor, the likelihood of using Public Transport (PT) decreases after relaxation of COVID 19 safety protocols enforcement, while the possibility of 'not using the public transport' increases.

The likelihood ratio test was used to assess the fitness of the model developed for public transport ridership. As indicated in Table 3, the −2 log likelihood was computed for the intercept-only model and the final model developed with all independent variables. The Pearson's chi-square test for the final model developed was significantly different ($\chi2$ = 1648.77, df = 68, p = 0.000) from the intercept-only model (p <.001) suggesting that the independent variables, as a group, contribute significantly to the prediction of the public transport ridership. The Akaike's Information Criterion for the final model was low compared to the intercept only model which means good fit (Tabachnick, Fidell, & Ullman, 2007). The McFadden R-square values of 0.319 indicated an acceptable fit.

3.2.1 Results of Moderate use of PT Relative to Do Not use PT

3.2.1.1 Facemask Wearing

The perception that 'wearing of mask' was safe (B= -1.9031, p<.001) and very safe (B= -0.4231, p<.05) to protect a person from being infected with COVID-19 is a significant negative predictor of 'moderate use of PT' relative to 'not using PT' with an OR of 0.1491 and 0.6550 respectively. This result implies that for every one-unit increase, the predicted odds for 'moderate use of PT' decreased by 0.85.1% and 34.5% after relaxation of safety protocols for those who had believed that wearing a mask was safe and very safe to protect them from being infected with COVID-19.

It was also observed that a person with a belief that 'all drivers/conductors wearing the mask' was safe (B= -0.8288, p<.001) to protect them from contracting the COVID-19 disease is negative and significant predictor of 'moderate use of PT' with an OR of 0.4366. This means that for every one-unit increase, the predicted odds for 'moderate use of PT' decreased by 56.34% after relaxation of safety protocols for those who believed that wearing a mask was safe to protect them from COVID-19.

3.2.1.2 Screening

For screening, only respondents who believed that 'pre-screening of all passengers/staff for COVID-19 symptoms before entering the station and boarding the buses' was 'safe' (B=0.3351, p<.01) positively predicted 'moderate use of PT' with an OR of 1.3981 suggesting that for every one-unit increase, the predicted odds for moderate use of PT increased by 39.81% after relaxation of COVID 19 safety protocol enforcement for those who had trust that pre-screening was safe.

3.2.1.3 Hand hygiene

A person who perceived that 'washing of hand with soap under running water' (B= -0.5967, p<.001) and the 'use of alcohol-based sanitizer before and after each transaction' (B=-0.7232, p<.05) in public transport was safe is a significant negative predictor of 'moderate use of PT' with OR of 0.5506 and 0.4852 respectively. This result implies that for every one-unit increase, the predicted odds for 'moderate use of PT' decreased by 44.9% and 51.5% after relaxation of COVID 19 safety protocol enforcement for those who believed that hand hygiene was safe to protect them from being infected with COVID-19.

Likewise, a person with a perception that 'washing of hands with soap under running water' (B= -1.2994, p<.001) and 'use of alcohol-based sanitizer before and after each transaction' (B= -1.8707, p<.001) was 'very safe' against COVID-19 disease is negative and significant with an OR of 0.2727 and 0.1540 respectively. This result suggests that for every one-unit increase, the predicted odds for 'moderate use of PT', decreased by 72.73% and 84.6% respectively after relaxation of COVID 19 safety protocols enforcement for persons who believed hand hygiene was 'very safe' to protect them against COVID-19 disease.

3.2.1.4 Ventilation/physical distancing

The safety protocols regarding aeration indicated that the perception of the 'opening of windows to promote fresh-air circulation' did not significantly predict 'moderate use of PT' relative to those who did 'not use PT'. However, the perception that 'social/physical distancing', 'passengers seated at regular intervals', 'passengers of the same household sited together' and 'reduction in the number of occupants' were safe and very safe to protect against COVID-19 disease were significant negative predictors of 'moderate use of PT' after relaxation of COVID 19 safety protocol enforcement.

On the other hand, the perception that 'assigning seats to each passenger' was safe (B= 0.6507, p<.001) and very safe (B= 0.9640, p<.001) against COVID-19 disease is a significant positive predictor of moderate use of PT' with OR of 1.9169, and 2.6222 respectively. This result suggests that for every one-unit increase, the predicted odds for 'moderate use of PT', increased by 91.69% and 162% respectively, after relaxation of COVID 19 safety protocol enforcement for persons who believed that assigning seats to each passenger was safe and very safe.

3.2.1.5 Cleaning/disinfection

Among the cleaning variable, the perception that 'disinfection of the interior of public transport' was safe (B= -0.9636, p<.001) and 'very safe' (B= -0.6631, p<.01) to protect one against COVID-19 negatively predicted 'moderate use of PT' with an OR of 0.3815 and 0.5152 respectively. Similarly, perception that 'Vehicles are cleaned after each trip' was very safe to prevent infection of COVID-19 shows a negative significant predictor of 'moderate use of PT' with an OR of 0.2022. However, people who perceived 'wiping down door handles, seat backs and window controls' was very safe (B= 0.2963, p<.001) to protect one from being infected with COVID-19 is a positive significant predictor of 'moderate use of PT' with respective OR of 1.3448.

3.2.2 Results of Regular use of PT Relative to Do Not use PT

3.2.2.1 Mask Wearing

The perception that 'all passengers wearing a mask' (B= -1.9031, p<.001) and 'all drivers/conductors wearing the mask' was safe (B= -2.3730, p<.001) is a significant negative predictor of 'regular use of PT' with an OR of 0.3033 and 0.0932 respectively relative to 'do not use PT'. This result implies that for every one-unit increase, the predicted odds for 'regular use of PT', decreased by 69.8% and 90.7% after relaxation of safety protocol enforcement for those who believed that wearing facemask was safe to protect them from being infected with the virus. Similarity, persons who had believed that 'all drivers/conductors wearing the mask' was very safe (B= -1.4133, p<.001) to protect them from contracting the COVID-19 disease is a significant negative predictor of 'regular use of PT' with an OR of 0.2433. The result explains that for every one-unit increase, the predicted odds for 'regular use of PT' decreased by 75.7% after relaxation of safety protocol enforcement for those who had believed that wearing a facemask was very safe to protect them from the COVID-19 virus.

3.2.2.2 Screening

The result shows that persons who had belief that a 'temperature check' was safe negatively predicted 'regular use of PT' with an OR of 0.6209. This means that the odds for 'regular use of PT', decreased by 39.9 % for those who had believed that temperature check was safe compared to people who believed temperature check was not safe to protect them from being infected by the COVID-19 virus. However, the perception that 'pre-screening of all passengers/staff for COVID-19 symptoms before entering a station and boarding the buses' was safe (B=0.6389, p<.001) positively predicted 'regular use of PT' with an OR of 1.8944, while very safe (B= -0.8789, p<.05) negatively predicted 'regular use of PT' with an OR of 0.4153. This result means that after relaxation of safety protocols, the respondents who believed pre-screening all passengers before boarding, had a higher probability of 89.44% % to 'regularly use PT' whereas the odd for 'regular use of PT' is likely to decrease by 58.5% for those who believed it was very safe compared to those who believed it was not safe to protect them from contracting the COVID-19 disease.

3.2.2.3 Hand hygiene

A person who perceived that 'washing of hand with soap under running water' (B= -4.0425, p<.001), the 'use of alcohol-based hand sanitizer' (B= -2.1769, p<.001) and the 'use of alcohol-based sanitizer before and after each transaction' (B=-2.9170, p<.001) was safe is a significant negative predictor of 'regular use of PT' with OR of 0.0175, 0.1134 and 0.0541 respectively. Most importantly, this result implies that for every one-unit increase, the predicted odds for 'regular use of PT', decreased by 98.2%, 88.7% and 94.6% after relaxation of COVID 19 safety protocol enforcement for those who believed that hand hygiene was safe to protect them from being infected with the COVID-19 virus. Similarly, a person with a perception that 'washing of hands with soap under running water' (B= -3.1309, p<.001), the 'use of alcohol-based hand sanitizer' (B= -2.6076, p<.001) and 'use of alcohol-based sanitizer before and after each transaction' (B= -3.6892, p<.001) was 'very safe' against COVID-19 disease is negative and significant with OR of 0.0436, 0.0737 and 0.0249 respectively. Notably, the result suggests that for every one-unit increase, the predicted odds for 'regular use of PT', decreased by 95.6%, 92.6% and 97.5% after relaxation of COVID 19 safety protocols enforcement for persons who believed hand hygiene was 'very safe' to protect them against COVID-19 disease.

3.2.2.4 Ventilation/social distancing

The perception that 'opening of car windows to promote fresh-air circulation' and 'assigning seats to each passenger' was safe and very safe is a positive significant predictor of 'regular use of PT'. Noticeably, for every one-unit increase, the predicted odds for 'regular use of PT', increased by 83.9% and 86.2% after relaxation of safety protocols for those who perceived opening of vehicle windows was safe and very safe respectively. In addition, 72.3% for passengers who had believed that 'assigning seats to each passenger' was very safe to prevent infection of the virus. However, the perception that 'enforcement of social distancing in stations', 'passengers seated at recommended distance', 'same household seated together' and 'reduction of number of occupants' was safe and very safe were negative significant predictors of 'regular use of PT'. Noticeably, for every one-unit increase, the predicted odds for 'regular use of PT' decreased by 97.4%, 97.2% and 91.4% after relaxation of safety protocol for those who perceived ventilation and social distance was safe to prevent infection of the virus.

3.2.2.5 Cleaning/disinfection

Focusing on the cleaning and disinfection of the transport, the perception that 'disinfection of public transport interior', 'cleaning vehicles after each trip', and 'wiping down door handles, seat backs and window controls' was safe and very safe negatively predicted 'regular use of PT'. Outstandingly, for every one-unit increase, the predicted odds for 'regular use of PT' decreased by 95.9%% after relaxation of safety protocols for those who perceived that wiping down was 'very safe' to prevent infection of the virus. Additionally, perception that disinfection of public transport interior and clean transport was safe and very safe respectively also recorded substantial decreases by 75.4% and 74.8% of 'regular use of PT'.

3.2.3 Discussion of Estimated Model

The high spread of the COVID-19 virus in public spaces reduced the movement of people and declined demand for public transport and to some extent, a shift toward non-motorized transport. To limit the spread of the virus and to promote the use of public transport, safety protocols were enforced in transport operations in most countries around the world. However, in recent times, due to the low level of infection and the fact that the majority have been vaccinated, most countries around the globe have relaxed the enforcement of safety protocols in public spaces. As the safety protocol enforcement has been relaxed, passengers' anxiety regarding COVID-19 infection in public spaces may still persist which in turn could decline public transport ridership. Therefore, the study aims to examine the effect of COVID-19 safety protocol on the public transport ridership after relaxation of safety protocol enforcement, using Ghana as a case study. Given that people reduced their travel significantly when safety protocols were not mandatory, we hypothesised that people who perceived enforcement of safety protocol protect them from being infected are less likely to travel in public transport as the safety protocol enforcement was relaxed in public spaces. Majority of the results supported the hypothesis. The findings were not surprising considering the substantial reductions in the use of public transport modes as compared to individual modes around the world during the early days of the pandemic when the safety protocols were not enforced (De La Garza, 2020; Ozbilen et al., 2021).

Specifically, the current study revealed that passengers who felt the enforcement of wearing a facemask in public transport was safe or very safe to protect them from being infected with COVID-19 were less likely to use public transport as the safety protocol enforcement was relaxed in public spaces compared to people who believed that wearing masks in public transport was not safe to protect them from the COVID-19 disease. In line with a previous study, it is possible passengers were much aware that wearing of masks lowers the number of viruses transferred to the respiratory tracts of persons in an enclosed environment, resulting in an overall infection risk reduction (Cartenì, Di Francesco, & Martino, 2020, 2021; Park & Kim, 2021) on public transportation. This means people who believed previously that enforcement of wearing facemasks was an effective measure to ease the transmission of the virus in public spaces desired public transport because other users were required to adhere to these measures (Chu et al., 2020; Schünemann et al., 2020). A study reported that facemasks were not being used by all the passengers (Dzisi & Dei, 2020), hence, a considerable decline in public transport use in several countries (Bucsky, 2020; Echaniz et al., 2021; Jenelius & Cebecauer, 2020; Wielechowski et al., 2020). Therefore, the relaxation of enforcement of the wearing of facemasks in public transport could have a significant reduction in public transport use especially for long journeys. In accordance with a previous study, people may hold the perception that as the enforcement has been relaxed, avoiding public transport is an effective preventive method to avoid the possibilities of infections when travelling (Yıldırım & Güler, 2022a).

Further, the result shows that passengers who believed pre-screening all passengers before boarding was safe, had a higher probability of using public transport, whereas those who believed that pre-screening was very safe appeared to hold negative perceptions towards the use of public transport as the safety protocols were relaxed. It can be explained that even though passengers perceived screening as safe they placed less importance on this precautionary measure when travelling in public transport. Consistent with a previous study, this suggests that these groups of people will choose public transport even if passengers were not required to be

COVID-19 Safety Protocols	Categories	Coefficient	p-values	OR	95% LL of OR	95% UL of OR	Coefficient	p-values	OR	95% LL of OR	95% UL of OR
		Moderate use of PT (relative to 'do not use PT')					***Regular use of PT (relative to 'do not use PT')***				
All occupants wearing masks throughout the trip.	Safe [a]	-1.9031	0.000	0.1491	0.1268	0.9916	-1.1929	0.000	0.3033	0.7899	0.8768
	Very safe [b]	-0.4231	0.033	0.6550	0.3469	1.2520	-0.0642	0.780	0.9378	0.5978	1.4711
All drivers and conductors wearing masks.	Safe [a]	-0.8288	0.003	0.4366	0.3294	0.9463	-2.3730	0.000	0.0932	0.2056	0.5543
	Very safe [b]	-0.6146	0.082	0.5409	0.2706	1.0809	-1.4133	0.000	0.2433	0.0726	0.2234
Temperature is checked upon arrival at the station.	Safe [a]	-0.2474	0.306	0.7808	0.4862	1.2540	-0.4765	0.046	0.6209	0.3737	1.0317
	Very safe [b]	-0.1099	0.725	0.8958	0.4857	1.6522	-0.1238	0.710	0.8836	0.4605	1.6952
Pre-screening of all passengers before boarding the bus.	Safe [a]	0.3351	0.000	1.3981	1.1312	3.4692	0.6389	0.000	1.8944	1.2426	4.4623
	Very safe [b]	-0.2979	0.377	0.7423	0.3833	1.4377	-0.8789	0.014	0.4153	0.2062	0.8362
Washing of hands with soap under running water.	Safe [a]	-0.8579	0.006	0.4240	0.2745	1.3640	-4.0425	0.000	0.0175	0.3484	0.5843
	Very safe [b]	-2.8508	0.000	0.0577	0.3782	0.7996	-3.1309	0.000	0.0436	0.7253	0.9342
The use of alcohol-based hand sanitizer.	Safe [a]	-0.5967	0.000	0.5506	0.6774	0.8844	-2.1769	0.000	0.1134	0.3869	0.7310
	Very safe [b]	-1.2994	0.000	0.2727	0.1352	0.5490	-2.6076	0.000	0.0737	0.2651	0.3792
Use of alcohol-based hand sanitizer after transaction.	Safe [a]	-0.7232	0.016	0.4852	0.2694	0.8739	-2.9170	0.000	0.0541	0.0288	0.1014
	Very safe [b]	-1.8707	0.000	0.1540	0.0781	0.3039	-3.6892	0.000	0.0249	0.0119	0.0521
Windows opened to promote fresh-air circulation.	Safe [a]	0.4295	0.059	1.5365	0.9834	2.4007	0.6091	0.011	1.8389	1.1488	2.9434
	Very safe [b]	0.0263	0.892	1.0267	0.7020	1.5016	0.6215	0.000	1.8617	1.2597	2.6096
Social distancing enforced in stations.	Safe [a]	-2.1153	0.000	0.1206	0.0381	0.0621	-3.6644	0.000	0.0256	0.4992	0.5987
	Very safe [b]	-1.2644	0.002	0.2824	0.1488	0.9434	-2.1596	0.000	0.1154	0.0507	0.2622
Seat assigned to each passenger.	Safe [a]	0.6507	0.000	1.9169	2.6534	6.9181	0.5441	0.000	1.7230	1.8545	3.5165
	Very safe [b]	0.9640	0.000	2.6222	0.6114	1.1069	0.5438	0.000	1.7226	0.1504	1.3450
Passengers seated at recommended distance.	Safe [a]	-1.8590	0.000	0.1558	0.0957	0.2536	-0.7665	0.002	0.4646	0.2893	0.7463
	Very safe [b]	-1.5839	0.000	0.2052	0.0981	0.4293	-2.0159	0.000	0.1332	0.0589	0.3011
Passengers of the same household seated together.	Safe [a]	-2.4363	0.000	0.0874	0.0518	0.1475	-3.5947	0.000	0.0275	0.0149	0.0507
	Very safe [b]	0.1891	0.454	1.2082	0.7365	1.9821	-0.7303	0.011	0.4817	1.1835	3.6406
Numbers of occupants per vehicle reduced.	Safe [a]	-1.6907	0.000	0.1844	0.0929	0.3656	-2.4586	0.000	0.0856	0.0413	0.1773
	Very safe [b]	-0.6763	0.052	0.5084	0.2944	1.8893	-1.1900	0.000	0.3042	0.2113	0.6202
Vehicles disinfected with highly efficient fogger.	Safe [a]	-0.9636	0.000	0.3815	0.2237	0.6506	-1.4016	0.000	0.2462	0.1353	0.4479
	Very safe [b]	-0.6631	0.016	0.5152	0.1334	1.3233	-0.6672	0.002	0.5131	0.4725	1.5179
Vehicles are cleaned after each trip.	Safe [a]	-0.1463	0.636	0.8639	0.4712	1.5838	0.1124	0.736	1.1189	0.5825	2.1493
	Very safe [b]	-1.5983	0.000	0.2022	0.1247	0.3279	-1.3790	0.000	0.2518	0.1478	0.4291
Door handles, seat backs and window controls are wiped down.	Safe [a]	0.4092	0.300	1.5056	0.3062	1.4406	-1.2930	0.002	0.2744	0.1218	0.6182
	Very safe [b]	0.1963	0.000	1.2169	0.1026	0.4586	-3.1878	0.000	0.0413	0.0181	0.0943
Constant		.234058	0.015				-0.6887	0.000			

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2Loglikelihood	Chi-square	df	Sig.
Intercept only	4872.307	4883.899	4868.307			
Final	3359.538	3765.262	3219.538	1648.77	68	.0000
McFadden R-square = 0.319						

Reference category (**not safe from being infected with COVID-19**), Base category (**do not use public transport**)

[a] safe from being infected with COVID-19

[b] very safe from being infected with COVID-19

PT (Public Transport); **OR** (odd ratio).

Table 3. Multinomial Logistic Regression: Parameter Estimates and Odd Ratio of the Model.

screened before boarding (Abdullah et al., 2021). However, those who had the belief that screening was very safe and were willing to use public transport were always less likely to use public transport as the safety protocols enforcement is relaxed. This finding means that people were not satisfied with the relaxation of the safety protocols and maintaining appropriate preventive measures might motivate people to regularly use public transport.

Likewise, it was revealed that persons who perceived the introduction of mandatory hand hygiene in public spaces was safe to protect one against contracting COVID-19 were less likely to use public transport after the safety protocol enforcement was relaxed in public spaces. Contrary to the findings of a previous study (Abdullah et al., 2021), the result means that people would not or rarely use public transport as the enforcement of hand hygiene in public spaces had been relaxed. This pointed to the fact that the COVID-19 infection anxiety associated with the use of public transport has not faded.

According to Park & Kim, (2021) when there is good ventilation inside a public transportation vehicle, indoor air is replaced by outdoor air, decreasing the number of viruses discharged by an infected person as well as the risk of infection. On the other hand, the number of viruses in the air can increase over time in unventilated public transport. On the contrary, the result shows that as the ventilation is not enforced, the use of public buses is more likely to increase. In accordance with a previous study, this could be that an air conditioner may be considered by passengers as an in-vehicle ventilation system. However, circulating the air inside will only spread the virus more, which does not lower the risk of infection. Therefore, as the safety protocol enforcement is relaxed, a ventilation system equipped with a virus filter is needed to reduce the risk of infection on public transportation (Park & Kim, 2021).

Public transport is often crowded, and such conditions were considered potential hotspots for virus transmission, particularly in developing countries. Compliance with social distancing directives and avoiding crowded places has been proven to reduce virus transmission (Ahmed, Zviedrite, & Uzicanin, 2018; Ahmed, Ahmad, & Jeon, 2021; Hadjidemetriou, Sasidharan, Kouyialis, & Parlikad, 2020; WHO, 2020). A study used sensitivity analysis and found indoor space social distancing, ventilation system installation, passenger number reduction in a vehicle, and seat distribution strategies as effective to reduce the spread of the disease (Park & Kim, 2021) and increase the use of public transport (Abdullah et al., 2021). However, this study results show that passengers who hold the past perception that enforcing social distance in public spaces was safe to slow down the transmission of the virus are less likely to use public transport as the safety protocol enforcement is relaxed. In accordance with a previous study, the result explains that mobility patterns are related to actual health risks and perceived risks (Barbieri et al., 2021) of the passengers. This means that the emergence of COVID-19 has changed the pattern of mode choice and to increase the use of public transport, it is important to maintain social distancing in public transport at all times. This result also means that if appropriate measures are not established to maintain physical distance in transport operations, passengers may avoid the use of public transport and shift to private transport as the enforcement of the protocols are relaxed in public spaces. This is because studies have established that when passengers perceive the risk of getting infected in public transport, they turn to shift to private transport as private transport provides the advantage of social distancing and appears as one of the safest modes (Abdullah et al., 2021).

Finally, the result further revealed that persons who had the perception that cleaning, or disinfection of public transport interior was safe to protect one from contracting COVID-19 during the pandemic period were less likely to use public transport as the enforcement of disinfection in public transport has been relaxed. The virus transmits from one person to another through close contact in a short range and by touching contaminated surfaces, particularly inside closed atmospheres. Therefore, in line with a previous study, the use of public transport might decline by the perceived health risk of travelling in a bus in which the cleaning of the interior is not mandatory or regulated (WHO, 2006).

In sum, passengers who felt enforcement of the safety protocols made them safe or very safe in public spaces during the pandemic were less likely to use public transport as the enforcement is relaxed in public spaces. This shows a clear position in perceptions related to high risk for public transport as the safety protocol enforcement is relaxed. In accordance with previous studies (Hotle, Murray-Tuite, & Singh, 2020; Shah et al., 2020), the above results explain that as the enforcement of safety protocols are relaxed, passengers are afraid of being infected, which may play a significant role in reducing public transport ridership. However, people who had believed that the safety protocols did not protect them from being infected with the virus were more likely to use public transport after relaxation of the safety protocol enforcement. Largely, relaxation of the enforcement of facemask wearing, social distancing, hand hygiene and cleaning or disinfection of transport interior could decrease the use of public transport. The findings suggest that the COVID-19 infection anxiety of most people, especially those who own cars, has not faded, which could lead to decreased use of public transport. To allay fear regarding virus infection through public transportation, the government should provide accurate information and take appropriate measures to lower the risk of infection as the enforcement of safety protocol is relaxed in public spaces.

4. CONCLUSION AND PRACTICAL IMPLICATION

Public transport offers huge economic, social, and environmental sustainability benefits. The success of public transport services depends on their adaptability to change. During the COVID-19 pandemic, individuals found public spaces as high-risk areas for catching the virus, and this significantly reduced travelling. In an attempt to reduce the spread of COVID-19 and enhance the movement of people, safety protocols were imposed in public spaces. The enforcement of safety protocols increased the use of public transport (Abdullah et al., 2021).

On the background that there were very low levels of infections and significant number of people have been vaccinated, the enforcement of safety protocols has been relaxed in public spaces. The relaxation of safety protocol enforcement may impact individual travelling behaviour which could decline the use of public transport because of fear of being infected with the virus. Hence, the study examined the effect of COVID-19 safety protocols perceptions on the use of public transport after relaxation of safety protocol enforcement. Majority of the findings supported the hypothesis that people who perceived that safety protocols were safe to protect them from being infected are less likely to travel in public transport as the enforcement of safety protocols are relaxed in public spaces.

A Multinomial Logistic Regression was used to estimate the effect of COVID-19 safety protocols on the use of public transport after relaxation of safety protocols. The preliminary finding indicates that the use of private cars declined during the enforcement of safety protocols. However, after relaxation of safety protocols, most participants preferred to travel with private transport mode than public transport. Among the safety protocol measures, it was revealed that 'facemask wearing covering both nose and mouth', 'reduction in the number of occupants per vehicle', 'alcohol-based hand sanitizer available for use before and after transactions' and 'vehicles are cleaned after every trip' were the most likely important factors commuters perceived as safe to prevent infection of the virus. However, the result of the MNL model estimation indicates that, largely, relaxation of mandatory facemask wearing, social distance, hand hygiene and disinfection of transport interior could decrease public transport ridership.

The current study findings suggest the need for novel transportation policies after the relaxation of COVID-19 safety protocol enforcement. Overall, the finding explained that the COVID-19 infection anxiety of most people has not faded, which could decrease public transport ridership. To allay fears regarding virus infection through public transportation, the government and transportation planners need to provide relevant information with appropriate measures to lower the perceived risk of infection.

Even though the mandatory adherence to safety protocols has been relaxed, the introduction of any policy regarding public transportation services should enable the prevention of the virus transmission. It is expedient for all public transport modes (Taxi, trotro, high occupancy buses) to invest in regular hygiene and cleaning to reduce the perceived health risk of virus infection which could encourage public transport ridership. The physical distancing measures may also need to be reintroduced in public transport operations to reduce passengers' fear of the risk of a renaissance of virus transmission. Otherwise, individuals who own private cars may prefer driving, even for long journeys, given the risk perceptions related to use of public transport after the relaxation of safety protocol enforcement in public spaces. This requires the Government of Ghana to consider a plan of implementing measures to reduce passenger overcrowding in public transport in order to lower the probability of infection.

Though the study has successfully used the COVID-19 safety measures to examine the perceptions towards the use of public transport after relaxation of safety protocol enforcement, the study has room for future study. The future study could explore the interaction of respondent sex, age, education with individual safety protocol measures.

ACKNOWLEDGEMENTS

This research was supported by the Ghana Government Book and Research Allowance for public universities.

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