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Influence of COVID-19 Mobility-Restricting Policies on Individual Travel Behavior in Malaysia

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Abstract: The COVID-19 pandemic has resulted in new postpandemic travel patterns as a result of the stay-at-home policies and restricted movement orders imposed by the Malaysian government. The purpose of this study was to investigate the changes in individual travel behavior after the government imposed a series of lockdowns, also known as movement control orders (MCO). From March to April 2021, a questionnaire survey was distributed throughout Malaysia, and 435 complete responses were collected. Results indicated that the respondents predominantly chose private cars for various traveling purposes during the pandemic. When choosing a travel mode during the pandemic, married respondents and essential workers placed a significantly higher priority on pandemic-related - items such as cleanliness, infection concern, social distance, and wearing face masks, compared to single respondents and nonessential workers. Binary logistic regression models were developed to estimate individuals' propensity to make trips for different purposes, i.e., work/study, social activities, recreational activities, and religious activities. Results indicated that essential workers were nearly three times more likely than the general population to make a work trip during the pandemic. Regarding social and recreational trips, males were more likely to make such types of trips as compared to females. Furthermore, those who perceived a higher risk of infection were less likely to make social and recreational trips. Regarding religious trips, males were significantly more likely to make such trips during the pandemic as compared to females. In addition, Muslims had significantly higher odds of making a trip for religious purposes during the pandemic. The findings of this study could be useful in transportation planning when considering travel restrictions during pandemics based on peoples' travel purposes and mode choices.

Keywords: COVID-19; movement control order; pandemic; mobility habits; travel behavior; mode choice

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1. Introduction

As of 6 September 2021, the novel coronavirus infection (COVID-19) has affected 220 countries and territories, with hundreds of thousands of people dying or having been hospitalized due to the spread of this disease [1]. Twenty months after (since December 2020) the first case was detected in Wuhan, China [2], the reported confirmed cases of COVID-19 and the consequent deaths continue to increase globally, creating a global health crisis. In Malaysia, the COVID-19 pandemic is the most significant infectious disease outbreak to have hit since the 1918 Spanish Flu, which killed 34,644 people [3]. Malaysia, with a population of 32.7 million and population density of 99 people per square kilometer [4], detected its first confirmed COVID-19 cases on 25 January 2020, involving three Chinese nationals [5], and the first confirmed death on 17 March 2020 [6]. As of

18 September 2021, over 2 million cumulative cases and over 22,000 deaths have been reported [7,8]. Malaysia has experienced three major waves of COVID-19 outbreaks since the first Wuhan case was reported. The first wave lasted from 25 January to 16 February 2020, the second wave from 27 February to 30 June 2020, and the third wave has been ongoing since 8 September 2020 [8,9].

Controlling the spread of the disease is the ultimate goal for any government in dealing with this unprecedented situation. Human mobility habits and close contacts have been shown in the past to contribute directly to the spread of infectious diseases [10–15]. Hence, all types of travel are usually restricted during pandemics [16–20]. During the early stages of the COVID-19 outbreak, many governments around the world, including that of Malaysia, enacted nonmedicinal interventions such as "stay-at-home" orders and travel restrictions to prevent population mobility, including closing international borders and airports; closing schools, offices, shops, and restaurants; instituting work-from-home policies; and canceling mass gatherings [2,17,21–24]. As a result, the enacted policies have resulted in the closure of many public services, retail businesses, and tourism activities, which has had a significant impact on the economic activities of many countries around the world, and has in turn significantly changed people's travel behavior [25–28].

In Malaysia, many sectors have been impacted by the extended movement restriction orders, which have been in effect since March 2020, and, as expected, these measures have not been economically beneficial. Tourism, retail, transportation, and hospitality have all suffered significant consequences. As a result, based on Malaysians' experiences, this study aimed to investigate the impact of mobility-restricting (lockdown) policies on travel behavior, as previous research on this topic has been limited. In this paper, we present analyses of data collected on how activities change in response to changing pandemic conditions. This paper is structured as follows: Section 2 reviews some of the existing works related to the impacts of mobility-restricting policies on travel behavior worldwide. This is followed by the Section 3, which explains the types of mobility-restricting policies (lockdown) imposed by the Malaysian government. Section 4 elucidates the analysis methods utilized in achieving the objectives of this study. The results of the statistical analyses are presented in Section 5. Finally, a discussion of the results together with the limitations of this study, identified areas for future research, and the conclusion are provided in Section 6.

2. Impact of Mobility-Restricting Policies on Travel Behavior

In addition to mobility, there is a two-way relationship between public transport use and virus transmission, particularly for areas with higher transport accessibility [29]. Thus, social distancing and lockdowns (in extreme cases) have been identified as effective strategies to mitigate the transmission of the virus causing the COVID-19 disease [30]. Accordingly, the governments of different countries have imposed different levels of lockdowns and mobility restriction periods. However, with prolonged lockdowns and travel restrictions, people are increasingly adapting their daily travel behavior. As reported in previous studies, drastic changes in travel behavior have been observed during COVID-19 globally [2,25,27,31–42]. In particular, [27] predicted that the types and frequency of out-of-home activities and daily travel patterns would change remarkably.

Many studies have reported the outcomes of cross-sectional surveys that were mainly conducted online. Common observations of many such studies include a remarkable increase in private car use and a significant decline in the use of public transport. A study conducted in the Boston area in the USA reported that transit ridership declined while car ownership increased due to the fear of infection and uncertainty among people about public transport [43]. This study further mentioned that 18% of households that do not own a car plan to buy cars due to COVID-19. Another study based on a global survey conducted during the first wave of COVID-19 reported that people used more private cars and less public transport during COVID-19 as compared to situation before

the pandemic [28]. This study also reported that the modal shift from public to private transport modes was significant.

Another study conducted in 10 countries on six continents stated that the frequencies of use of all modes were remarkably reduced [44]. They further stated that people tended to avoid public transport as airplanes and buses were perceived to be the riskiest transport modes. Using a data collected through an international survey, Dingil and Esztergár-Kiss (2021) [45] also confirmed that people perceived personal vehicles, i.e., cars and motorcycles, and active modes as the safest travel modes during the pandemic. They further proved that public transport users were more likely to change their travel modes compared to users of other travel modes (i.e., car, motorcycle, walking), and travel distance and income level were the key determinants in decision making during the pandemic. In another study, Abdullah et al. (2021a) [46] confirmed that the use of public transport declined, while the use of active modes (walking and bicycling) increased during the COVID-19 pandemic. Eisenmann et al. (2021) [47] conducted a travel survey in April 2020 and indicated that the car became an important mode of transport in Germany, while public transport lost relevance. Another survey-based study conducted in Poland revealed that 90% of the respondents stopped using or limited their use of public transport [48]. However, 75% of them declared that they would use public transport after the pandemic, while the rest had completely lost interest in using public transport. A recent case study conducted in Italy reported that there was a direct correlation between the daily number of confirmed COVID-19 cases and the volume of public transport trips taken several days before the day of the contagion [49].

Cieśla et al. (2021) [50] proposed four scenarios for passenger transport services (i.e., pessimistic, optimistic, most likely, and surprising (or unexpected)) in Poland during pandemic situations. Key factors that should be controlled (e.g., controlling the number of passengers inside vehicles) and that should be improved (e.g., provision of disinfectants) in order to enhance the quality of passenger transport services were identified and discussed in this study.

Outcomes of a survey conducted in Chicago explained that people tend to shift from shared modes, e.g., rideshare and transit options, to nonshared modes that prevent contacts, e.g., active modes and personal vehicles [34]. A study conducted in Sicily in Italy stated that people expressed a positive opinion about the use of micromobility, e.g., bicycles, scooters, etc., during COVID-19 [51]. Another study conducted in Trieste, Italy concluded that there could be a potential increase in the use of bicycles; however, that might not increase the use of active mobility, since there was a possibility that some walking trips might be replaced by the cycling trips [52]. In addition, this study indicated that the trips by motorcycles and cars were less affected, while the modal shift from bus to bicycles could be significant. Although the use of bicycles could increase, as mentioned in these studies, bike-sharing schemes could be significantly affected, as mentioned by Teixeira and Lopes (2020) [53]. However, compared to the drop in subway ridership, the drop in the City Bike ridership was less significant; therefore, this mode was more resilient. However, a study conducted in Belgium revealed that people who normally used bicycles before lockdowns decreased their trips. Further, for commuting trips, people who walked before decreased their walking trips and increased their use of cars [54].

Previous studies also reported on significant demographic variables and determinants in the mode choice for trips during the pandemic. Abdullah et al. (2020) [28] reported that a significant difference was noted in the primary trip purpose between before and during COVID-19 situations, and the most frequent category of trip during the pandemic was shopping trips. Meanwhile, in another study, Abdullah et al. (2021a) [40] reported that gender, car ownership, and household income were significant variables for mode choice for trips greater than 5 km in Pakistan. In addition, Jiao and Azimian (2021) [55] conducted a survey in the USA and developed binary logit models to explore the characteristics of trips by public transport during the second phase of the pandemic. Outcomes of this study indicated that demographic variables, e.g., age, gender, ethnicity, education,

number of family members, income, and type of employment, as well as emotional and health characteristics, significantly influenced the choice of public transport. A recent study conducted in Pakistan compared the choices of public transport and solo modes and concluded that females and people whose trip frequencies were higher tended to use public transport more often as compared to solo modes [46]. This study further revealed that the "safety precautions" factor, which was determined by social distancing and use of face masks and hand sanitizers, was a significant determinant of the choice of public transport over solo modes. A recent study conducted in South Korea by Kim et al. (2021) [39] stated that the risks perceived by people have a strong influence on their reduction in public transit use. As it is complicated to implement preventive measures, e.g., social distancing, for public transit modes, the need for implementation of strict enforcements, e.g., mandatory use of face masks and providing face masks and hand sanitizers for free in transit areas were also highlighted in that study.

3. Lockdown Policies in Malaysia

Prior to the implementation of lockdown policies, the spread of COVID-19 infection in Malaysia was managed in a less aggressive manner. The first spike of COVID-19 cases started on 15 March 2020 (with 190 cases), followed by the cumulative confirmed cases exceeding 500 on 16 March 2020. The first COVID-19 death was reported on 17 March 2020. Because of the difficulty in tracing the individuals who were in close contact with the COVID-19 patients, the Malaysian government took drastic interventions by imposing the first total lockdown from 18 March 2020 to 4 May 2020. The lockdown in Malaysia consisted of the national quarantine and cordon sanitaire measures implemented to flatten the curve of COVID-19 cases [56]. Following the implementation of the lockdown, all Malaysians were instructed to stay primarily indoors, with outdoor activities strictly restricted. Under this first lockdown policy, six major restrictions were enforced by the Office of the Prime Minister [57]: (1) prohibition of movements of persons and mass gatherings, (2) prohibition of movement of Malaysians traveling abroad, (3) prohibition of foreigners entering Malaysia, (4) closure of all schools and kindergartens, (5) closure of higher educational institutions and skills training centers, and (6) closure of the operations of all public and private premises except for those involved in essential services. Outdoor restriction was prescribed as a community-based control measure, with only one resident from a family allowed to go out at a time and required to stay within 10 km of the residence. In addition, interstate travel was totally banned during this period. Meanwhile, the public transport services were allowed to operate with limited operation hours, i.e., from 6 a.m. to 10 a.m., when people use public transport to go to work, and from 5 p.m. to 10 p.m., after working hours [58]. During the services, stringent standard operation procedures (SOPs) were imposed. However, this measure did not include taxi and e-hailing services.

Following the success of the first total lockdown policy in reducing the number of COVID-19 cases, the government started implementing a more relaxed lockdown policy from 5 May 2020. This included the resumption of all public transportation services on 4 May 2020, but with social distancing measures in place [59]. During this phase, two family members were allowed to buy food and other daily essentials, but offices, schools, and many industries remained closed except for essential services, and mass gatherings were still banned [60]. A series of partial lockdown were subsequently implemented, which lasted until 9 June 2020.

After successfully containing the spread of COVID-19 in the country, the Malaysian government announced on 7 June 2020 that the partial lockdown would be replaced by the recovery movement from 10 June 2020 to 31 August 2020 [61]. The recovery movement phase was intended to gradually reopen the economic and social sectors of the country. Under this phase, interstate and interdistrict travel, as well as other sectors, were permitted to operate, but only under strict standard operation procedures and measures. Education, religious, social, and cultural activities, as well as theaters, were permitted to reopen, with the exception of nightclubs. Although Malaysia's international borders remained closed to

foreign travelers, certain groups of travelers could enter and exit Malaysia under certain conditions, such as for work, study, or medical reasons, subject to the necessary passes and approval from relevant authorities [62]. In addition, those who entered Malaysia (locals and foreigners) were also required to undergo COVID-19 testing and a mandatory 14-day quarantine upon arrival. However, on 28 August 2020, the Prime Minister of Malaysia announced the extension of the recovery movement phase to 31 December 2020 due to the emergence of new clusters and the ongoing spikes of daily new cases [63]. During this extension period, the operations of the previously mentioned sectors remained the same. Nevertheless, due to a significant increase in COVID-19 cases nationwide and a high infectivity rate as reported by the Ministry of Health (MOH) in their risk assessment analysis, the Malaysian government announced the extension of the recovery movement phase, first until 31 March 2021, and then to 31 May 2021.

During the recovery movement phase, COVID-19 cases began to show an increasing pattern again around March 2021. This situation caused the government to impose stringent movement control orders in specific areas identified as high-risk regions with high numbers of COVID-19 cases. Complete lockdowns were imposed at specific localities in which the residents were not permitted to leave their homes, and food items were sent to them by the respective authorities. The government also mandated COVID-19 testing for all residents within the lockdown localities [62].

The loosened lockdown policies in Malaysia have been accompanied by another increase in COVID-19 cases. On 28 May 2021, the office of Prime Minister declared a nationwide total lockdown that came into effect on 1 June 2021. The initial implementation of total lockdown was for 14 days, until 14 June 2021, but it has been extended under the newly enacted plan known as the National Recovery Plan (NRP) [64]. The plan will be implemented until the number of daily COVID-19 cases falls below 4000. This urgent action was taken due to the rapid increase in COVID-19 cases, which surpassed 8000 cases per day (at the time of the NPR announcement), and the presence of more virulent new variants, which spread rapidly to the lungs and are associated with higher death rates. Current cases (as of September 2021, i.e., at the time of this writing) have exceeded 19,000 cases per day, with over 2,000,000 total cases and over 22,000 deaths.

As highlighted in these studies, travel behavior and mobility patterns of people have been significantly affected during the COVID-19 pandemic. In particular, public transport ridership drastically declined as people trusted private vehicles more. In addition, there have been increases in the use of active modes in many countries as well. Factors affecting the change in travel behavior could be different across different countries depending on the travel restrictions imposed by the governments of those countries, as well as the risk perceptions of the people. The current study explored the influence of lockdown policies on changes in travel behavior during the third wave of the COVID-19 pandemic in Malaysia.

4. Methodology

4.1. Survey Design and Sample

An online questionnaire survey was conducted in Malaysia during the third wave of the COVID-19 pandemic, i.e., from early March 2021 to the end of April 2021. During the survey, movement restrictions were still in effect in some areas in Malaysia (regions). The survey was used to gather information from members of the general public (respondents) from various socioeconomic backgrounds on the main reasons for changes in their travel behavior during the pandemic (if any) such as trip frequency, mode preferences for a variety of trip purposes during the COVID-19 situation, and the importance they placed on choosing the mode of transportation.

The questionnaire consisted of two sections: (1) sociodemographic characteristics, and (2) travel behavior during COVID-19. The sociodemographic section included questions on gender, age, religion, marital status, level of education, current employment status, household income, number of people in the household, vehicle ownership, and whether or not the respondent is an essential worker. Meanwhile, the statements on travel behavior

during COVID-19 consisted of questions on the respondents' main purpose for traveling before and during COVID-19, the approximate distance from their home to their main travel destination during COVID-19, the main reason behind the changes in the travel behavior during the pandemic, trip frequency for various activities during COVID-19, and travel modes for various activities during COVID-19. In addition, the respondents were asked to declare how high a priority they placed on pandemic-related items while choosing a mode during the pandemic.

The questionnaire was created in the English and Malay languages using Google forms, and distributed in March 2021 via emails, social media platforms (such as Facebook, Instagram, and Twitter), and WhatsApp/Telegram. These platforms were chosen since 86% (28 million) of the Malaysian population are active social media users [65]. The questionnaire survey was conducted in accordance with the guidelines established by the School of Civil Engineering at Universiti Sains Malaysia. The survey was completely voluntary and noncoercive. The survey resulted in 435 complete responses. The calculations for the appropriate sample size for this study were done according to Slovin's formula [66]. In addition, we also conducted power analysis using GPower 3.1 software to confirm that the required sample was adequate for regression analyses and statistical tests [67,68].

4.2. Statistical Analyses

Descriptive and quantitative comparative analyses were performed on the collected data. In this study, nonparametric tests and binary logistic regression were used for inferential statistical analyses. Descriptive analysis was used to describe the characteristics of the sample in this study, especially the socioeconomic demographics of the 435 respondents who completed the survey. In addition, the primary purpose of traveling by the respondents during the MCO and their preferred transport mode were revealed. Exploratory factor analysis (EFA) was conducted on the pandemic-related items which might have affected mode choice during the pandemic. Maximum likelihood was used as the extraction method. The EFA resulted in a single underlying factor. Cronbach's alpha was used to assess the internal reliability. The factor scores were then computed using a refined factor score approach known as Bartlett's method.

Nonparametric statistical tests (Kruskal–Wallis and Mann–Whitney U tests) were then conducted on the factor scores to ascertain the effect of various sociodemographic variables on the underlying factor. Mann–Whitney U tests were carried out to compare the differences between two groups, such as males and females. The Kruskal–Wallis test is a generalization of the Mann–Whitney test and was used to find out the differences between more than two groups, such as four age groups in this study.

4.3. Binary Logistic Regression

Binary logistic regression was conducted to ascertain the effects of sociodemographic variables on the likelihood of the respondents making trips during the pandemic. Four different binary logistic regression models were developed for different traveling purposes, i.e., work/study, social, recreational, and religious purposes. The variables representing the number of trips made for various purposes during the pandemic were modified to consist of only two categories, i.e., zero trips and any number of trips. Hence, the dependent variable can be rephrased as "did you make a trip during the pandemic?" with "yes" representing the scenario if a respondent made any number of trips and "no" representing the scenario wherein a respondent did not make a trip at all. The binary logit models were then used to measure the likelihood of respondents making a trip for work/study, social, recreational, or religious purposes during the pandemic. The sociodemographic variables, i.e., gender, age, marital status, car ownership, employment status, essential worker, and the underlying pandemic-related factors, were entered as the independent variables. The household income was not entered into the models because it had a significant correlation with the age variable. Religion (consisting of two categories, i.e., Muslim and other) was entered as an independent variable in the binary logit model measuring the likelihood of

making a trip for religious purposes. The last category of each independent categorical variable was used as the reference category. Since the numbers of divorced/widowed respondents and those who declared their employment status to be "other" were too small, these groups were removed from the analysis. Hence, a final sample size of 393 respondents was used to estimate the binary logit models.

Likelihood ratio tests were used to determine whether the developed models were better than the intercept-only models. Hosmer and Lemeshow tests were performed to determine whether the data fit the model well. To determine how much variance was explained by the binary logit models, Nagelkerke R squared were computed.

5. Results

5.1. Socioeconomic Demographics of the Respondents

Table 1 summarizes the socioeconomic demographics of the 435 respondents who completed the survey. The responses received consisted of 43% males and 57% females, with most of them (66%) being young adults (below 40) and 83% of them being well-educated (holding a bachelor's degree or above). The higher percentage of young adults and well-educated respondents might be due to their active presence on social media (i.e., Facebook, Instagram, and Twitter), and freeware and cross-platform instant messaging software (e.g., WhatsApp and Telegram) compared to the older adults and less-educated respondents. In addition, 368 (85%) of the respondents were Muslims.

Table 1. Socioeconomic characteristics of the survey respondents.

Items	Category	N	%
Gender	Male	188	43
	Female	247	57
Age	Below 30	154	35
	31–40	135	31
	41–50	122	28
	Above 50	24	6
Education level	High Certificate/Matriculation/A-Level/Diploma and below	76	17
	Bachelor degree (Undergraduate)	223	51
	Masters	88	20
	PhD/Doctorate	48	11
Employment	Student	97	23
	Government employee	131	30
	Private employee (salaried worker)	146	34
	Business/ Self-employed	39	9
	Other	22	5
Monthly household income (RM)	Below 3969	158	36
	3970–8699	141	33
	Above 8700	136	31
Essential worker	Yes	180	41
	No	255	59
Number of people in the household	1–2	82	19
	3–4	151	35
	5 or more	202	46
Car ownership	Yes	412	95
	No	23	5
Motorbike ownership	Yes	251	58
	No	184	42

Table 1. *Cont.*

Items	Category	N	%
Bicycle ownership	Yes	211	49
	No	224	51
Marital status	Single	167	38
	Married	246	57
	Divorced and widowed	22	5

5.2. Primary Purpose of Traveling

People travel every day as part of their daily routine. Each person has a different reason for traveling on a daily basis. Some people travel for work, while others travel for school or college, and still others travel for a variety of reasons. The primary purpose of travel in this study refers to the main reason people perform outdoor trips in their daily lives due to a specific requirement. This information is crucial especially when it comes to pandemic situations, because people probably try to avoid making trips but they cannot avoid making trips that are mandatory and beyond their control.

From the survey, most of the respondents, i.e., about 57%, declared work to be their primary purpose for traveling before the pandemic, whereas only 49% declared work to be their primary purpose for traveling during the movement restriction period (Figure 1). This is due to the fact that most of the public and private sectors opted for work-from-home policies during this phase. According to JobStreet's Malaysia Survey Report, about 67% of Malaysian companies required staff to work from home [69]. Similarly, travel for the primary purpose of studying reduced from 22% before the pandemic to 12% during the lockdown period. The stated findings could be explained by the fact that during the MCO, higher learning institutions adopted asynchronous and synchronous e-learning, whereby students were not required to attend the physical class. Travel for social activities (e.g., feasts, conferences, meetings, seminars, courses, etc.) also showed a decline during the COVID-19 pandemic. This is logical because gathering activities were not allowed during the lockdowns.

Interestingly, during the pandemic, the primary purpose of traveling for shopping was increased to 28.7%, compared to 12.2% before the pandemic. This finding indicates that during the pandemic, the primary purpose of traveling changed significantly from working and study trips to shopping trips or other trips (Figure 1). A previous study also reported that the primary traveling purpose significantly shifted from work and study trips to shopping trips or other trips during the pandemic [28].

Respondents were also asked to choose the main reason that contributed to the changes in their travel behavior during the pandemic, and most of them (more than 75%) agreed that their travel behavior changed due to the implementation of the movement control order (lockdown) by the government.

5.3. Mode Choice for Outdoor Trips

Figure 2 depicts the mode choices of respondents taking outdoor trips. Generally, it can be concluded that people preferred to use private cars over other modes to perform all types of trips during the pandemic. That is, public transport lost its popularity and importance during the pandemic. As previous studies have suggested, public transport was considered a less attractive travel mode in Malaysia even before the pandemic, mainly due to reliability, safety, and customer service concerns [70]. In addition, it can be noted that for recreational activities, 17% of respondents chose active modes.

5.4. Influence of Pandemic-Related Factors on Mode Choice

Four pandemic-related items were considered in this study, namely infection concern, wearing face masks, social distance and cleanliness. Among these items, the respondents put the highest priorities on infection concern and wearing face masks (83% and 81%,

respectively). This could be due to the awareness campaigns regarding how long it takes for symptoms to appear and how this virus is easily transmitted via coughing, sneezing, speaking, or breathing near an infected person. Although lower than infection and wearing face masks, most of the respondents also put a high priority on social distancing and cleanliness (76 and 71%, respectively).

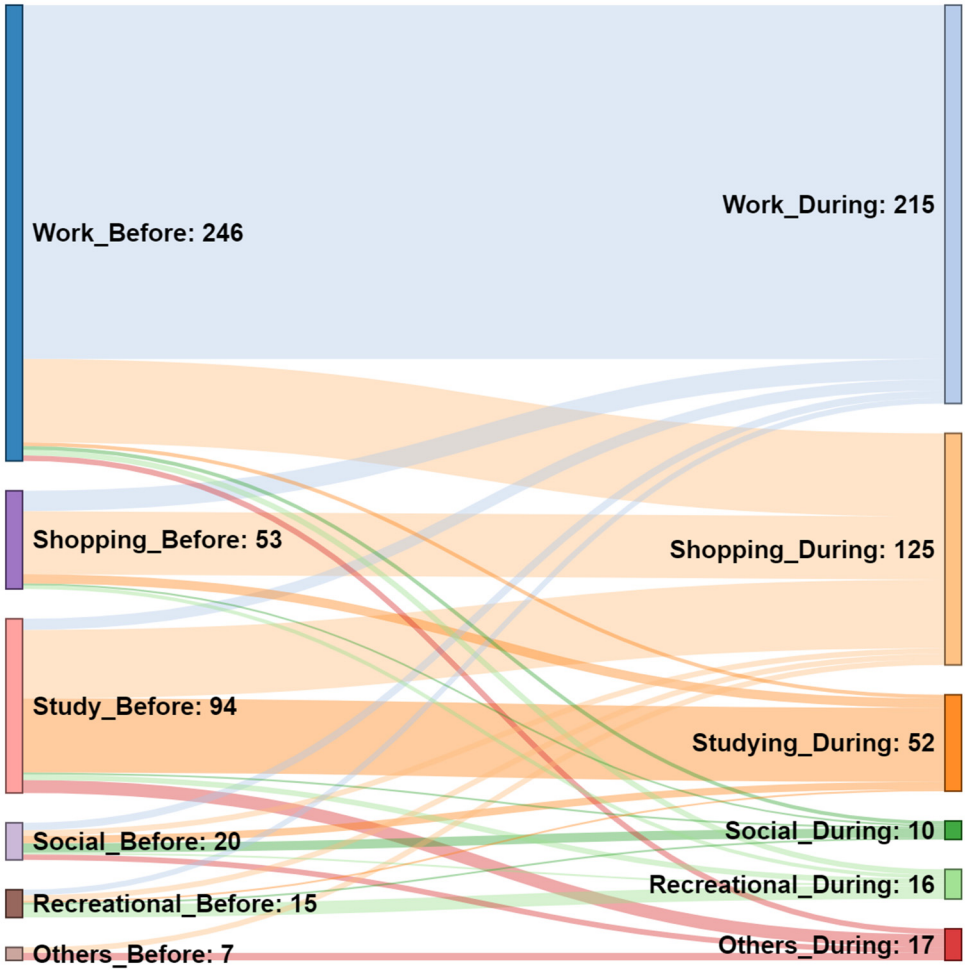

Figure 1. Comparison of primary reasons for travel prior to and during COVID-19.

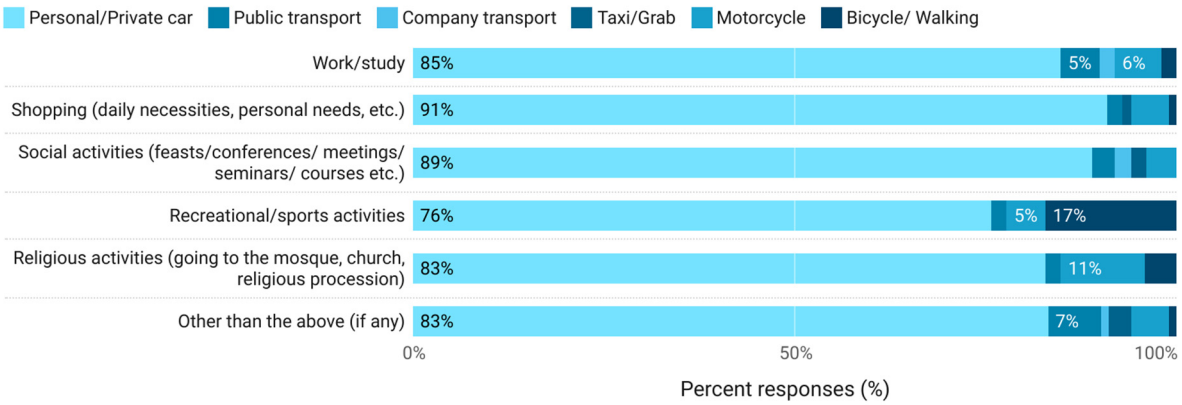

Figure 2. Choices of modes for different activities during COVID-19.

Factor analysis with maximum likelihood estimation was conducted on the pandemic-related items which were likely to affect mode choice during the pandemic. A single-factor

solution was obtained which explained about 68.627% of the variance. The Cronbach's alpha was greater than 0.7, indicating satisfactory internal consistency. Factor scores were computed using Bartlett's method to represent the relative standing of each respondent on the underlying pandemic-related factors. The outcomes of the factor analysis are summarized in Table 2.

Table 2. Outcomes of factor analysis.

Items	Pandemic-Related Factor
Cleanliness	0.839
Infection concern	0.816
Social distance	0.912
Wearing face masks	0.737
% of variance explained	68.627
Cronbach's alpha	0.895
Kaiser–Meyer–Olkin measure of sampling adequacy	0.833
Bartlett's test of sphericity	<0.05
Determinant of correlation matrix	0.087

The Mann–Whitney U test was used to assess the effects of gender and car ownership on the priority placed on pandemic-related items when selecting a mode of transportation. The results indicated that females put a higher priority on pandemic-related items while choosing a travel mode during the pandemic than males (U = 19,667.5, $p = 0.002$). This is consistent with the findings reported in Brooks and Saad (2020) [71] that mentioned women were more concerned about COVID-19 than men. In addition, the car owners scored higher on the pandemic-related factor as compared to the non-car-owners (U = 3599.5, $p = 0.027$). A recent study conducted in Turkey mentioned that car owners used their private cars to commute to work from home [36]. That is, people placed a higher priority on their health as compared to the economy.

Meanwhile, Kruskal–Wallis tests were conducted to evaluate the effects of various age groups on pandemic-related items in choosing the transport mode. The results found a significant difference between the various age groups on the underlying factor scores ($\chi^2 = 16.008$, df = 2, $p = 0.001$). The post hoc Mann–Whitney U test indicated that the 41–50 age group scored higher on the underlying pandemic factor as compared to the 31–40 age group. No significant difference was found in the other age groups. The sample size for the oldest age group (i.e., above 50) was small.

The Kruskal–Wallis test was also conducted to evaluate the effect of household income and number of family members on pandemic-related items in choosing a transport mode. The result indicated that there was no significant effect of household income ($\chi^2 = 4.824$, df = 2, $p = 0.090$) and number of family members ($\chi^2 = 3.580$, df = 2, $p = 0.167$) on the underlying factor scores.

In addition, as confirmed with the Mann–Whitney U tests, married respondents and essential workers placed a significantly higher priority on pandemic-related items than single respondents (U = 17,301.5, $p = 0.002$) and nonessential workers (U = 20,018.0, $p = 0.009$) when choosing a travel mode during the pandemic.

5.5. Propensity for Traveling during the Pandemic

The likelihood of making a trip for work/study, social, recreational, or religious purposes was modeled using binary logistic regression. The propensity to make a trip for shopping purposes was not modeled because an overwhelming majority of the respondents declared that they made shopping trips during the pandemic, indicating that the probability of making a shopping trip was very high.

Outcomes of the likelihood ratio test, Hosmer and Lemeshow test, and Nagelkerke R squared for the different developed models are summarized in Table 3. As can be understood from this table, all the models were significant. The likelihood ratio tests for all

models were significant, indicating that the full models (those with all predictors) were significant improvements as compared to the respective null models (which contained only the intercept). The Hosmer and Lemeshow tests were nonsignificant ($p > 0.05$) for all models, indicating that the models were well-fitting. Nagelkerke R-squared values for all trip types are also shown in Table 3. Although these values appear to be low, from a social and behavioral science perspective these values are acceptable, as explained in previous studies. For example, according to Falk and Miller (1992) [72], R-squared values of 0.10 or greater are considered adequate. Cohen (1988) [73] defines R-squared values as low if they are less than 0.12, medium if they are between 0.13 and 0.25, and high if they are greater than 0.26.

Table 3. Goodness-of-fit statistics for the developed regression models.

Binary Logit Model	Likelihood Ratio Test	Hosmer and Lemeshow Test	Nagelkerke R-Squared
Work/study	$\chi^2 = 69.448$, df = 11, $p = 0.000$	$\chi^2 = 2.371$, df = 8, $p = 0.967$	0.238
Social	$\chi^2 = 36.985$, df = 11, $p = 0.000$	$\chi^2 = 9.573$, df = 8, $p = 0.296$	0.123
Recreational	$\chi^2 = 39.818$, df = 11, $p = 0.000$	$\chi^2 = 6.444$, df = 8, $p = 0.598$	0.128
Religious	$\chi^2 = 117.662$, df = 12, $p = 0.000$	$\chi^2 = 6.616$, df = 8, $p = 0.579$	0.352

Finally, the binary logit model for work/study, social, recreational, and religious trips classified 77.4, 67.9, 62.1 and 76.6% of the cases, respectively.

The binary logit model for work or study trips is shown in Table 4. As can be seen, the employment status and being an essential worker were found to be significant in explaining the propensity to make a trip for work or study purposes during the pandemic. The essential workers were almost thrice as likely to make a work trip during the pandemic as the other respondents. Government and private employees were also almost thrice as likely to make a work trip during the pandemic compared to business persons.

Table 4. Binary logit model for work/study trips.

Variable	B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Gender	0.194	0.261	0.457	1.214	0.728	2.024
MS	0.747	0.492	0.128	2.112	0.806	5.534
EW	1.027	0.322	0.001 ***	2.793	1.486	5.248
Car	−0.200	0.625	0.750	0.819	0.240	2.790
Age			0.208			
Age_1	−1.614	1.160	0.164	0.199	0.020	1.935
Age_2	−0.791	1.123	0.481	0.453	0.050	4.092
Age_3	−1.133	1.107	0.306	0.322	0.037	2.820
Emp			0.000			
Emp_1	−0.382	0.535	0.474	0.682	0.239	1.945
Emp_2	1.041	0.465	0.025 **	2.832	1.139	7.042
Emp_3	1.131	0.466	0.015 **	3.099	1.243	7.725
Pandemic-related factor	0.097	0.123	0.427	1.102	0.867	1.402
Constant	1.200	1.271	0.345	3.319		

Gender = 1 if the respondent is male and 0 otherwise. MS (marital status) = 1 if the respondent is single and 0 otherwise. EW (essential worker) = 1 if the respondent is an essential worker and 0 otherwise. Car = 1 is the respondent own a car and 0 otherwise. Age_1 = 1 if the respondents belong to the 18–30 years category and 0 otherwise. Age_2 = 1 if the respondents belong to the 31–40 years category and 0 otherwise. Age_3 = 1 if the respondents belong to the 41–50 years category and 0 otherwise. Emp_1 = 1 if the respondent is a student and 0 otherwise. Emp_2 = 1 if the respondent is a government employee and 0 otherwise. Emp_3 = 1 if the respondent is a private employee and 0 otherwise. ** $p < 0.05$, *** $p < 0.01$.

Gender, marital status, car ownership, employment status, and the underlying pandemic-related factor were found to be significant predictors of the likelihood of making a social trip during the pandemic (see Table 5). Males were almost twice as likely to make a social trip compared to females. Further, the results show that the odds of making a social trip were 2.5 times greater for single people as opposed to married people. Those who owned a

car were less likely to make a social trip than those who did not own a car. Students were less likely to make a social trip compared to business persons. Those who scored higher on the pandemic-related factor had significantly greater odds of making a social trip during the pandemic.

Table 5. Binary logit model for social trips.

Variable	B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Gender	0.592	0.228	0.009 ***	1.808	1.158	2.824
MS	0.919	0.367	0.012 **	2.507	1.221	5.148
EW	0.214	0.257	0.405	1.239	0.748	2.052
Car	−1.119	0.538	0.038 **	0.327	0.114	0.937
Age			0.631			
Age_1	−0.213	0.672	0.751	0.808	0.216	3.016
Age_2	−0.396	0.613	0.518	0.673	0.202	2.238
Age_3	−0.631	0.605	0.297	0.532	0.162	1.742
Emp			0.076			
Emp_1	−1.265	0.509	0.013 **	0.282	0.104	0.765
Emp_2	−0.305	0.415	0.462	0.737	0.327	1.663
Emp_3	−0.537	0.423	0.204	0.585	0.255	1.339
Pandemic-related factor	−0.178	0.107	0.096 *	0.837	0.679	1.032
Constant	0.665	0.828	0.422	1.944		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

As can be concluded from Table 6, gender, car ownership, employment status, and the underlying pandemic-related factor were found to be significant predictors of the propensity to make a trip for recreational purposes during the pandemic. Males had significantly greater odds of making a recreational trip during the pandemic compared to females. Those who owned a car were less likely to make a recreational trip than those who did not own a car. Government and private employees had significantly lower chances of making a recreational trip during the pandemic compared to business persons. Those who scored higher on the pandemic-related factor were less likely to make a recreational trip during the pandemic.

Table 6. Binary logit model for recreational trips.

Variable	B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Gender	0.834	0.219	0.000 ***	2.302	1.499	3.534
MS	0.274	0.359	0.445	1.316	0.651	2.659
EW	−0.324	0.244	0.184	0.723	0.448	1.166
Car	−1.220	0.609	0.045 **	0.295	0.090	0.973
Age			0.506			
Age_1	0.147	0.692	0.832	1.158	0.299	4.493
Age_2	0.592	0.639	0.354	1.807	0.517	6.322
Age_3	0.557	0.629	0.376	1.745	0.509	5.984
Emp			0.115			
Emp_1	−0.801	0.496	0.107	0.449	0.170	1.187
Emp_2	−1.022	0.422	0.015 **	0.360	0.157	0.823
Emp_3	−0.861	0.426	0.043 **	0.423	0.184	0.974
Pandemic-related factor	−0.233	0.111	0.036 **	0.792	0.638	0.984
Constant	1.215	0.879	0.167	3.372		

** $p < 0.05$, *** $p < 0.01$.

As can be understood from Table 7, gender, marital status, and religion were the significant predictors of the propensity to make a trip for religious purposes during the pandemic. Males were almost 10 times more likely to make a trip for religious purposes during the pandemic than females. Single people were more likely to make a trip for

religious purposes than married people. Muslims were 11 times more likely to make a trip for religious purposes during the pandemic.

Table 7. Binary logit model for religious trips.

	B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Gender	2.349	0.279	0.000 ***	10.475	6.057	18.115
MS	0.997	0.418	0.017 **	2.711	1.194	6.156
EW	0.109	0.283	0.701	1.115	0.640	1.941
Car	−0.493	0.573	0.390	0.611	0.199	1.879
Age			0.426			
Age_1	−0.036	0.753	0.961	0.964	0.220	4.217
Age_2	−0.631	0.696	0.365	0.532	0.136	2.082
Age_3	−0.553	0.688	0.421	0.575	0.149	2.214
Emp			0.641			
Emp_1	−0.660	0.560	0.239	0.517	0.173	1.549
Emp_2	−0.418	0.472	0.375	0.658	0.261	1.658
Emp_3	−0.324	0.471	0.492	0.723	0.287	1.820
Religion	2.425	0.446	0.000 ***	11.300	4.717	27.069
Pandemic-related factor	−0.167	0.121	0.167	0.846	0.667	1.073
Constant	−2.995	0.989	0.002 ***	0.050		

Religion = 1 if the respondent is a Muslim and 0 otherwise. ** $p < 0.05$, *** $p < 0.01$.

6. Discussion and Conclusions

Undoubtedly, the world experienced a wide-reaching shock with the emergence of COVID-19. Although the world has faced global pandemics like the Spanish Flu around a century ago, the global community was unprepared to confront the COVID-19 pandemic. As a result, whether they like it or not, the global community is being forced to change their ways of life and daily routines. Since March 2020, the government of Malaysia has enforced a series of total lockdowns and "partial" lockdowns in order to reduce the number of daily COVID-19 cases. Undeniably, prolonged lockdowns have caused adverse implications not only for public health, but also for many other sectors including transportation, tourism, retail, business, and education.

This study explored the impact of COVID-19 a year after its emergence and the prolonged lockdown on individuals' travel behavior in Malaysia. Travel is one of the sectors that was dramatically affected during the pandemic, as reported in many previous studies. Many published studies so far have discussed the implications for this sector during the early stages of COVID-19. However, fewer studies have discussed such issues after people have lived with COVID-19 for 18 months. Questions such as the likelihood of people's being willing to travel for any purpose and how concerned people are about pandemic-related factors when choosing a travel mode remain unanswered, particularly in the Malaysian context.

During the pandemic, people usually prioritized pandemic-related factors when selecting a mode of transportation. In this study, some key pandemic-related factors were identified, i.e., infection concern, wearing face masks, social distance, and cleanliness. According to the findings, two factors, namely infection concern and wearing face masks, play a significant role in choosing a travel mode, followed by social distancing and cleanliness. The findings are in line with the previous studies reflecting the impacts perceived safety and concerns about being infected had on mode choice [74–76]. The effects of sociodemographic factors such as gender, car ownership, marital status, and job status on prioritizing pandemic-related items when selecting a mode of transportation were also studied. The findings revealed that females, car owners, married people, and essential workers significantly prioritized pandemic-related items while selecting a mode to travel during COVID-19. Previous studies have also revealed that males prefer to take risks, while females prefer to avoid them [77,78]. This also aligns with a study conducted in

Italy that concluded that the risk perceptions by females and nurses were higher during the early days of COVID-19 [79]. We also found that the car owners significantly prioritized pandemic-related factors when determining their travel mode during the pandemic compared to non-car-owners. Previous studies have also discussed similar issues in that car owners tended to use their private car for commuting from home to work during the pandemic, indicating that people placed a higher priority on their health and comfort over the economy [36,80]. Furthermore, when determining a mode of travel during the pandemic, the findings show that married people and essential workers put a higher priority on pandemic-related factors than single and nonessential workers. The reason could be that married people and essential workers prioritize their family members' health. Previous studies have also highlighted that healthcare workers particularly fear for the health of their family during pandemics [81,82]. Chang (2020) [83] stated that the pressures of COVID-19 for medical staff could be significantly different from those perceived by the general public owing to the fear of infection. In addition, a study conducted in Spain by Mansilla Domínguez et al. (2020) [84] concluded that people with family members working in healthcare had a significantly higher perception of the risk of infection than those without family members in healthcare. Our findings also indicated that the 41–50 age group placed a higher priority on pandemic-related items than the 31–40 age group. This might be because they are aware that older people have a higher risk of developing severe illness if they contract the disease than young adults [85].

Furthermore, we investigated the likelihood of respondents traveling for work/study, social, recreational, and religious purposes during the pandemic. It was discovered that essential workers and government and private employees were more likely to make a work trip during the pandemic compared to members of other employment categories. Demographic variables, car ownership, and pandemic-related factors were not significant predictors of the propensity to make a work trip. However, as explained in a recent study conducted in Italy, male students displayed a higher likelihood of traveling to the university compared to females, and younger students tended to go to the university more than employees [86]. The findings of current study highlight the importance of providing appropriate travel options for all those who visit their workplaces during pandemics. For example, safer options (in terms of the infection risk) with precautionary measures, e.g., social distancing and sanitization public transport or on-demand transport systems, should be arranged for those who commute to work. Further, additional parking spaces should be provided for the employees who travel to their workplaces using their own vehicles. Transport difficulties, including parking spaces to cater for the additional demand, have been identified as a key hindrance for working during pandemics, particularly for healthcare workers [87].

For both social and recreational trips, males were more likely to make such type of trips. As mentioned earlier and as identified in previous studies, males are greater risk takers than females. Furthermore, those who scored higher on the pandemic-related factor were less likely to make social and recreational trips. That means that pandemic concern played a key role in determining social and recreational trips during the lockdown and people who perceived a higher risk of infection tended to avoid social and recreational trips.

Males, single people, and Muslims were the most likely to travel for religious reasons. During the pandemic, although religious gatherings were permitted with precautionary measures, adherence to such measures was critical [88,89]. However, as mentioned by Algahtani et al. (2021) [89] elderly people and males were less likely to comply with preventive measures when engaging in religious activities. This means that despite the preventive strategies are in place, government interventions are necessary, e.g., for education and to protect vulnerable and noncomplying groups.

Although our results revealed some interesting findings, several limitations exist in this study. The analyses presented in this study were based on 435 returned questionnaire responses from the residents of Malaysia. Although this sample size was adequate for the statistical tests and models used in this study, sufficient sample sizes could not be

obtained for some categories, such as those over 50 years old. Despite the fact that such categories were merged with others, larger sample sizes should be collected to represent a representative sample of the population in terms of demographic characteristics. Another limitation is that the questionnaire was distributed online, and only those with internet access could complete it. Although the internet usage is very high in Malaysia, i.e., 90% of the population [90], some population categories, e.g., the elderly and those who live in the countryside, might have limited access to the internet and such categories might not have been well represented in the questionnaire survey. Furthermore, the travel habits of people in different cities and regions (for example, in city centers and the countryside) may differ remarkably. Future research could look into such aspects as well.

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