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Exploring the changes in travel behavior in a developing country amidst the COVID-19 pandemic: Insights from Metro Cebu, Philippines

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\textbf{ABSTRACT}

This article investigates changes in travel behavior from selected urban cities in Metro Cebu, Philippines during the COVID-19 pandemic a year after the first lockdown. Different categories of community quarantine and Granular lockdowns have since been imposed to curb the spread of the virus. An online survey was distributed to analyze socio-demographic characteristics and reasons for traveling in relation to weekly trip frequency before and during pandemic. These are presented and analyzed through data visualization and multinomial logistic regression. Results show that the major reason for traveling before pandemic was work-related but has since shifted to buying essentials or for leisure or recreation. Weekly trip frequencies were lesser when compared before pandemic, but several socio-demographic groups have shown otherwise. There is statistical significance for those less likely to travel when commuters are employed, self-employed or students compared to unemployed, earning PHP 10,000 or less compared to those earning above PHP 50,000, in a household size of 10 compared to all other household sizes, and those with college degree against elementary or no formal education.

\textbf{Introduction}

The emergence of a worldwide pandemic brought about by the Coronavirus disease (COVID-19) has altered all walks of life. The World Health Organization has declared the ubiquitous presence of the SARS-CoV-2 that causes the infection as a global pandemic (World Health Organization, 2020) since its first reported cases in Wuhan, China on December 2019 (World Health Organization, 2020). With the rapid increase in number of deaths daily, it can be said that anxiety-induced behavior is apparent (Arafat et al., 2020).

The number of cases in the Philippines has been reported to be one of the highest when the Department of Health confirmed the first case in the country in January 30, 2020 (Department of Health, 2020). In just over a year, at least 600,000 cases have been reported, including about 13,000 deaths. At one point, the Philippines ranked the third highest reported cases and deaths within Southeast Asia and Western Pacific Region (World Health Organization, 2021). To minimize the transmission of the virus, health protocols, as advised by the World Health Organization, have been enforced, such as social distancing and constant sanitation of facilities. Work-from-home arrangements of businesses and schools have also been mandated. Strict curfews have been implemented on a community scale, along with quarantine classifications in various levels. The transportation system has also been sternly controlled to curb the spread of the disease, to a point where only private vehicles and designated company vehicles for workers were initially allowed at the start of the lockdown during the first quarter of 2020.

With sharp increases in positive cases of COVID-19, urgent measures were authorized by the President of the Philippines to mitigate the situation (Parrocha, 2020), as well as approving several government agencies to aid in the management of the situation (Inter-Agency Task Force).
Transportation Research Interdisciplinary Perspectives 12 (2021) 100461

F.L. Mayo et al.

On a national level, the Department of Health (DOH) was directed to coordinate with Department of Transportation (DOTr) and Department of National Defense (DND) for logistics of personal protective equipment to frontliners. The Department of Public Works and Highways (DPWH) was also directed to coordinate with private entities in converting large structures into fully functional quarantine facilities. These were manned by teams that comprise of personnel from DOH Centers for Health Development, Department of the Interior and Local Government (DILG) regional offices, Local Government Units (LGUs), and uniformed personnel. LGUs, through their respective Office of the Mayor, were also directed to provide basic necessities of its residents under lockdown, disinfection of their localities, and identify human resources to conduct contact tracing of persons under investigation (PUI) and persons under monitoring (PUM).

Community quarantine protocols were established with varying classifications as prescribed by the Inter-Agency Task Force for the Management of Emerging Infectious Diseases (IATF). Different LGUs in the country were classified with a particular community quarantine protocol, which was initially based on the number of confirmed cases of COVID-19 (Inter-Agency Task Force for the Management on Emerging Infectious Diseases, 2020). It was later revised and based on healthcare utilization rate, which pertains to the percentage of dedicated beds and equipment being used for COVID-19 (Inter-Agency Task Force for the Management on Emerging Infectious Diseases, 2020). This has since been the basis for escalating or deescalating the classification. Table 1 summarizes these quarantine protocols and its corresponding restrictions, particularly on public land transportation and travel as recommended by the Department of Transportation (Department of Transportation, 2020).

Enhanced Community Quarantine (ECQ) is the highest level of community quarantine, wherein it has the greatest number of restrictions of activities in a community. Modified Enhanced Community Quarantine (MECQ) is a transitional phase of shifting from ECQ to GCQ, and its restrictions are lessened from ECQ, such as allowing private vehicles to ply on the roads. General Community Quarantine (GCQ) eases the restrictions further, such as allowing public transportation to operate but at 50% capacity. Modified General Community Quarantine (MGCQ) has the lowest level of community restrictions, wherein most of socio-economic activities are permitted with minimal public health standards.

As of 18 May 2021, nearly 3.3 million have only been vaccinated in the country (Department of Health, 2021), which translates to about 3.03% of the population. The slow rollout of the vaccines and its administration have been attributed to delays in procurement (Bonquin, 2021), logistical challenges, as well as hesitancy of people to be inoculated (Yap and Cinco, 2021), further delaying the targeted herd immunity in the country to around first quarter of 2022 (Gonzales, 2021).

Metro Cebu, which comprises of Cebu City, Lapu-Lapu City and Mandaue City, was one of the heavily affected areas by the pandemic. Situated in Region VII in Central Visayas, both Cebu City and Mandaue City are located in the island of Cebu, while Lapu-Lapu City is on Mactan Island. Both islands are connected by two bridges, and given the population density of these cities, viral transmission was fast. This was made worse when informal settler residents that were living in densely populated Barangays, the Philippines’ smallest unit of government, contacted the virus (Letigio, 2020; Saavedra, 2020). The city was reported with the highest number of cases (Letigio, 2020), causing it to be placed under ECQ in two occasions. Fig. 1 shows the timeline of community quarantine classifications of the three cities of Metro Cebu from March 2020 up to May 2021. Because the highest level of community quarantine was ordered for Metro Cebu, transportation was substantially restricted; The Office of the Vice-President has since ordered the deployment of buses and shuttles to provide transportation mobility for medical and healthcare front-liners (Letigio, 2020). With the alarming number of cases, the mayors of Metro Cebu implemented Executive Orders (Office of the Mayor of Cebu City, 2020; Office of the Mayor of Mandaue City, 2020; Office of the Mayor of Lapu-Lapu City, 2020) in their respective cities, mandating a strict 24-hour home quarantine, and requiring a quarantine pass (or QPass) when people go outside of their residences. Each household was provided with one QPass to reduce the number of people in public; A single person was to be designated to go out from a household to buy groceries, medicines, or essentials. Exempted from the QPass requirement were those classified as Authorized Persons Outside of Residences (APOR), and these included doctors, nurses, and essential service providers. They were simply required to present their valid ID and certificate of employment from their employer as proof that they are indeed APOR.

As the number of confirmed cases lessened and stabilized, travel and mobility restrictions were also relaxed. After more than a year since the first lockdown in the metropolitan and having been placed under the strictest community quarantine classification twice, it is interesting to investigate how travel behavior has changed. Therefore, it is the aim of this study to determine how the purpose for traveling before and during pandemic has changed. It also aims to determine the changes in weekly travel frequency in relation to purpose for traveling. Finally, it aims to predict the weekly travel frequency of specific socio-demographic factors. By identifying the travel behavior of commuters in a locality, travel demand can be better estimated, and appropriate travel resource for the mostly affected socio-demographic groups can be best provided.

Literature review

Safety, as defined by Maurice, et al. (Maurice et al., 2003) pertains to the wellbeing of the community and the control of risk factors associated with it. In particular, the conditions that establish the state of safety are summarized in four points: (1) harmonious and non-violent co-existence between groups and communities, (2) harmonious and non-violent co-existence of individuals within a living environment, (3) prevention and control of injuries that cause harm, and (4) provision of effective measures to ensure that the three previous conditions are met. Points 1 and 2 pertain to the people that exist and reside within the community, while point 3 refers to environmental factors that affect wellbeing of the people, wherein their health are encompassed. Govender (Govender, 2017), Mahmoud and Hine (Mahmoud and Hine, 2016), and Ojo (Ojo, 2019) mentioned passengers’ safety and wellbeing as one of the important service indicators in the transportation sector.

The coronavirus was initially characterized in 1965 by Tyrrell and Bynoe from a patient who had colds (Tyrrell and Bynoe, 1966). It has since undergone several mutations, with the latest being identified as Severe Acute Respiratory Syndrome Coronavirus 2 or SARS-CoV-2. Because of its fatality, the number of reported cases and deaths have reached an alarming level, which has prompted the World Health Organization to declare the outbreak of the virus as a pandemic. Every affected country has since adopted ways to reduce the transmission of the virus.

Travel behavior during previous outbreaks

In a health crisis, there are expected changes in travel or movement of people. This is mainly due to internal motivation to protect oneself from infection, and external measures in preventing the transmission to other people through travel restrictions (Schoeder et al., 2013); (Rei-singer and Mavondo, 2005). In addition to influencing the intention to travel to a certain destination, the decision not to travel at all is also affected (Reisinger and Mavondo, 2005); (Bittichainumwat and Chakraborty, 2009). The risk associated with viral transmission also altered travel behavior, such as decreased trip frequency (Anwari et al., 2021). This has been demonstrated in studies conducted during previous outbreaks, such as the Ebola outbreak in 2014. A study by Cahyanto et al., (2016) in the United States examined the factors that contributed to avoidance of domestic travel by Americans. Their study was done
through an online survey, and it was revealed that there was a significant reduction in domestic travel as influenced by perceived susceptibility and self-efficacy. Demographic characteristics also played a role, which included gender and age. Another study was done by Peak and Wesolowski (2018) in Sierra Leone; their study used an algorithm to analyze mobile phone call detail records to detect changes in travel during a home lockdown, and the results also showed a remarkable reduction in human mobility. Yet contrary to these findings, a Queensland Social Survey (QSS) survey conducted by Leggat et al. (2010) in Australia during the H1N1 outbreak in 2009 revealed that despite awareness and concern of people about the virus, most were still unwilling to cancel their travel. In addition, although having shown symptoms of H1N1, majority would not have postponed travel. Similar findings were also found by Lee et al. (2013) in South Korea wherein the desire and intention to travel were unaffected by the perceptions towards H1N1. Another outbreak in South Korea also occurred in 2015 brought about by SARS MERS. Joo et al. (2019) analyzed the travel behavior of commuters using their smart card data, and their findings revealed that there was a significant reduction of trip frequency due to fear of viral infection and contraction. Several factors were identified that contributed to reduction of trips, which included potential SARS MERS hotspots, average land values of Transportation Analysis Zones, and individual transit use. During the Zika Virus outbreak in 2015 in the United States, people were inclined to avoid travel due to fear or concern of their health, especially in areas of high concentration of cases, according to a study conducted by Widmar et al. (2017).

Travel behavior during COVID-19 pandemic

With the most recent COVID-19 pandemic, several studies on travel behavior have been done. De Vos (2020) stressed out how travel has been affected by the pandemic, and alternative means such as walking and cycling were sustainable options while maintaining well-being. Large reductions of travel using public transit in Washington (Brough et al., 2020) and Chicago (Shamshiripour et al., 2020) in the United States have also been observed. The amount of trips and distance have also significantly reduced in other countries, with about 60% in average daily distance traveled and 90% of trips using public transportation in Switzerland (Molloy et al., May 2020), and 68% distance traveled and 55% of trips in the Netherlands (de Haas et al., 2020). With the closing of physical stores and businesses, trips to amusement areas and shopping stores were also found to be drop significantly in Hong Kong (Zhang et al., 2021).

Unlike COVID-19 that has affected almost all nations, previous outbreaks were generally contained within limited areas and regions. Moreover, the case-fatality ratio of COVID-19 is significantly higher (Dhillon et al., 2020). It has now become common for people to carry out their activities at home whenever possible, as exhibited by an increase in online social media presence, communication, and online shopping (Shamshiripour et al., 2020). Although several studies have elucidated behavioral travel changes during the current pandemic, they were mostly carried out in developed nations; only limited studies in developing countries have been conducted, such as a study by Anwari et al., (2021) that aimed to determine the changes in travel pattern in Bangladesh. Their study revealed that a large proportion of their survey respondents reduced travel for recreational trips but only showed a small reduction for work-related reasons Irwawan et al. (2021) also found a significant reduction of trips in Indonesia, reducing average trips from 5 to 2 days a week for both work and school related travel. Travel for shopping has also reduced from 3 to once a week. Similar findings were also found by Aditya and Rahul (2021) in India, wherein majority of their survey respondents were willing to reduce their trips for recreation and essential trips but otherwise for work.

The contribution of this work is three-fold, as follows: (1) New knowledge is added to the domain in transportation, particularly in travel behavior, after a year since the metropolitan’s strictest travel restriction. To the best of the authors’ knowledge, there are no published studies about travel behavior during an outbreak in the Philippines; (2) The gap in travel supply and demand are revealed in this study, including socio-demographic groups that are mostly affected by the transport disparity. Particularly unique to the Philippines is how the government developed various classifications of community quarantine protocols and granular lockdowns as ways to minimize the spread of COVID-19; and (3) The application of multinomial logistic regression to travel behavior during an outbreak in the Philippines.

Methodology

To determine changes in travel behavior of residents in Metro Cebu, relevant data are collected from each of the urban cities. These data are also used to determine the travel behavior that can be significantly predicted in relation to socio-demographic groups.

Data collection

A questionnaire was developed and prepared using the Google Forms platform. It consisted of three sections—the first section presented a consent form to the respondents, which included the purpose of the survey, its procedure, and a confidentiality clause. The second section asks for basic information about the respondents, such as age, gender, highest educational attainment, current employment status, marital status, monthly salary or allowance, their current city of residence, their usual city of destination, household size, and who they are currently living with. For the purpose of exploring the possibility of attributing COVID-19 related information by the respondents to their travel behavior, they are to answer relevant questions about COVID-19. They are asked if they know someone in their circle of family, friends and acquaintances is positive of COVID-19. They are also asked if they are aware if their neighbor tested positive of COVID-19. Lastly, they are to indicate their opinion regarding COVID-19 pandemic, if it is real, unreal or they are uncertain. To disqualify respondents that are not currently residing in Cebu City, Lapu-Lapu City or Mandaue City, they are required to agree in continuing to participate in the survey only if they are indeed currently residing in either of the three cities. Finally, the third section asks the respondents what their primary reason was for traveling during the pandemic. They are also asked to answer how often they travel weekly before and during pandemic.

The questionnaire was written in both local dialect (Cebuano) and the English language. It was reviewed by the Central Visayas – Research Ethics Committee (CV-REC) on January 13, 2021 and was approved on March 1, 2021, just about a year since the lockdown started in the country. It was distributed online through social media channels between the months of March and April 2021 using a snowball sampling technique: The questionnaires were initially forwarded to family, friends and acquaintances of the authors; after which, they forward them to their own circle of family, friends and acquaintances. The process continues until the target number of samples is reached. A total of 2,002 responses were gathered for processing and analysis.

The data collected were assessed in IBM SPSS Statistics 21. The frequency distribution of each of the socio-demographic factors, questions about COVID-19, weekly trip frequency and reasons for traveling are presented using cross tabulation. The change in weekly travel frequency before and during COVID-19 pandemic are visually explained through an Alluvial diagram. To identify which socio-demographic factors and questions about COVID-19 can be attributed to the changes in weekly travel frequency, a multinomial logistic regression is done.

Data visualization

The survey data are visually presented to provide an overview of characteristics of variables and travel behavior. Frequency distribution tables are generated to present information about the frequencies of
socio-demographic variables, trip frequency and reasons for traveling before and during pandemic. The table is represented through a matrix of values, with the first column showing the different categorical variables, and the succeeding columns showing the frequency and relative frequency. Alluvial diagrams are also used as a visualization of the flow of information to represent changes between variables, or even of the same variable but at different conditions (such as the passing of time). It is a flow diagram wherein nodes represent the variables, and the stream of flow between variables represent the changes. The height of a node determines the relative size of the variable, such as the frequency of each category of socio-economic variables, while the height of the stream represents the proportion of the frequency that flows from one node to the next node.

Multinomial logistic regression

The multinomial logistic regression is a regression model wherein an outcome or a dependent variable has more than two nominal categories (Kleinbaum and Klein, 2010). It is basically a method to predict the outcome of a dependent, ordered variable using proportional odds when one or more independent variables are given. It has the advantage of showing how the model can predict the outcome of the dependent variable.

Assumptions of multinomial logistic regression

When using multinomial logistic regression to model the behavior of a nominal dependent variable, a few assumptions must be satisfied. The first and seconds assumptions are that the dependent variable must be nominal, while the independent variables are either continuous, nominal, or ordinal. The third assumption is that there should be independence of observations. The fourth assumption requires a non-multicollinearity between all independent variables. The fifth assumption requires a linear relationship between any continuous independent variable and the logit transformation of the dependent variable. Lastly, outliers or highly extreme values or points must not be present.

Fitness of the multinomial logistic regression

After having satisfied the assumptions for multinomial logistic regression, the model needs to be checked of its overall goodness-of-fit. This involves several statistical tests, such as the Pearson and Deviance chi-square goodness-of-fit test; the likelihood ratio test; and the Cox and Snell, Nagelkerke, and McFadden pseudo R².

Results and discussion

The socio-demographic characteristics of the 2002 respondents are summarized in Table 2. For comparison, the national statistics, based on the data obtained from the Philippine Statistics Authority (PSA) (Philippine Statistics Authority, 2020), is also shown in the same table. At the time of this writing, the most recent statistical data published is from 2015 except employment status from 2021 (Philippine Statistics Authority, 2021), and marriage statistics from 2019 (Philippine Statistics Authority, 2021). Due to the differences in data binning in the national statistics, some categories have been merged to coincide with the corresponding categories in this study. Information obtained from these characterististics before and during pandemic also include weekly travel frequency and reasons for traveling. These are discussed in detail in the succeeding section.

Socio-demographic characteristics

The survey revealed that the youngest age group correspond to the greatest number of participants (39.3%), with decreasing proportion as age group increases. It also follows the same trend with the national statistics (28.6%). Females (52.5%) showed higher proportion than males (47.5%) and is similar to national statistics (50.2% and 49.8%, respectively). Most of the respondents have a college degree (75.8%), with decreasing proportion as the highest educational attainment lowers. Those taking graduate studies (7.9%) were also found to be greater in proportion than technical or vocational (3.9%). For employment status, both the survey (53.8%) and national statistics (43.0%) showed that many are still employed despite the on-going pandemic. However, proportion of unemployed is substantially higher in Metro Cebu (12.6%) than the national data (4.2%). The student category is also substantially higher in national (31.9%) compared to Metro Cebu (24.4%). Most of the respondents in this study are single (54.9%), which also follows similar behavior with the national data (44.0%). However, a distinction is observed wherein the national data shows a smaller difference between single and married compared to this study. In terms of monthly salary, an opposite trend is seen: The proportion of those earning lowest is higher with decreasing proportion as income group increases, while the national data shows otherwise. Majority of the respondents travel to (70.7%) and reside in (54.4%) Cebu City, which follows the same proportion of population compared to Lapu-Lapu City and Mandaue City. Many of the respondents are either living alone (48.5%) or with their family, relatives, or partner (41.8%), and is reflected by the average household size (3.3). It is observed that there is only a small difference in the household size in this survey and the national data (4.4).

Questions pertaining COVID-19

Aside from the basic socio-demographic profile, respondents were presented with close-ended questions regarding their knowledge of the COVID-19 situation in Metro Cebu. Their responses are summarized in Table 3. These questions were asked as they could possibly be explanations for the changes in travel behavior of Metro Cebu residents.

Majority of the respondents (61.9%) either were unaware or believe that their family, friends or partner circle was negative of COVID-19. Most of them were aware (58.9%), however, that their neighbors tested positive. Their general belief towards COVID-19 is that most of them believe it is real (79.4%). A concerning portion of the respondents believe that it is not real (5.6%), while the rest are uncertain (15.0%).

Purpose of travel

Changes in travel pattern can be analyzed by showing how the travel frequency or purpose of travel has changed (Anwari et al., 2021) from before to during the COVID-19 pandemic. Table 4 summarizes the frequency distribution of purpose of travel before and during pandemic. The purposes indicated are to go to school, to go to work, to buy essentials, to visit family, relatives, or friends, for recreation, and others. For the purpose related to buying essentials, this pertains to travelling to buy grocery, medicine, or necessities. For the purpose described as others, this relates to travelling to visit the church, the gym or reasons not covered by other options.

Table 4 shows that before pandemic, almost half of the respondents travel to go to work (46.9%), followed by buying essentials (21.0%), going to school (17.0%), for recreation (5.4%), other reasons (5.2%), and buying essentials (4.3%). However, during pandemic, it is observed that more than half of the responses now travel to buy essentials (52.3%). Travelling to go to work (11.2%) or school (2.1%) has dropped significantly. Although physical contact has been restricted in school and work, they have recently relaxed as defined by the community quarantine protocol; The current community quarantine classification of the three cities of Metro Cebu have consistently stayed minimal (MGCQ) since the number of cases have also consistently stayed low and HUR have consistently stayed below 60%. After having experienced extended lockdowns and stringent travel restrictions in 2020, perhaps people have developed the urge to travel for recreation (17.3%), to do activities that could not be done during lockdown such as going to the church, the gym, or other places (10.2%), or visit family, relatives, or friends (6.8%).
While Table 4 shows the number of responses before and during pandemic for each purpose of travel, it is unable to show how they have shifted from one activity to another. To do so, this is presented through an Alluvial diagram, shown in Fig. 2. The left and right side of the chart, usually referred to as nodes, shows the distribution of purpose for traveling before and during the pandemic, respectively. Each purpose for travelling is represented by rectangles, with its height being proportional to the total number of responses for that category. The connection of nodes from before to during pandemic are represented as flows, and the thickness of the flow represents the proportion of responses that shifted from a category before pandemic to individual categories during pandemic.

It can be observed in the diagram that before pandemic, the reason to go to work, represented with green flow, is the largest node (46.9%), which implies that this is most travel-related reason. However, during pandemic, this has significantly dropped to 11.2% due to physical contact restrictions together with work-from-home arrangements, with a large proportion shifting to buying essentials. Buying essentials, such as food, grocery, or medicine, is the second highest reason for travelling (21.0%) before pandemic, represented with a blue flow, and has significantly increased as the highest during pandemic (52.3%). A large proportion of those who travel to buy essentials before pandemic has retained their reason for traveling during pandemic. A large proportion from all other reasons has also shifted to traveling to buy essentials during pandemic, contributing to its increase in the responses.

Although people are still wary of the pandemic, traveling for recreation has shown to be the second highest reason (17.3%) during pandemic, wherein it used to be the fourth highest reason before pandemic, represented with a cyan flow. It can be observed in the alluvial diagram that the flow to traveling for recreation during pandemic from all other reasons before pandemic is considerable. After being under strict lockdown for a year, people have shown eagerness to travel for leisure. Traveling to go to school before pandemic (17.0%), represented with a red flow, has also significantly reduced during pandemic. Although schools and academic institutions in Metro Cebu are still currently enforcing virtual classes, exceptions are still allowed, such as for the conduct of major projects or laboratory experiments as a requirement for finishing their program or degree. Those who chose other reasons for travelling before pandemic (5.2%), represented with an orange flow, have also increased during pandemic (10.2%), showing a similar trend for leisure travel. Traveling to visit family, friends, and relatives before pandemic (4.3%), represented with a gray flow, have also shown a slight increase during pandemic (6.8%). A similar reasoning for traveling for leisure can be said for visiting family, friends, and relatives due to prohibition of physical engagement with people at the onset of community quarantine lockdowns.

Travel frequency

Among the interventions during community lockdowns is the reduction of travel frequency through implementation of restrictions in movement of people and vehicles. As the restrictions eased, travelling for reasons other than buying essentials or for essential work has been permitted. Table 5 shows a summary of the travel frequency before and during pandemic.

The table shows the different classifications of weekly travel frequency, and the frequency and relative frequency distributions are shown for both before and during pandemic. It should be noted there are no values for the option under “I no longer travel” before pandemic, as this option was only made available for scenarios during the pandemic when traveling was initially strictly restricted. In this way, we can show the number of responses who chose not to travel due to the pandemic, in contrast to those who still chose to do so. The highest travel frequency before pandemic revealed to be between one to two times a week (35.4%), followed by five to six times a week (31.5), and every day (20.3%). Only 12.8% of the respondents travelled between three to four times a week. With the pandemic, a shift in travel frequency is apparent, as many of the respondents now travel either three to four days a week (38.2%) or one to two days only (32.3%). Travelling every day (12.0%) or five to six days (10.1%) have decreased significantly, with a proportion of the responses no longer travelling at all (7.4%). This comes to no surprise as many of the work, classes or business are still done virtually.

Weekly travel frequency and purpose of travel

A comparison of the changes in weekly travel frequency, in relation to different purposes of travel during pandemic, is done through a three-tiered alluvial diagram, as shown in Fig. 3. The diagram shows three nodes, each arranged in descending frequencies, instead of two: The leftmost (first) node represents weekly travel frequency before pandemic (BP), the middle (second) node represents the purpose for travelling before pandemic (BP), and the rightmost (third) node represents the weekly travel frequency during pandemic (DP).

It can be seen in the diagram that the widest flow from the first node (Weekly Travel Freq BP) to the second node (Purpose of Travel BP), regardless of weekly travel frequency before pandemic, move towards the purpose of going to work, followed by buying essentials and going to school. The least flow moves towards visiting family, relatives, or friends, other reasons, and for recreational purposes. Movement of flow from the second node (Purpose of Travel BP) to the third node (Weekly Travel Freq DP) mostly goes towards three to four days a week and is followed by one to two days a week. There is less flow towards traveling every day, five to six days a week and no longer travel. While businesses, classes and activities have mostly adapted to virtual arrangements, the relaxation of travel restrictions may possibly be attributable to traveling five to six days a week and every day. Despite the slow rollout of the COVID-19 vaccine in Metro Cebu, people still travel mostly for economic reasons.

Socio-demographic factors and weekly travel frequency

A more detailed view of the weekly travel frequency in relation to socio-demographic factors is presented through cross tabulation. Aside from purpose of travel, the changes in weekly travel frequency are examined based on each socio-demographic factors. Table 6 shows a cross-tabulation of all socio-demographic factors and weekly travel frequency before and during pandemic. All subcategories in each socio-demographic variable are graphically compared using a bar chart in Fig. 4 and segmented bar chart in Fig. 5 for both before and during pandemic. The bar chart shows the frequency distribution of each socio-demographic subcategory in that category, while the segmented bar chart shows the proportion of each subcategory relative to the total responses of that category (e.g., the proportion of male subcategory in the gender category).

It can be observed that both genders exhibit a similar change in weekly travel frequency: There is a decrease during pandemic in weekly travel of one to two days, five to six days, and every day, while there is significant increase in three to four days. Females travelled proportionally more frequent than males before pandemic but has changed to the opposite during pandemic. Younger age brackets tend to show higher proportion of travels in all weekly travel options, except every day. Those aged above 60 tend to show lesser proportion in all weekly travel options during pandemic except one to two days. Middle aged groups, such as 36 to 44 and 45 to 54 years old, showed higher travel frequency due to work-related reasons, as these age groups generally have higher job satisfaction and stability compared to younger age groups (Ehsan et al., 2001). College respondents showed the highest travel frequencies in both before and during pandemic, followed by high school and technical/vocational while graduate school background showed a decrease in proportion of travel frequency in three to four days yet increased in all other options. Regular employees are observed to show decreased proportion in weekly travel in all options except every day. The proportion of those unemployed also showed a decrease in
Table 1
Community quarantine protocols, classification parameter, and land transport restrictions in the Philippines.

| Protocol                              | Healthcare Utilization Rate | Restrictions                                                                 |
|---------------------------------------|----------------------------|-----------------------------------------------------------------------------|
| **Enhanced Community Quarantine (ECQ)** | 85% or more                | • All forms of public transportation suspended                              |
|                                       |                            | • Commissioned shuttle services are allowed for employees of permitted offices or establishments |
|                                       |                            | • Point-to-point transport services provided by the government are allowed, prioritizing healthcare workers |
|                                       |                            | • A strict one-meter distance between passengers shall be observed           |
| **Modified General Community Quarantine (MGCQ)** | 70–84%                   | • All forms of public transportation suspended                              |
|                                       |                            | • Commissioned shuttle services are allowed for employees of permitted offices or establishments |
|                                       |                            | • Point-to-point transport services provided by the government are allowed, prioritizing healthcare workers |
|                                       |                            | • Private transportation and vehicles utilized by persons authorized outside residences (APOR) are allowed, subject to guidelines of Department of Transportation |
|                                       |                            | • A strict one-meter distance between passengers shall be observed           |
|                                       |                            | • Bicycles and non-motorized vehicles strongly encouraged                    |
| **General Community Quarantine (GCQ)**   | 60–69%                    | • Public transportation allowed with restrictions:                           |
|                                       |                            | o Public utility buses and Jeepsneys not to exceed 50% capacity including driver and conductor |
|                                       |                            | o UV (Utility Vehicle) express and taxis not to exceed two passengers per row, except for driver’s row where one passenger is only allowed |
|                                       |                            | o Tricycles (auto rickshaw) to allow only one passenger in the sidecar, while back riding is still not allowed |
|                                       |                            | • Commissioned shuttle services are allowed for employees of permitted offices or establishments |
|                                       |                            | • Point-to-point transport services provided by the government are allowed, prioritizing healthcare workers |
|                                       |                            | • Private transportation and vehicles utilized by persons authorized outside residences (APOR) are allowed, subject to guidelines of Department of Transportation: |
|                                       |                            | o Only one passenger allowed in the front passenger seat, and not exceed two passengers at the back rows |
|                                       |                            | o Motorcycle back riding not allowed                                          |

| Protocol                              | Healthcare Utilization Rate | Restrictions                                                                 |
|---------------------------------------|----------------------------|-----------------------------------------------------------------------------|
| **Modified Enhanced Community Quarantine (MECQ)** | Below 60%                 | • A strict one-meter distance between passengers shall be observed in all modes of transportation |
|                                       |                            | • Bicycles and non-motorized vehicles strongly encouraged                    |
|                                       |                            | • Public transportation allowed with restrictions:                           |
|                                       |                            | o Public utility buses and Jeepsneys not to exceed 50% capacity including driver and conductor |
|                                       |                            | o UV (Utility Vehicle) express and taxis not to exceed two passengers per row, except for driver’s row where one passenger is only allowed |
|                                       |                            | o Tricycles (auto rickshaw) to allow only one passenger in the sidecar, while back riding is still not allowed |

Weekly travel in one to two days and five to six days yet increased in three to four days and every day. Proportion of contractual employees and self-employed decreased in three to four days while students showed an increase in all weekly travel options except every day. Regardless of marital status, a significant increase in weekly travel of three to four days is observed, while the rest of the weekly travel options decreased. Those earning PHP 10,000 or less are observed to show lesser travel frequency for five to six days but more in one to two days and three to four days. Because public transport systems in Metro Cebu are privately operated, mobility for the poor within and between urban cities are limited as well. Those earning higher have the luxury to travel not just for work, but also for leisure or non-essential reasons, because they either can afford any public modes of transportation, or they own a private car or motorcycle. The leniency of people following health protocols and restrictions during the COVID-19 in an urban city of a developing country, such as the Philippines, could be due to the eased travel policies imposed by the government (Ecarma, 2021) which has provided the opportunity to travel to those that can afford to do so (Macasero, 2020). There is lesser proportion of those who travel during
Table 2
Frequency distribution of socio-demographic characteristics of Metro Cebu residents against national statistics.

| Socio-Demographic Variables | Survey | National Statistics |
|-----------------------------|--------|---------------------|
|                             | Freq.  | Rel. Freq. (%)      | Freq.  | Rel. Freq. (%)      |
|                             |        |                     |        |                     |
| Age                         |        |                     |        |                     |
| 18–26                       | 787    | 39.3                | 19,658,679 | 28.6 |
| 27–35                       | 540    | 27.0                | 15,702,341 | 22.8 |
| 36–44                       | 325    | 16.2                | 12,592,015 | 18.3 |
| 45–53                       | 205    | 10.2                | 9,714,872  | 14.1 |
| 54–60                       | 97     | 4.8                 | 3,606,834  | 5.2  |
| Above 60                    | 48     | 2.4                 | 7,548,769  | 11.0 |
| Gender                      |        |                     |        |                     |
| Male                        | 951    | 47.5                | 24,479,231 | 49.8 |
| Female                      | 1,051  | 52.5                | 24,685,620 | 50.2 |
| Highest Educational Attainment (HEA) | | | | |
| None                        | 6      | 0.3                 |          |                     |
| Elementary                  | 29     | 1.4                 |          |                     |
| High School                 | 213    | 10.6                |          |                     |
| College                     | 1518   | 75.8                |          |                     |
| Technical/Vocational        | 78     | 3.9                 |          |                     |
| Graduate School             | 158    | 7.9                 |          |                     |
| Employment Status           |        |                     |        |                     |
| Unemployed                  | 252    | 12.6                | 3,441    | 4.2  |
| Employee-Contractual        | 181    | 9.0                 | 7,335    | 9.7  |
| Employee-Regular            | 897    | 44.8                | 28,106   | 34.1 |
| Self-employed               | 184    | 9.2                 | 17,226   | 20.9 |
| Student                     | 488    | 24.4                | 26,257   | 31.9 |
| Marital Status              |        |                     |        |                     |
| Single                      | 1,099  | 54.9                | 34.8     | 44.0 |
| Married                     | 727    | 36.3                | 32.5     | 41.0 |
| Separated                   | 6      | 0.3                 | 11.8     | 15.0 |
| Common-law                  | 106    | 5.3                 |          |                     |
| Widow/Widower               | 64     | 3.2                 |          |                     |
| Monthly Salary/Allowance in PHP (in USD) | | | | |
| 10,000 and below (200.00 and below) | 819 | 40.9 | 199,244 | 2.6 |
| 10,001–20,000 (200.01–400.00) | 399 | 19.9 |          |                     |
| 20,001–30,000 (400.01–600.00) | 394 | 19.7 |          |                     |
| 30,001–50,000 (600.01–1,000.00) | 255 | 12.7 | 1,921,779 | 24.8 |
| Above 50,000 (Above 1,000.00) | 135 | 6.7 | 5,633,462 | 72.6 |
| Current City of Residence   |        |                     |        |                     |
| Cebu City                   | 1089   | 54.4                |          |                     |
| Lapu-Lapu City              | 464    | 23.2                |          |                     |
| Mandaua City                | 449    | 22.4                |          |                     |
| Usual City of Destination   |        |                     |        |                     |
| Cebu City                   | 1416   | 70.7                |          |                     |
| Lapu-Lapu City              | 285    | 14.2                |          |                     |
| Mandaua City                | 301    | 15.0                |          |                     |
| Household Members Living With |      |                     |        |                     |
| Alone                       | 970    | 48.5                |          |                     |
| Family, relatives or partner| 836    | 41.8                |          |                     |
| Friends                     | 79     | 3.9                 |          |                     |
| Workmates                   | 117    | 5.8                 |          |                     |
| Household Size              |        |                     |        |                     |
| 1–2                         | 1203   | 60.1                |          |                     |
| 3–4                         | 208    | 10.4                |          |                     |
| 5–6                         | 278    | 13.9                |          |                     |
| 7–8                         | 236    | 11.8                |          |                     |
| 9–10                        | 37     | 1.8                 |          |                     |
| More than 10                | 40     | 2.0                 |          |                     |
| Weighted Average            | 3.3    | 4.4                 |          |                     |

* Available data is only literacy rate; b Corresponding student category in national statistics is “not part of labor force”; c In Millions; d No available data; e Available data is average household size; f Calculated as sum of product of household size category midpoint and corresponding frequency over sum of all frequencies

Table 3
Frequency distribution on information regarding COVID-19.

| Questions | Before Pandemic | During Pandemic |
|-----------|-----------------|-----------------|
|           | Freq. Rel. Freq. (%) | Freq. Rel. Freq. (%) |
| 1. Do you know someone close to you (such as immediate family, relatives or friends) who tested positive of COVID-19? | Yes /I believe so 762 38.1 | No /Not that I am aware of 1,240 61.9 |
| 2. Are you aware if someone in your neighbor tested positive of COVID-19? | Yes /I believe so 1,180 58.9 | No /Not that I am aware of 822 41.1 |
| 3. What is your general belief regarding the COVID-19 pandemic? | COVID-19 is real 1,589 79.4 | Uncertain 301 15.0 |
| | COVID-19 is not real 112 5.6 | |

Table 4
Frequency distribution of purpose of travel before and during COVID-19 pandemic.

| Purpose of Travel | Before Pandemic | During Pandemic |
|-------------------|-----------------|-----------------|
|                   | Freq. Rel. Freq. (%) | Freq. Rel. Freq. (%) |
| To go to school   | 341 17.9 | 43 2.1 |
| To go to work     | 939 46.9 | 224 11.2 |
| To buy essentials | 421 21.0 | 1,048 52.3 |
| To visit family, relatives or friends | 87 4.3 | 137 6.8 |
| For recreation or leisure | 109 5.4 | 346 17.3 |
| Others            | 105 5.2 | 204 10.2 |

pandemic in all weekly travel frequencies except three to four days of those travelling from Cebu City, while Lapu-Lapu City and Mandaue City showed an increase in proportion for traveling five to six days and every day. The same behavior is also observed for those travelling to either of the three cities. Because Cebu City has had several instances wherein it logged the most number of COVID-19 cases (Montemayor, 2020; Robles, 2020; Saavedra, 2020), it makes sense why residents in this city are more wary in traveling compared to those living in Lapu-Lapu City and Mandaue City. The proportion of travelers who are single that are traveling one to two days or three to four days during pandemic are higher compared to five to six days or every day, while those living with family, relatives or their partner showed higher proportion of all weekly travel frequencies except one to two days. Those living with friends showed a higher proportion in traveling one to two days or five to six days, and lesser on three to four days or every day. Single travelers tend to travel less compared to those living with other people perhaps for reduced risk of infection, as being sick while living alone can be difficult. Living with family, relatives or partner tend to travel more perhaps due to being confined with them for an extended period during lockdown. Household sizes of one to two and five to six showed lesser proportion of travel frequency in one to two days and five to six days, but more in three to four days and every day. A household size of three to four and seven to eight also showed higher proportion of travel frequency for one to two days, five to six days and every day. A household size of 9 to 10 has a higher weekly travel frequency during pandemic for one to two days and three to four days, while the opposite is observed in a household size of more than 10. In addition to how Filipinos generally value close family ties, it is also economically viable for the working population to live in a co-shared space to reduce or minimize monthly rent.

Factors affecting changes in travel frequency

To determine if socio-demographic variables and questions about COVID-19 have an influence on the weekly travel frequency, a multinomial logistic regression model are initially examined.
Assumptions of a multinomial logistic regression model

The dependent variable of the multinomial logistic regression model in this study is the weekly travel frequency during pandemic. Its values are presented as ranges (one to two times a week, three to four times a week, five to six times a week, every day, and no longer travel) and are classified as a nominal variable. The independent variables are represented by the socio-demographic variables, as well as the questions related to COVID-19. Their values are also presented in categories and are classified as nominal variables. These satisfy the first two assumptions of a multinomial logistic regression model.

A test of independence of observations is conducted to check if there is a significant relationship between the independent variables. All independent variables are paired for the test using linear regression. A matrix of the results of the test for independence is presented in Table 7. The first column and row represent all the independent variables. Cramer’s V was used for comparing two independent variables with more than two categories, while Pearson’s chi-square was used for two independent variables with only two categories. A value of 1.000, indicating highest association, shows the intersection of the same week, five to six a week, every day, and no longer travel) and are classified as a nominal variable. The independent variables are represented by the socio-demographic variables, as well as the questions related to COVID-19. Their values are also presented in categories and are classified as nominal variables. These satisfy the first two assumptions of a multinomial logistic regression model.

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variables, highlighted in grey. The threshold for weak association between variables is set to a value up to 0.300, a value between 0.300 and 0.500 signifies medium association, and above 0.5 means a strong association (Cohen, 1988). The results show that age has a strong association with three other independent variables: employment status ($\Phi_c = 0.401$), marital status ($\Phi_c = 0.410$), and monthly salary ($\Phi_c = 0.355$). There is also a strong association between employment status and monthly salary ($\Phi_c = 0.429$), city of residence and city of destination ($\Phi_c = 0.523$), and household members living with and household size ($\Phi_c = 0.536$).

A non-multicollinearity is also required between independent variables. Variance inflation factor (VIF) and tolerance are used as indicators of collinearity of independent variables. Table 8 summarizes these indicators for each of the independent variable. The acceptable variance inflation factor should be below 10 or a tolerance of at least 0.10 (Hair et al., 2010). Based on the test for multicollinearity, all the independent variables resulted within the acceptable threshold for non-multicollinearity.

A linear relationship is also required between continuous independent variables and the logit transformation of the dependent variable. However, since all independent variables in this study are nominal, this assumption is not applicable.

The last assumption requires the exclusion of outliers in the data. In this study, outliers pertain to sub-categories whose total number of responses before and during pandemic are < 10 (Peduzzi et al., Dec. 1996). Two sub-categories were found to have low responses: (1) sub-category “Unemployed” under Highest Educational Attainment, and (2) sub-category “Separated” under Marital Status. As these can present problems in the calculation of regression coefficients and odds ratio, they are correspondingly combined with other sub-categories that shares similar attributes. In the case of “Unemployed” for the employment status, its frequencies for each day of the week before and during pandemic is combined with “Elementary.” For “Separated,” it is combined with “Single.”

Given all the tests of the assumptions, a notable finding is that while all assumptions are satisfied, there are independent variables that violate the independence of observations. However, since this study seeks to find out how the socio-demographic factors and questions about COVID-19 could possibly influence the changes in weekly travel frequency during pandemic, their inclusion in the model is important. Moreover, the results of the test for multicollinearity showed that all independent variables are non-collinear.

Multinomial logistic regression

After satisfying the assumptions of a multinomial logistic regression, the model can be developed. The goodness of fit is initially tested to determine how fit the model is to the data.

**Goodness of model fit.** To assess the suitability of the model to the data, the following indicators were determined: (1) In the Likelihood Ratio chi-square test, the final model shows statistical significance and is a significant improvement in fit over a null model, with $AIC = 5,321.316, BIC = 6,217.621, [\chi^2(156) = 231.211, p < 0.001]$; (2) the Pearson’s chi-square test indicates that the model shows non-statistical significance, indicating that the model fits the data well $[\chi^2(6,540) = 6,641.597, p = 0.187]$. The Deviance chi-square also shows non-statistical significance, indicating that the model fits the data as well $[\chi^2(6,540) = 4,717.713, p = 1.000]$; (3) the results of the Pseudo R-square are 0.109, 0.116, and 0.041 for Cox and Snell, Nagelkerke, and McFadden, respectively (Osborne, 2015; Bedwell, 2016; Smith and McKenna, 2013).

**Results of the multinomial logistic regression.** The Omnibus Likelihood Ratio test of each independent variable is summarized in Table 9. The table shows all the independent variables in the first column and their corresponding chi-square, degrees of freedom and significance in the
succeeding columns. The test shows the likelihood ratio of the overall contribution of each independent variable to the model. Since each independent variable or category is represented by several sub-categories, Table 9 only shows the result for each category that is treated as an omnibus test of that category. Using a threshold value of $\alpha = 0.05$, we can see that occupation ($p < 0.001$) and marital status ($p = 0.012$) are the only significant predictors of the model.

A comparison of the results provided for each sub-category is presented in the tables in Appendix O. The table shows the regression coefficients of each sub-category, $B$, as indicators on which sub-category are significant in predicting weekly travel frequency in relation to a reference category. In this case, the reference category is those that no longer travel. From a logical point of view, although there is an expected reduction in trip frequencies at the start of the pandemic, people have begun to travel more due to isolation in their homes for several weeks. As lockdown restrictions eventually eased, this translated to higher weekly travel frequencies. By setting "I no longer travel" as the reference category, changes in travel behavior when people have grown accustomed to the pandemic can be better compared. The odds ratio, $\text{Exp}(B)$, indicates the odds of a person to travel on a certain weekly travel frequency by a certain factor in relation to the reference category. For comparisons within socio-demographic and COVID-19-related questions, the last sub-category is the reference category.

Traveling one to two days a week. The parameter estimates of the multinomial logistic regression for traveling one to two days a week is

Table 9 only shows the result for each category that is treated as an omnibus test of that category. Using a threshold value of $\alpha = 0.05$, we can see that occupation ($p < 0.001$) and marital status ($p = 0.012$) are the only significant predictors of the model.
presented in Table 10. Among all the categories, sub-categories under employment status and household size are considered significant predictors. Under employment status, “student” is the reference subcategory; contractual employees ($B = -1.037$, s.e. $= 0.435$, $p = 0.017$), regular employees ($B = -1.646$, s.e. $= 0.455$, $p < 0.001$), self-employed ($B = -1.779$, s.e. $= 0.375$, $p < 0.001$) and students ($B = -1.104$, s.e. $= 0.518$, $p = 0.050$) were less likely to travel one to two days a week, in favor of no longer traveling. The odds ratio indicates that the odds a person travels one to two days a week when they are either contractual or regular employees, self-employed, or students is lesser by a factor of
Fig. 5. Comparison of weekly travel proportions before (BP) and during pandemic (DP) based on (a) gender, (b) age, (c) highest educational attainment, (d) employment status, (e) marital status, (f) monthly salary/allowance, (g) city of residence, (h) city of destination, (i) household members, and (j) household size.
Table 8

Test for multicollinearity of independent variables.

| Variables                      | Tolerance | Variance Inflation Factor |
|--------------------------------|-----------|---------------------------|
| Age                            | 0.564     | 1.772                     |
| Gender                         | 0.996     | 1.004                     |
| HEA                            | 0.814     | 1.229                     |
| Employment Status              | 0.807     | 1.239                     |
| Marital Status                 | 0.681     | 1.469                     |
| Monthly Salary                 | 0.696     | 1.438                     |
| City Residence                 | 0.993     | 1.008                     |
| City Destination               | 0.901     | 1.109                     |
| Household Members              | 0.895     | 1.117                     |
| Household Size                 | 0.990     | 1.011                     |
| Acquaintance COVID-19 Positive | 0.987     | 1.013                     |
| Neighbor COVID-19 Positive     | 0.995     | 1.005                     |
| COVID General Opinion          | 0.564     | 1.772                     |

Exp(B) = 0.354, Exp(B) = 0.193, Exp(B) = 0.169, and Exp(B) = 0.363, respectively, compared to the odds of those unemployed when all other sub-categories are held constant. Likewise, the sub-category under household size of more than 10 (B = -1.945, s.e. = 0.919, p = 0.034) is also a significant predictor in the model. The reference sub-category is one to two. The odds ratio indicates that a person traveling one to two days and coming from a household size above 10 decreases by a factor of Exp(B) = 0.143 compared to the odds of someone coming from a household of only 1 or 2, when all other sub-categories are held constant.

Traveling three to four days a week. The parameter estimates for traveling three to four days a week is presented in Table 11. The only sub-categories that are significant predictors are contractual (B = -1.437, s.e. = 0.451, p = 0.001) and regular employees (B = -1.402, s.e. = 0.371, p < 0.001) under employment status. The reference category is “unemployed.” The odds ratio indicates that the odds a person travels three to four days a week when they are either contractual or regular employees decreases by a factor of Exp(B) = 0.238 and Exp(B) = 0.246, respectively, compared to the odds of those unemployed, holding all other sub-categories constant.

Traveling five to six days a week. The parameter estimates for traveling five to six days a week are presented in Table 12. Just like traveling one to two days a week, a similar set of sub-categories are found to be significant predictors, with the addition of those earning PHP 10,000 and below under the monthly salary/allowance category. The significant predictors under employment status are contractual employees (B = -1.643, s.e. = 0.542, p = 0.002), regular employees (B = -1.292, s.e. = 0.532, p = 0.015) and self-employed (B = -1.806, s.e. = 0.445, p < 0.001), with unemployed as the reference sub-category. The odds ratio indicates that the odds of a person traveling five to six days a week when
they are either contractual or regular employees, or self-employed decreases by a factor of Exp(B) = 0.193, Exp(B) = 0.275 and Exp(B) = 0.164, respectively, compared to the odds of those unemployed when the rest of the sub-categories are held constant. For the monthly salary/allowance category, the only significant predictor is those earning PHP 10,000 or less (B = -1.283, s.e. = 0.193, Exp(B) = 0.632) compared to the odds of those unemployed when all other sub-categories are held constant. For household size, the only significant indicator is above 10 (B = -2.856, s.e. = 1.177, p = 0.015), with a household size of 1 or 2 as the reference sub-category. The odds ratio indicates that the odds of a person traveling five to six days a week when coming from a household size that is more than 10 decreases by a factor of Exp(B) = 0.057 compared to the odds of those coming from a household size of 1 or 2, when all other sub-categories are held constant.

**Traveling every day of the week.** The parameter estimates for traveling every day is presented in Table 13. The only significant predictor are college students (B = 1.182, s.e. = 0.550, p = 0.031) under highest educational attainment, with elementary as the reference sub-category. The odds ratio indicates that the odds of a person with a college degree that travels every day is higher by a factor of Exp(B) = 3.261 compared to those who have only elementary education or none, when all other sub-categories are held constant.

**Discussions and policy implications**

The COVID-19 global pandemic has caused major changes in the...
behavior of people in their lives and continues to do so. From the time the pandemic initially began until the current period, there are discernible changes in behavior as a means to deal or cope with the health crisis (Arafat et al., 2020; Yuen et al., 2020).

Changes in weekly travel

During the first few months at the start of the community lockdowns, there was a significant reduction in weekly travel frequency due to travel restrictions. When the community quarantine was finally lowered from ECQ to GCQ, and eventually MECQ in 2020, people began to travel more. While this study corroborates to some of the findings by Anwari et al. (2021), Irawan et al. (2021), and Aaditya and Rahul (2021) in terms of travel frequency, it should be noted that the focus on the changes in travel behavior of the residents in Metro Cebu is when people have started to adopt the new normal under the lowest community quarantine classification, a year after the initial lockdown. Trip frequency of residents in Metro Cebu has now averaged to three to four days a week, compared to pre-pandemic wherein the highest travel frequency was five to six days a week. As the current travel frequency normalizes to before the outbreak, is the current travel supply still sufficient? And while the current major reason for traveling is still for work, this study also revealed how leisure or recreation have become another major reason for people to travel. Compared to the first few months of the pandemic, it is observed that weekly travel frequency has become frequent. Although online classes and several work-at-home arrangements are still in effect, the reopening of businesses and establishments meant that employees and laborers need to go to work by traveling with public transport. This also meant that customers are now able to easily access these locations, especially since the prolonged home isolation has meant that employees and laborers need to go to work by traveling with public transport. This also meant that employees and laborers need to go to work by traveling with public transport. This also meant that employees and laborers need to go to work by traveling with public transport.
caused more people to go out of their homes (Miao et al., 2021). With the current government regulations in public transport operations, there is a wide margin between the increase in mobility needs of commuters and the limited supply of public transportation in light of maximum allowable passengers and health protocols (W. B. S. and P. R., 2020; Semilla, 2020). Considering that the COVID-19 pandemic is the first major outbreak in the country, and by anticipating the pattern of travel behavior during these times, necessary course of action can be prepared ahead by the LGU and the national government. Prioritization of socio-demographic groups that urgently need to travel can be provided with suitable transportation interventions. For example, LGUs may coordinate with currently operating businesses, companies and establishments to identify their laborers and workers, especially those who are earning below minimum wage, that need to commute for work. Public buses or other mass transport modes can then be subsidized by the government to shoulder worker’s fare, and a schedule of transport operations be developed to coordinate with the work schedule of the workers.

### Travel restrictions under community quarantine protocols

The results of this study also uncovered concerns over the purpose of travel. While Table 4 showed that the predominant reason for traveling during pandemic is to buy essentials, the second highest is for recreation. This contrasts the results regarding opinion and awareness about COVID-19, wherein almost 80% believe that COVID-19 is real, and almost 60% are aware or believe that their neighbor is positive of COVID-19. This can perhaps be explained by the continued decrease in cases of COVID-19 in Metro Cebu, along with the declaration of MEQ status in Metro Cebu since September 2020 until the present. Moreover, the long lockdowns and isolation have impacted the mental health of the...
people (Buenaventura et al., 2020; Khan et al., 2020) and going outside of their homes and traveling for leisure or recreation may have helped in its alleviation (Miao et al., 2021). The reoperation of businesses and transportation are once again restricted to operate, creating a vicious cycle. Travel restrictions under each community quarantine classification need to be reviewed that reflects the travel behavior of people.

Among the different socio-demographic characteristics of people residing in Metro Cebu, the weekly travel frequency is significantly predicted by employment status. Those who are employed, either contractual or regular, self-employed or students, are less likely to travel compared to those unemployed. This could be explained by the work-at-home arrangements, where those working or studying at home are preoccupied by their respective responsibilities in either work or school. The unemployed, however, may be focusing on menial tasks at home and could perhaps pursue other forms of activities to engage outside their residences. Another significant predictor is monthly salary or allowance, wherein those earning PHP 10,000 or less tend to travel less compared to those earning more than PHP 50,000. Because of limited

Table 13
Regression coefficients and odds ratio for traveling every day*.

| Category                                      | Sub-category                  | B      | Std. Error | Wald f. | d. value | Exp (B) | Confidence Interval |
|-----------------------------------------------|-------------------------------|--------|------------|---------|----------|---------|---------------------|
| Intercept                                     |                               | -1.423 | 1.645      | 0.746   | 1        | 0.388   | 22.477              |
| Age                                           | 18 to 26                       | 1.345  | 0.902      | 2.225   | 1        | 0.136   | 3.839               |
|                                               | 27 to 35                       | 1.248  | 0.863      | 2.091   | 1        | 0.148   | 3.485               |
|                                               | 26 to 44                       | 0.900  | 0.853      | 1.112   | 1        | 0.292   | 2.459               |
|                                               | 45 to 53                       | 0.695  | 0.871      | 0.636   | 1        | 0.425   | 2.003               |
|                                               | 54 to 60                       | 0.373  | 0.894      | 0.174   | 1        | 0.676   | 1.452               |
|                                               | Above 60**                     | 0.000  |            |         |          |         | 2.522               |
| Gender                                        | Male                          | 0.297  | 0.217      | 1.874   | 1        | 0.171   | 1.346               |
|                                               | Female**                      | 0.000  |            |         |          |         | 2.059               |
| Highest Educational Attainment                | High School                   | -0.498 | 1.017      | 0.230   | 1        | 0.631   | 0.614               |
|                                               | College                       | 1.182  | 0.550      | 4.627   | 1        | 0.031   | 3.261               |
|                                               | Technical/Vocational          | 0.567  | 0.420      | 1.826   | 1        | 0.177   | 1.763               |
|                                               | Graduate School               | 1.290  | 0.713      | 3.273   | 1        | 0.070   | 3.633               |
|                                               | Elementary**                  | 0.000  |            |         |          |         | 14.692              |
| Employment Status                             | Employee – Contractual        | -0.520 | 0.496      | 0.417   | 1        | 0.518   | 0.726               |
|                                               | Employee – Regular            | -0.771 | 0.524      | 2.166   | 1        | 0.141   | 0.463               |
|                                               | Self-Employed                 | -0.773 | 0.434      | 3.175   | 1        | 0.075   | 0.461               |
|                                               | Student                       | -0.393 | 0.595      | 0.436   | 1        | 0.509   | 0.675               |
|                                               | Unemployed**                  | 0.000  |            |         |          |         | 2.166               |
| Marital Status                                | Single                        | -0.015 | 0.663      | 0.000   | 1        | 0.983   | 0.968               |
|                                               | Married                       | 0.638  | 0.618      | 1.065   | 1        | 0.302   | 1.893               |
|                                               | Common-Law                    | 0.312  | 0.839      | 0.139   | 1        | 0.710   | 1.367               |
|                                               | Widow/Widower**               | 0.000  |            |         |          |         | 7.078               |
| Monthly Salary/Allowance in PHP (in USD)      | 10,000 and below (200.00 and below) | -0.471 | 0.607      | 0.602   | 1        | 0.438   | 0.625               |
|                                               | 10,000 to two0,000 (200.01 to 400.00) | -0.141 | 0.554      | 0.065   | 1        | 0.799   | 0.869               |
|                                               | 20,001 to 30,000 (400.01 to 600.00) | -0.128 | 0.542      | 0.055   | 1        | 0.814   | 0.880               |
|                                               | 30,001 to 50,000 (600.01 to 1,000.00) | -0.113 | 0.546      | 0.043   | 1        | 0.836   | 0.893               |
|                                               | Above 50,000 (Above 1,000.00)** | 0.000  |            |         |          |         | 2.603               |
| City of Residence                             | Cebu City                     | 0.121  | 0.286      | 0.180   | 1        | 0.672   | 1.129               |
|                                               | Lapu-Lapa City                | 0.377  | 0.372      | 1.026   | 1        | 0.311   | 1.458               |
|                                               | Mandaue City**                | 0.000  |            |         |          |         | 3.025               |
| City of Destination                           | Cebu City                     | -0.146 | 0.313      | 0.219   | 1        | 0.640   | 0.864               |
|                                               | Lapu-Lapa City                | -0.026 | 0.468      | 0.003   | 1        | 0.955   | 0.974               |
|                                               | Mandaue City**                | 0.000  |            |         |          |         | 2.438               |
| Household Members                             | Alone                         | -0.065 | 0.492      | 0.018   | 1        | 0.894   | 0.937               |
|                                               | With Family, Relatives or Partner | 0.733 | 0.735      | 0.993   | 1        | 0.319   | 2.080               |
|                                               | With Friends                  | -0.714 | 0.804      | 0.789   | 1        | 0.374   | 0.489               |
|                                               | With Workmates**              | 0.000  |            |         |          |         | 2.367               |
| Household Size                                | three to four                 | 0.415  | 1.030      | 0.163   | 1        | 0.687   | 1.515               |
|                                               | five to six                   | -0.346 | 0.949      | 0.133   | 1        | 0.715   | 0.707               |
|                                               | 7 to 8                        | -0.545 | 0.933      | 0.342   | 1        | 0.559   | 0.580               |
|                                               | 9 to 10                       | 0.058  | 0.925      | 0.004   | 1        | 0.950   | 1.059               |
|                                               | Above 10                      | -1.873 | 1.129      | 2.754   | 1        | 0.097   | 1.154               |
| Acquaintance positive of COVID-19             | Yes                           | -0.160 | 0.218      | 0.538   | 1        | 0.463   | 0.852               |
|                                               | No**                          | 0.000  |            |         |          |         | 1.307               |
| Neighbor positive of COVID-19                 | Yes                           | 0.090  | 0.219      | 0.168   | 1        | 0.682   | 1.094               |
|                                               | No**                          | 0.000  |            |         |          |         | 1.681               |
| COVID Belief                                  | COVID-19 is real              | 0.355  | 0.445      | 0.637   | 1        | 0.425   | 1.427               |
|                                               | Uncertain                     | -0.336 | 0.516      | 0.425   | 1        | 0.515   | 0.714               |
|                                               | COVID-19 is not**             | 0.000  |            |         |          |         | 1.965               |

* Weekly travel frequency reference category is “No longer travel.” ** Reference category within socio-demographic and COVID-19-related sub-categories.
transportation to minimize viral transmission and avoid reverting back. Lastly, a person living in a large household size is also another significant predictor and tend to travel less on a weekly basis compared to those living alone or with another person. Large households are known to be common especially in urban areas such as Metro Cebu, with household members sometimes including both nuclear and extended family (Medina and de Guzman, 1994; Lanaria, 2013). Because the risk of viral transmission is higher in larger households (Martin et al., 2020), it is understandable why those living there showed a tendency to reduce travel frequency. This was manifested during the first few months since the pandemic began wherein two barangays, majority of its residents being informal settlers with houses adjacent each other, were placed under total lockdown due to the rapid increase in cases (Letigio, 2020).

Despite the on-going COVID-19 pandemic and the slow rollout of vaccines, there is still high preference for non-essential travel among Metro Cebuanos. Although the government has deployed military personnel at the start of the pandemic, their gradual departure when community quarantine levels were lowered have driven people to travel like how they used to before pandemic. While the virus may be difficult to eradicate, promotion and enforcement of hygiene and sanitation by the government cannot be stressed enough to minimize transmission, especially in informal public transport modes. This is an opportunity for policy makers to provide better strategies to enforce and maintain minimum health standards.

Conclusions

This study assessed the changes of travel behavior of Metro Cebuanos during the COVID-19 pandemic. A comparison of weekly travel frequency before and during pandemic was conducted to represent the changes in travel behavior. Socio-demographic factors and questions pertaining COVID-19 were used as references in comparing the changes in weekly travel frequency.

The results of this study offer useful inputs to policymakers in developing countries that share similar attributes and characteristics with Metro Cebu. It is evident in the findings that a substantial proportion of the population classified under low-income groups or blue-collar workers have a high demand for travel due to economic reasons. Moreover, the prolonged home isolation has motivated the people to travel more once restrictions eased, which translated to higher travel frequencies for leisure or recreation. Thus, it is imperative that the government enforce a stricter implementation of health protocols in transportation to minimize viral transmission and avoid reverting back to a higher community quarantine classification. This can be imposed through higher penalization of violators of improper or non-usage of face masks for commuters, and non-compliance of 50% maximum passenger capacity for public transport operators. In conjunction, more enforcers should be visible in dense areas and high foot traffic within the curfew hours. A similar approach can be applied to violation for traveling beyond curfew hours for non-essential travel.

As the conduct of this study is exploratory, it is one of its limitations. Prospective studies may use other techniques to better capture the changes in travel behavior. Because the survey instrument was administered as a self-assessment of respondents, travel behavior was only gauged through weekly travel frequencies and purpose of travel. Future studies may introduce more indicators as basis in evaluating travel behavior.

Another limitation of the study is the distribution of the online survey questionnaires through snowball technique, which is a non-probabilistic approach. It is important that the responses of the participants are as accurate as they can recall since the start of the pandemic. In this notion, the deployment of the survey questionnaires was to be done the soonest. Distribution of the questionnaires were done through social media channels. Though snowball sampling promotes faster response turnover, representation of each socio-demographic factor may be underrepresented: because the technique involves the referral of questionnaires to friends, family or acquaintances, the samples may not be representative.

Finally, the use of the internet to distribute online survey may limit the responses of those who have no access to mobile phones or personal computers, or internet connection. However, given the global health crisis, online deployment was the best option. Further studies can validate the findings of this study and include more responses that were underrepresented.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Appendix B

Appendix C

Appendix D

Appendix E

Appendix F

Appendix G

Appendix H

Appendix I
Office of the Mayor of Lapu-Lapu City, Executive Order No. 2020-048 An Executive Order Implementing Enhanced Community Quarantine in the City of Lapu-Lapu and Providing Guidelines Thereto. Philippines, 2020.

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