Effects of Change of Socialising and Discretionary Trips, and Activities During COVID-19 Pandemic on Social and Mental Health

by

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Dissertation submitted in partial fulfilment of

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Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

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SERI ISKANDAR, PERAK

January 2022

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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ABSTRACT

In order to analyse the complexity of travel behaviour, activity pattern study which is one of the human activity approaches which includes social science perspective has been implemented in this study to alleviate the limitations in traditional concept. The first objective of this study is to correlate the effects of change of socialising and discretionary trips during COVID-19 pandemic on social and mental health using bivariate analysis. Secondly, to correlate the effects of change of socializing and discretionary trips, and activities during COVID-19 pandemic on social and mental health using multivariate analysis. The bivariate and multivariate analysis used dataset extracted from 'Survey on Effects of COVID-19 Pandemic on Travel Behaviour in Malaysia' which containing information on daily different individuals' travel and activity pattern before and after COVID-19 pandemic in Malaysia and health-related quality of life (QOL) questions to determine the relationship between the variables. Based on the comparison of overall activity travel participation between weekdays and weekends using bivariate analysis, it is concluded that socialising and discretionary trips during weekdays have stronger impact towards our social and mental health during COVID-19 pandemic. Based on the multivariate analysis, only dining trips is significant towards social health. In addition, online shopping is found to impact both social and mental health model, while online grocery shopping is affecting mental health model only. In a nutshell, COVID-19 pandemic caused an activity-travel behavior changes specifically in out-of-home travel participations and in-home activities converging on socialising and discretionary purposes. For future work, it is suggested to incorporate individuals time-use diary over a time period in the dataset and evaluate health as three factor structure which are physical, social and mental health.

ACKNOLEDGEMENTS

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ABBREVIATIONS AND NOMENCLATURES

PKP - Movement Control Order (MCO): *Perintah Kawalan Pergerakan (PKP)*

PKPP - Conditional Movement Control Order (CMCO): *Perintah Kawalan Pergerakan Bersyarat (PKPB)*

QOL - Quality of Life

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CHAPTER 1

INTRODUCTION

1.1   Background of Study

1.1.1   Travel during COVID-19 Pandemic

The Coronavirus Disease 2019 (COVID-19) is a worldwide pandemic, according to the World Health Organization (2019), with the first case reported in Wuhan, Hubei Province, China, in late December 2019 (Zhu, et al., 2020 as cited in Irawan, et al., 2021). As a measure to inhibit the spreading of SARS-CoV-2 which is virus that causes COVID-19, 'lockdowns' as a term that is frequently used in both local and international media are implemented in most countries as a response in ensuring the health safety of the populations. According to Minister of Health Malaysia (2022), as data of 1st March 2022, the total confirmed COVID-19 cases in Malaysia has reached 3, 420, 138 cases.

Since former Malaysian Prime Minister, Tan Sri Muhyiddin Yassin declared the implementation of the Movement Control Order (MCO) on March 16, 2020 which applied to all states in Malaysia, many standards have been established under the Prevention and Control of Infectious Diseases Act 1988 ("the Act") to control and prevent the spread of COVID-19 (Fan & Cheong, 2020). The MCO was prolonged and eased to a few stages in 2020 and 2021, including the Conditional Movement Control Order (CMCO) and Recovery Movement Control Order (RMCO) (Wikipedia, 2021). The timeline of MCO, CMCO and RMCO are shown in **Table 1.1**.

TABLE 1.1: Timeline of MCO, CMCO and RMCO (Wikipedia, 2021)

Phase	Date
Movement Control Order (MCO) *Perintah Kawalan Pergerakan (PKP)* **(18 March 2020 - 3 May 2020)**	
Phase 1	18 March 2020 - 31 March 2020
Phase 2	1 April 2020 - 14 April 2020
Phase 3	15 April 2020 - 28 April 2020
Phase 4	29 April 2020 - 3 May 2020
Conditional Movement Control Order (CMCO) *Perintah Kawalan Pergerakan Bersyarat (PKPB)* **(4 May 2020 - 9 June 2020)**	
Phase 1	4 May 2020 - 12 May 2020
Phase 2	13 May 2020 - 9 June 2020
Recovery Movement Control Order *Perintah Kawalan Pergerakan Pemulihan (PKPP)* **(RMCO, 10 June 2020 - 31 March 2021)**	
Phase 1	10 June 2020 - 31 August 2020
Phase 2	1 September 2020 - 31 December 2020
Phase 3	1 January 2021 - 31 March 2021

Social health relates to individuals' ability to engage and develop meaningful relationships with others (George, 2022) while mental health includes individuals' social well-being, psychological and emotional (U.S. Department of Health & Human Services, 2020). Travel restrictions that implemented as a safety measure to promote social distancing in order to minimize health hazards caused by COVID-19 has estimated to give negative effects on individuals' social and mental health as both variables' definitions correlated with each other. Social distancing could undermine the social rhythm, by depriving individuals' habitual coping responses with stress (Shanmugam, Juhari, Nair, Ken, & Ng, 2021) as daily travel participation especially in socialising and discretionary trips are limited during the pandemic.

Certain activities are considered to be more pleasurable, including socialising and recreation or leisure activities, which are deemed to have a positive impact on people's everyday well-being (Kahneman, D., et al., 2004 as cited in Ramli & Dharmowijoyo, 2018). The online activity participations covered in this study are work or school from home, online grocery shopping, online shopping, online meeting, food delivery and streaming movies. Meanwhile, this study also focuses on analysing travel participation in socialising and discretionary trips which the examples are shown in **Figure 1.1**. Socialising trips are associated with trip purposely for social engagement with others such as visiting families, relatives or friends. While discretionary trips are trips for non-mandatory activities which can be re-scheduled at a high level of flexibility such as religion/civic services and hobbies.

Examples of Socialising and Discretionary Trips

1) Visiting
2) Religion/civic services
3) Amusement outside home
4) Hobbies
5) Exercise/athletics/sport
6) Shopping
7) Healthcare
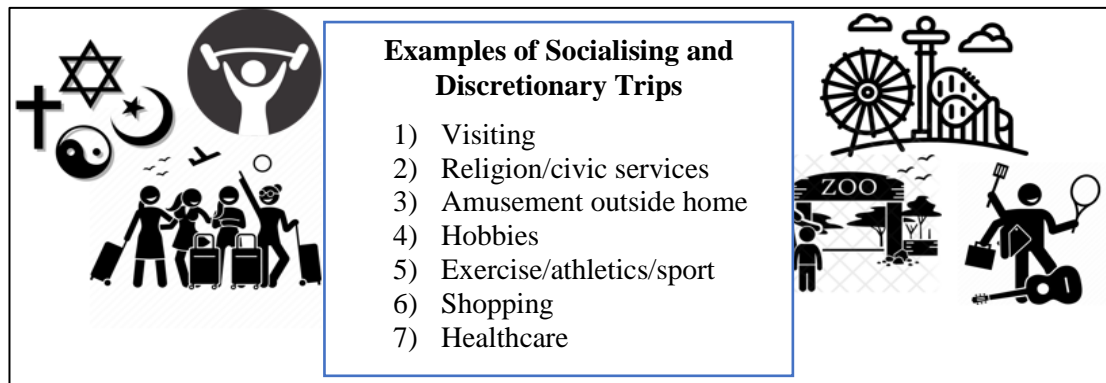
FIGURE 1.1: Examples of socialising and discretionary trips

During COVID-19 pandemic, travel is minimized mainly due to authority constraints (law enforcement such as lockdown and mobility restriction policies) and individuals' perceived risk towards COVID-19. During COVID-19 pandemic, due to the authority constraint where there are limitations on travel due to the government's restrictions, individuals cannot travel and participate in different activities on a given day which may affect their social and mental health. High perceived risks of COVID-19 also play a huge role in reducing travel and activity participation during the pandemic. Based on study conducted in Indonesia which investigates the respondent attitudes and perspectives towards COVID-19, almost all of the respondents tended to have a strong perception towards COVID-19, with more than 96% of them thinking the pandemic is dangerous or extremely dangerous (Rizki, et al., 2020). As a result, individuals will reduce daily travel frequency due to the fear of infection.

1.1.2 Human Activity Approach to Replace the Traditional Concepts

The application of social science in transportation field indicates an affirmation where transportation runs throughout a broader societal framework, including various approaches to impacts, costs and transportation modes. In traditional approaches of studying travel behaviour, travel is assumed to be a choice process. This is incorrect because in time-space-prisms, a circumstance in which travel is a fixed constraint, the choice element is eliminated. The traditional approach also assumes that all individuals engage in identical daily activities and travel. Therefore, the traditional concepts approach only valid to travel behaviour of homogeneous population groups (Senbil and Kitamura, 2009 as cited in Dharmowijoyo D. B., 2016). This concept disregards the fact that all individuals have different social and personal identities in social-cultural, geographical and economic aspects across time-space-prisms.

Activity pattern studies is more extensive because it takes account the demand for travel and activity participation as series of responses from social responsibility, biological needs, or the consequences due to the living environment itself (Fox, 1995). In activity pattern studies which implemented in this study, activity and trips participation amid a time budget are translated to activity-travel pattern which used as the unit of analysis of activity-based models to investigate individuals' travel behaviour to alleviate the limitations in traditional concept.

The main weakness of the traditional approach is it does not provide relation between non-travel and travel context of ever day's life or the "secondary effects" on members of the household are not directly afflicted by the trip (Fox, 1995). However, in the human activity approach, it recognizes household organization as a fundamental concept in understanding travel behaviour. It views travel in context of everyday household activity patterns, where each individual or group uses travel as a derived demand. It includes relation and linkages among members of the household, as well as explicit consideration of temporal, interpersonal and spatial constraints on travel and location options.

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1.2   Problem Statement

Over the past years, the advancement of transportation field introduced new extensive comprehensions in analysing the complexity of travel behaviour. The traditional approach which considered as one of the conventional models, pay only lip-service to the idea that travel is a derived demand and it fail to recognize the basic forces which generate travel and the numerous characteristics of travel, such as timing, duration of journey, mode, frequency, route selection and destination (Burnett and Thrift, 1979 as cited in Fox, 1995). Activity pattern study which is one of the human activity approaches, is considered more accurate in explaining individuals' travel behaviour compared to traditional approaches as the traditional approaches only recognize travel behaviour in mobility phenomena by considering only one-way trips. Therefore, in order to improve previous research related to topic, this study incorporates the activity pattern study to alleviate the weaknesses of the traditional approach. The data analysis method will include household and individual socio-demographic characteristics in order to recognize non-homogeneity of travel behaviour between individuals. It will also include daily different individuals' travel pattern and activity participation during and before COVID-19 pandemic in Malaysia and health-related quality of life (QOL) questions which derived based on the Short-Form 36 (SF-36) to correlate effects of change of socialising and discretionary trips, and activities during COVID-19 pandemic on social and mental health.

Considering the recentness of COVID-19 pandemic, to the author's knowledge, there is only minimal amount of research study which relates travel pattern and activity participation changes due to the pandemic with social and mental health in Malaysia. Since socialising and discretionary trips tend to correlate on better well-being and social and mental health (Dharmowijoyo & Joewono, 2020), the findings of this study may provide a better understandings and insight in establishing new policies on COVID-19 travel restrictions as transport and health are interrelated at many levels with transport directly and indirectly influencing health (Zhang, 2013). This study will investigate the effects of change of socialising and discretionary trips, and activities during COVID-19 pandemic on social and mental health, while incorporating the complexity of travel behaviour which is missing traditional approaches.

1.3   Objectives

The objectives of this project are as follows:

1. To correlate the effects of change of socializing and discretionary trips during COVID-19 pandemic on social and mental health using bivariate analysis

2. To correlate the effects of change of socializing and discretionary trips, and activities during COVID-19 pandemic on social and mental health using multivariate analysis

1.4   Scope of Study

Scope of study covering the understanding of the relationship between travel behaviour and social and mental health. This study only focusses on individuals travel pattern before and during COVID-19 pandemic. Even though there are variety of types of trips, this study converged only on socialising and discretionary trips. Meanwhile, the online activities participation covered in this study are work or school from home, online grocery shopping, online shopping, online meeting, food delivery and streaming movies. Individuals' change in activity-travel behaviour during COVID-19 pandemic and health-related quality of life (QOL) questions will be analysed using bivariate and multivariate analysis in determining his or her level of social and mental health. However, this study only recognized health as social and mental health without incorporating physical health.

CHAPTER 2

LITERATURE REVIEW

2.1   Time-Space-Prism

In time geography, Hägerstrand developed the time-space-prism which describes the theory in sociology and social-psychology into geography science. The time-space-prism which shown in **Figure 2.1** encompasses the temporal and spatial potential for activity and travel participation within a time budget (Feixiong, 2019). According to the time-space prism concept, an individual retains multiple characteristics in multiple dimensions, comprising personal, social, household and spatial dimensions (Dharmowijoyo & Joewono, 2020). Individual's multiple characteristics will interact within its multiple dimensions to form needs and constraints which will shape their everyday activity-travel participations. Since everyone has different daily needs and constraints, every individual's everyday decision-making process and activity-travel participations would be also different. This uniqueness justifies the reasoning on why every individual would have different daily time-space prisms with others. Hägerstrand recognised some constraints that may limit people's ability to travel and participate in activities (Miller, 2003). Capability, coupling, and authority constraints are the three types of constraints identified by Hägerstrand. Capability constraints limits the individual's ability to participate in activity and travel in time-space-prism. As an example, our daily travel and activity participation are limited as we need to spend a portion of our daily time budget to meet our physiological needs such as eating, sleep and personal care. Coupling constraints limit individuals' decisions due to the necessity to be in same location and time to engage with other individuals or materials. Authority constraints associate with limitations that are imposed by authorities who have control and influence over any given individuals.
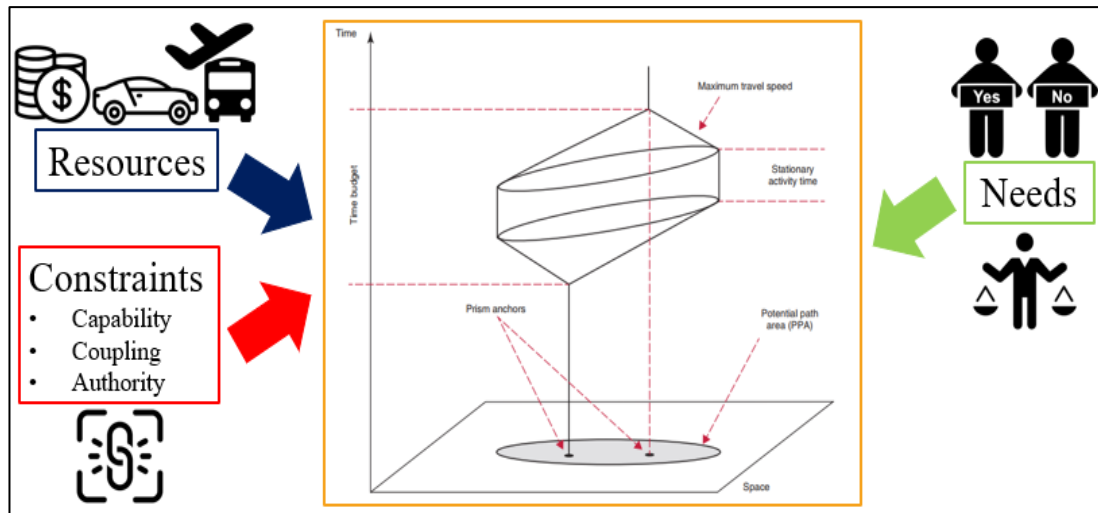
FIGURE 2.1: Time-Space-Prism

Example of resources in time-space prism are travel mode options, money and built environment. The lack of or availability of these resources may also be linked to dissimilar activity-travel behaviour (Dharmowijoyo D. B., 2016). Mobility poverty (such as demonstrated by fewer trips and trip chains and lower total travel time) and less discretionary trips, including for social engagement and visiting public amenities (Dharmowijoyo, Susilo, & Syabri, 2020) are results from lacks resources in time-space prism which usually faced by individual with lower income.

Human activity patterns represent the means by which people fulfil individual's desires and needs (Chapin, 1974 as cited in Fox, 1995). Needs can be categorized into two groups. Firstly, subsistence needs (food, sleep, clothing, health care, shelter), plus activities which supply financial income to cover fundamental human needs (Fox, 1995). Secondly, needs which included individually, socially and culturally defined needs. For example, activities that entails participation in a variety of social and recreational engagement such as out-of-home family dining trips and hobbies.

Individuals' prisms and paths would be shaped by the interaction between constraints and needs due to personal and social identities in social-cultural, economic and geographical contexts across time-space prism. (Dharmowijoyo D. B., 2016) as shown in **Figure 2.2** and it is a fundamental concept to grasp in order to have a better comprehension of individual's daily activity-travel pattern.
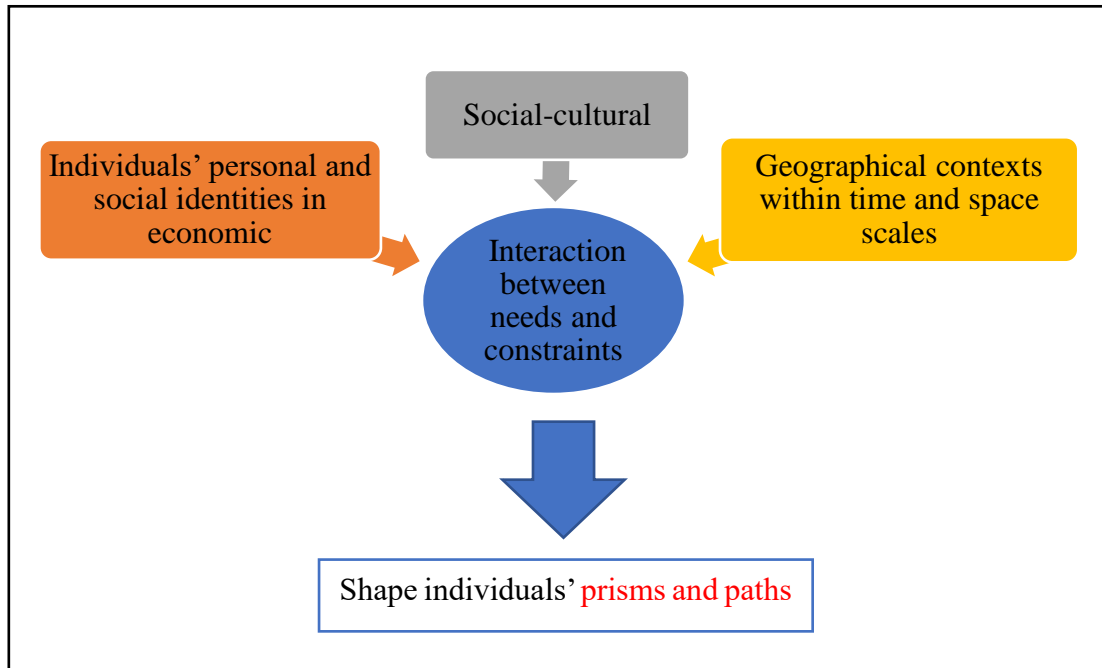
FIGURE 2.2: Interaction between needs and constraints in Time-Space-Prism

2.2 Linkage Between Travel Behaviour and Social and Mental Health

In explaining the relation between travel behaviour and social and mental health, it is crucial to recognize the intermediate parameters involved within the particular causal effect relationship which proposed as shown in **Figure 2.3**. In time-space-prism, individual's travel behaviour in travel and activity participation correlate with needs, constraints and availability of resources.
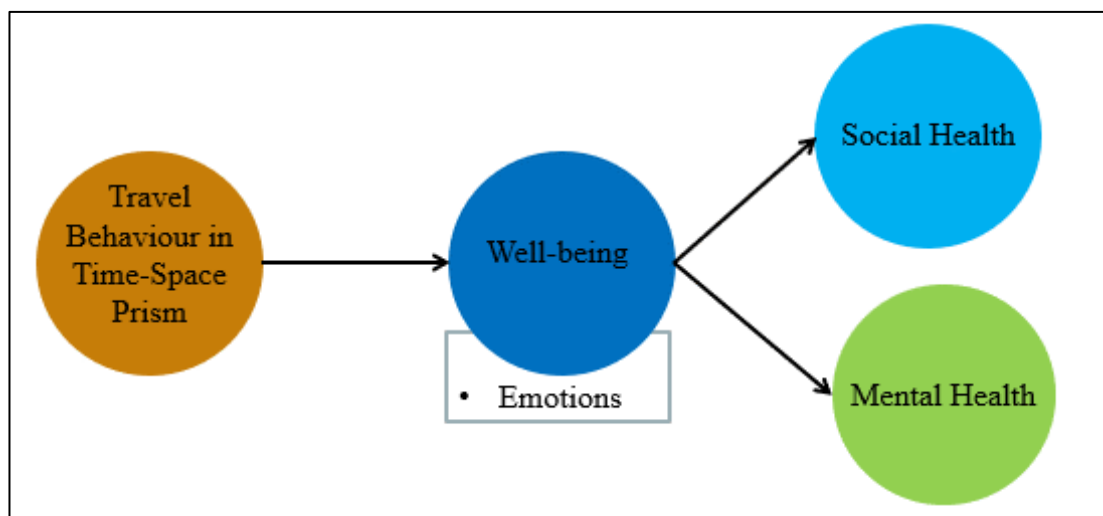
FIGURE 2.3: Relation between travel behaviour in time-space prism and social and mental health

Travel behaviour such as travel mode, number of trips chains and duration of trips as shown in **Figure 2.4** will affect well-being because while travelling as travelers are exposed to their surroundings environment which may stimulate emotional responses and lead to a particular mood (Wee & Ettema, 2016). As an example, different modes of transportation provide variety of travel experiences, levels of interaction with the outside environment and levels of physical activity. Therefore, their influence on individual's mood or emotions is likely to differ. Individuals who use public transport such as public bus in a metropolis city as travel mode during peak hours to a certain location, may exposed to road congestion whereby it is causing the individual to move at a slower speed, longer trip duration and increased vehicular queueing. As a result, he or she may experience negative emotions such as irritated or annoyed. If aggregated, and especially in the context of repetitive trips, such responses

will have negative impact on an individual's social and mental health. During COVID-19 pandemic, the out-of-home activity restrictions are also found to influence individuals' subjective well-being and consequently mental health, as some of the activities are essential to maintain or enhance their well-being (Ettema et al. 2010 as cited in Rizki, et al., 2020).
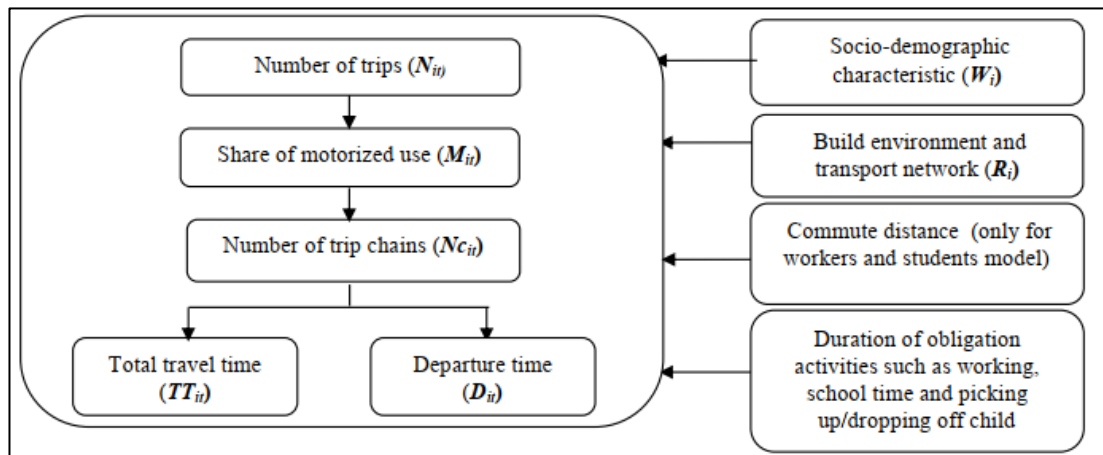
FIGURE 2.4: Interaction among individuals activity travel behaviour
(Dharmowijoyo D. B., 2016)

A person-centred analysis shown that in developing countries, individuals who have a more balanced life, with enough time spent for active leisure/travel, leisure activities, work/school and sleeping have better physical, mental, and social health (Hunt et al., 2015 as cited in Dharmowijoyo, 2016). This shows that theoretically, in order to have a better social and mental health, individuals need to have more frequent leisure and social engagement associated with higher time spent and number of activities and trips which correlated to our social and well-being needs. In a study conducted to study the impact of people's transportation-related social inclusion due to the duration of their activities, built environment, travel characteristics and socio demographics as shown in **Figure 2.5** in Bandung, Indonesia, it reveals that individuals with higher social inclusion index are more likely to have longer time spent for out-of-home discretionary trips during weekday (Dharmowijoyo & Joewono, 2020). Higher social inclusion index may indicate a better social and mental health.
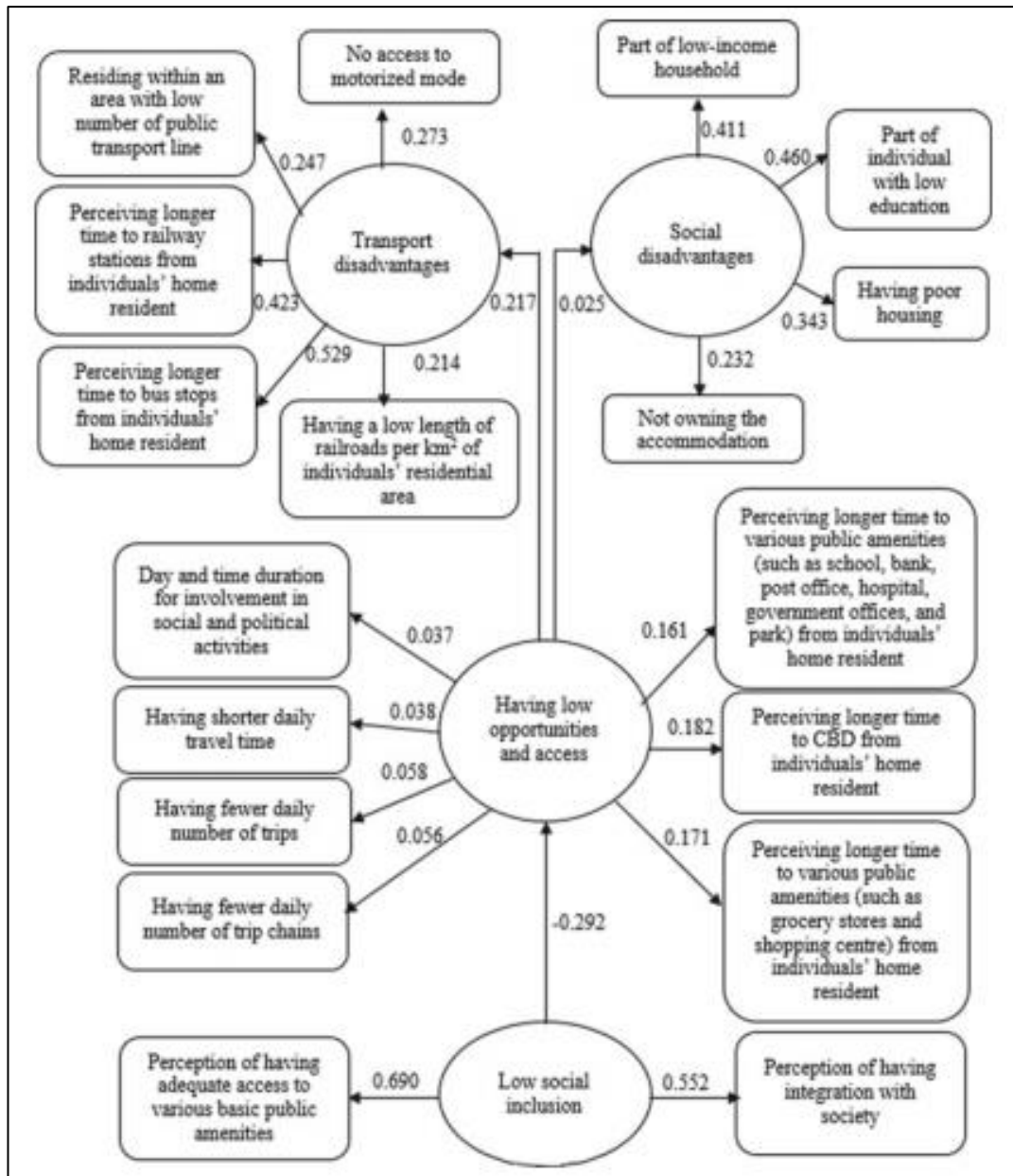
FIGURE 2.5: Factor loadings of the observed variables used to estimate the Social
Inclusion Index (Dharmowijoyo & Joewono, 2020)

2.2.1 Evaluation of Social and Mental Health Based on Health-Related Quality of Life (QOL) Indicators

Several common approaches for evaluating health-related QOL have been developed. Among these methods, Short-Form 36 (SF-36) is one of the most commonly used generic health-related QOL measures and adopted by more than 110 countries (Zhang, 2013). The Short Form-36 was designed from the General Health Survey of the Medical Outcomes Study by Stewart and colleagues (Ware and Sherbourne, 1992, and McHorney et al., 1993 as cited in Zhang, 2013). There are eight subscales that comprehended in SF-36 as shown **in Figure 2.6** which are physical functioning (PF), bodily pain (BP), limitations on role functioning because of physical health (RP), mental health (MH), general health (GH), social functioning (SF), vitality (VT) and limitations on role functioning because of emotional problems (RE). These eight subscales are used as a health-related QOL to measure health, consist of physical, social and mental health.
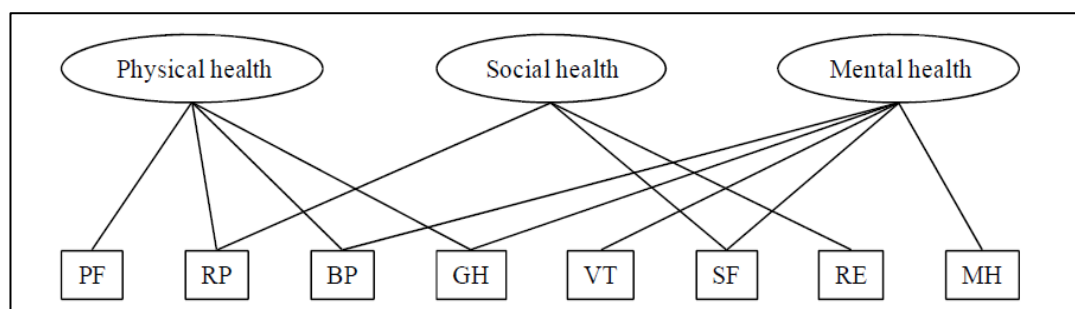
FIGURE 2.6: Health-related QOL with three-factor structure (Zhang, 2013)

In this project, the questionnaire design which containing information on daily different individuals' travel pattern and activity participation before and after COVID-19 pandemic in Malaysia and health-related quality of life (QOL) questions was derived to study the relationship between change in travel and activity pattern, specifically in socialising and discretionary trips and social and mental health.

2.3 Existing Studies Related to Travel Behaviour during COVID-19 Pandemic

According to a study that used instantaneous data from Taiwan's Taipei Metro System to investigate the effects of the COVID-19 outbreak on metro use, the effects of the COVID-19 is more significant during weekend compared weekday as shown in **Figure 2.7**. From the analysis of the data, one COVID-19 case reduced metro use by 1.2% and 3.04% during weekdays and the weekdays respectively (Chang, Lee, Yang, & Liou, 2021). From the analysis of daily ridership in metro station located near to leisure and entertainment areas, the recreational leisure trips decrease in both during weekend and weekdays. This is due to perceived factors of population whereby they intended to reduce their recreational leisure trips in response to the fear of infection (Chang, Lee, Yang, & Liou, 2021).

Variable	Panel A. use subsample for weekdays				
	Coefficient		S.E	Coefficient		S.E
COVID19	−0.023	***	0.003			
Magnitude[#1]	−1.20%					
COVID19_cum				−0.003	***	0.000
Magnitude[#1]				−0.18%		
Other variables	Yes			Yes		
Adjusted R^2	0.655			0.655		
N*T	25,272			25,272		
	Panel B. use subsample for weekend				
Variable	Coefficient		S.E	Coefficient		S.E
COVID19	−0.063	***	0.012			
Magnitude[#1]	−3.04%					
COVID19_cum				−0.005	***	0.001
Magnitude[#1]				−0.26%		
Other variables	Yes			Yes		
Adjusted R^2	0.628			0.628		
N*T	13,608			13,608		

Note: The dependent variable is the number of metro trips (in 10,000). #1: The magnitude of the effect is evaluated at the sample mean of metro trips in the pre-COVID-19 period (2017–2019). #2: All other variables can be found in Table 3. ***, **, * indicates statistical significance at the 1%, 5%, and 10% levels.

FIGURE 2.7: Estimation result of the metro trip equations by weekday and weekend (Chang, Lee, Yang, & Liou, 2021)

In a study investigating activity-travel behavior change due to COVID-19 in Australia, it is shown that the outbreak distorted the respondents' out-of-home activities such as shopping, social activities, and dining trips by 76%, 80%, and 76%, respectively (Beck and Hensher, 2020 as cited in Irawan, et al., 2021). In a study which aiming to examine the change in activities and associated travel during the beginning of COVID-19 pandemic in Indonesia, the results demonstrated 71.28% and 15.82% of the respondents reported their travel reductions as "very significant" and "significant," respectively (Irawan, et al., 2021). Focusing on socialising and discretionary trips, result from the data analysis showing that sightseeing and dining trips also decreased from at least three times to once a week during the pandemic (Irawan, et al., 2021). In addition, average number of social and shopping trips reduced substantially, from two to one and three to twice weekly (Irawan, et al., 2021).

In more extensive study conducted in Indonesia which investigates the effect of imposed experiences during the outbreak on travel behaviour changes during new-normal, most respondents from the online questionnaire irritated (4.19), dull (3.94), worried (3.81), tired (3.25) and annoyed (3.23) during the outbreak (Rizki, et al., 2020) as shown in **Figure 2.9**. This indicates most of the respondents have negative emotions due to the COVID-19 pandemic and this may affect their social and mental health. From the multinominal logistic regression of the data, the difference in frequency of travel during and before COVID-19 decreases for out-of-home activities with varied value of t-stat coefficients are shown in **Figure 2.10** and thus, we can conclude that out-of-home dining trips, recreational trips and social trips decreases during the outbreak. Based on **Figure 2.10**, all types of online in-home activity are significant with positive coefficient indicating its frequency increased during COVID-19 pandemic.

Emotional/affective subjective well-being		
Negative valence		
Displeased experiences	3.06	1.136
Deactivation		
Passive	2.98	1.239
Dull	3.94	1.059
Unpleasant activation		
Frustrated	2.79	1.060
Annoyed	3.23	1.081
Irritated	4.19	.966
Worried	3.81	.915
Unpleasant deactivation		
Depressed	2.64	1.026
Tired	3.25	1.072

FIGURE 2.8: Respondents emotions/affective well-being (Rizki, et al., 2020)

Type of Trips	Frequency of travel before COVID-19 (trips/week)		Frequency of travel during COVID-19 (trips/week)		Difference in frequency of travel during and before COVID-19		
	Mean	SD	Mean	SD	Mean	SD	t-stat
Work/school trips	6.7	3.309	2.77	2.84	-3.93	3.688	-26.024**
Grocery shopping trips	3.78	2.405	2.58	1.686	-1.2	2.121	-11.791**
Electronics/ fashion shopping trips	2.12	1.726	1.41	1.085	-0.71	1.59	-10.074**
Out-of-home dining trips	3.4	2.385	1.45	1.33	-1.95	2.372	-20.631**
Recreation trips	2.76	1.99	1.36	1.17	-1.4	1.976	-17.462**
Social trips	3.59	2.458	1.89	1.63	-1.7	2.245	-16.624**
Type of Online In-home Activity	Frequency of online in-home activities before COVID-19 (trips/week)		Frequency of online in-home activities during COVID-19 (trips/week)		Difference in frequency of online in-home activities during and before COVID-19		
	Mean	SD	Mean	SD	Mean	SD	t-stat
E-meeting/e-learning	2.28	2.351	5.49	3.782	3.21	3.743	20.786**
Grocery e-shopping	2.16	1.729	2.89	2.166	0.73	1.842	7.583**
Electronic/fashion e-shopping	1.8	1.433	2.07	1.769	0.27	1.418	3.377**
Online delivery food/drinks	3.67	2.577	3.8	2.8	0.13	2.652	1.019
Entertainment activities	4.51	3.554	6.4	3.597	1.89	2.931	10.799**

**significant at 5%, *significant at 10%

FIGURE 2.9: Travel-activity changes during the outbreak (Rizki, et al., 2020)

CHAPTER 3

METHODOLOGY

3.1 Research Methodology

This project will be investigating the relationship between change of socialising and discretionary trips, and activities during COVID-19 pandemic on social and mental health. The independent variables of this study which is the change of socialising and discretionary trips, and activities during COVID-19 pandemic, obtained from the survey conducted in the previous study entitled 'Survey on Effects of COVID-19 Pandemic on Travel Behaviour in Malaysia' datasets. The datasets consist of collected information on daily different individuals' activity travel pattern and participation before and after COVID-19 pandemic in Malaysia.

In the data analysis, the Statistical Package for the Social Scientist (SPSS) software were used in carrying out the bivariate and multivariate analysis. Since the dependant variable, social and mental health are not quantitative elements, health-related quality of life (QOL) questions based on the Short-Form 36 (SF-36) was developed in the questionnaire design. Therefore, the state of social and mental health will be measured by carrying out factor score analysis incorporating the variables that are used to estimate mental and health indices as shown in **Figure 3.1**. In the data analysis, analysis of variance (ANOVA) and linear regression were chosen to investigate the empirical relationship between change of socialising and discretionary trips, and activities during COVID-19 pandemic on social and mental health. The methodology flowchart is shown in **Figure 3.2**.
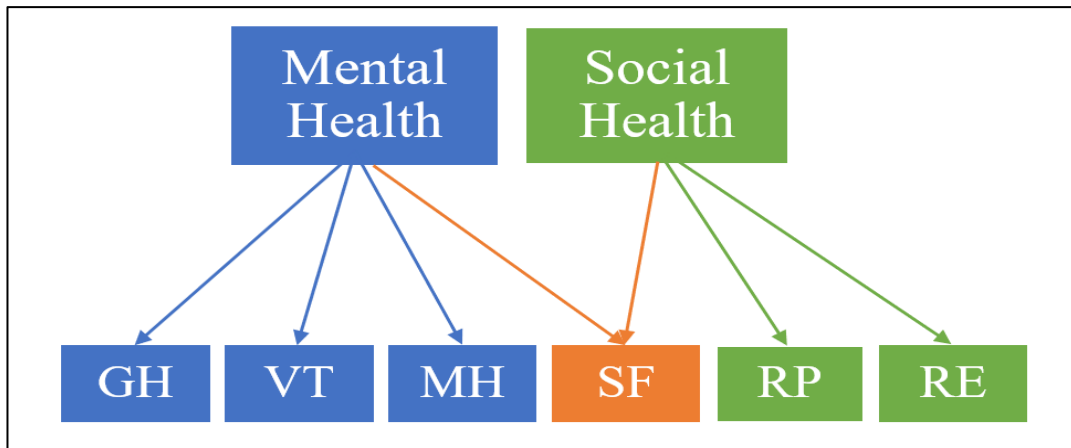
FIGURE 3.1: Health-related QOL with two-factor structure
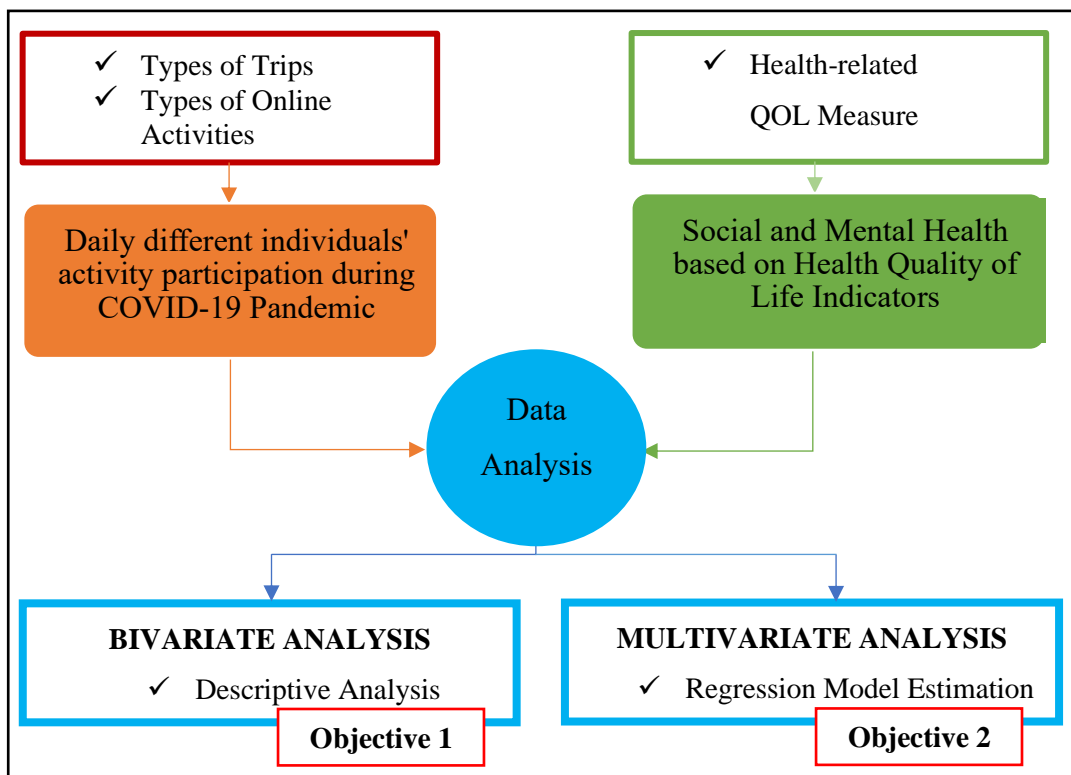
FIGURE 3.2: Methodology Flowchart

Throughout the early stage of this project study, a range of reliable sources were utilized to gather and expand the knowledge about the topic, especially while understanding and preparing the literature review, problem statement and during interpreting the results. The relevant data collected are assured to be accurate and related to the topic of this study. Past research publications are thoroughly reviewed and discussed with supervisor and final year teammate to develop a better understanding about the topic research.

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3.1.1 'Survey on Effects of COVID-19 Pandemic on Travel Behaviour in Malaysia' Dataset

The 'Survey on Effects of COVID-19 Pandemic on Travel Behaviour in Malaysia' dataset was collected from November 2020 until June 2021. As shown in **Table 3.1, 3.2 3.3** and **3.4**, the survey was utilized to gather information about respondents' individual and household socio-demographic and spatial characteristics which cover their personal characteristics and built environment. Besides, it also contained respondents' activity travel behaviour, online activities comparison before and after COVID-19 pandemic (PKP, PKPB and PKPP) in weekdays and weekends based on a 7-point Likert scale, ranging from 1 (least frequent) to 7 (most frequent). The travel behaviour section covers their comparison of travel frequency, comparison of total number of daily trips, main purpose of travel and comparison of trip duration for the main purpose of travel. The data collected six categories of trip classifications, five of which are discretionary trips: grocery shopping, dining, socialising, sport and healthcare. Meanwhile, online activity participations covered in this survey are work or school from home, online grocery shopping, online shopping, online meeting, food delivery and streaming movies.

TABLE 3.1: Questionnaire Contents – Section A

Socio-demographic and Spatial Characteristics		
Type of Data	Category	
Individual sociodemographic information	- Gender - Age - Highest level of education	- Occupation - Occupation sector - Marital status
Household sociodemographic information	- Household size - Household income - Number of cars owned by household	- Number of motorcycles owned by household - State of residence - Postcode of residence
Journey to nearest amenity	Perceived time taken for journey to nearest city, nearest school, nearest grocery shop, nearest health clinic, nearest hospital, nearest mall	

TABLE 3.2: Questionnaire Contents – Section B

Activity Travel Behaviour Comparison Before and After COVID-19 Pandemic			
		Time period	Type of trips
• Comparison of travel frequency • Comparison of total number of daily trips	Weekdays/ Weekends	• Before and after the COVID-19 pandemic (PKP and PKPB)	• Work/school trips • Grocery shopping trips • Dining trips • Socialising trips • Sport/recreational trips • Healthcare trips
		• Before and after the COVID-19 pandemic (PKPP)	

TABLE 3.3: Questionnaire Contents – Section C

Online Activities Comparison Before and After COVID-19 Pandemic			
	Activity	Time period	Purpose of Travelling
Comparison of weekly activity frequency	• Work/study from home • Grocery e-shopping • E-shopping • E-meeting • Online delivery food/drinks • Streaming movies	Before and after the COVID-19 pandemic (PKP and PKPB) Before and after the COVID-19 pandemic (PKPP)	• Work/school trips • Grocery shopping trips • Dining trips • Socialising trips • Sport/recreational trips • Healthcare trips • Others

TABLE 3.4: Questionnaire Contents – Section D

Health Before and After COVID-19 Pandemic		
Health-related Quality of Life (QOL) Questions	• Weekdays • Weekends	Time period
		Before PKP
		During PKP and PKPB
		During PKPP

The social and mental health indexes were derived using factor score analysis with a varimax rotation of the specified categories which both dependent variables are defined based on the health-related quality of life (QOL) measures. Varimax rotation which is widely utilised when a factor is generated from the joint interaction of multidimensional data of the latent variables (DiStefano et al., 2009 as cited in Dharmowijoyo, Susilo, & Syabri, 2020). The factor scores has mean of zero which are are standardised variables within a range of -3 to 3 throughout the sample as a Z-score metric, fundamentally carrying identical data in a more compressed form (Hair et al., 1998 as cited in Dharmowijoyo, Susilo, & Syabri, 2020). The least square method was used to obtain the factor scores using the Statistical Package for the Social Scientist (SPSS). In this study, bivariate analysis is primarily used to investigate the relationship between two variables, namely independent variable: change of socialising and discretionary trips during COVID-19 pandemic, and dependant variables: social and mental health. Meanwhile, multivariate analysis is a more advanced form of statistical analysis technique when used when there are more than two independent variables in the data set which are change of socialising and discretionary trips during COVID-19 pandemic and online during COVID-19 pandemic, and dependant variable: social and mental health. The independent variables are obtained from 'Survey on Effects of COVID-19 Pandemic on Travel Behaviour in Malaysia' dataset. The comparison covers the time period of before PKP/PKPB, during PKP/PKPB and during PKPP. The dependant variables involved in the analysis are social and mental health. Both variables are treated as separate variables, with a unique solution derived from factor score analysis for each of the variable. The method of analysis adopted in this study are Analysis of Variance (ANOVA) and simple linear regression model conducted using Statistical Package for the Social Scientist (SPSS).

3.2   Project Flowchart

The methodology flowchart involved in this project have been set up to achieve the objective 1 and 2 as stated in 'Objective' section. **Figure 3.3** shows the flowchart of this project. Firstly, the problem definition was identified. During the project research, weekly meetings with the supervisor and final year teammate were held to discuss about past research publications relating to the project topic to gain a better understanding of the project. Data collection was carried out to gather data and information are analysed using bivariate and multivariate analysis. The results from the data analysis are interpreted. A conclusion was concluded based on the findings of this investigation and followed with recommendation to improve the quality of the future study related to this topic. The scope of work for this study is shown in **Figure 3.4**.
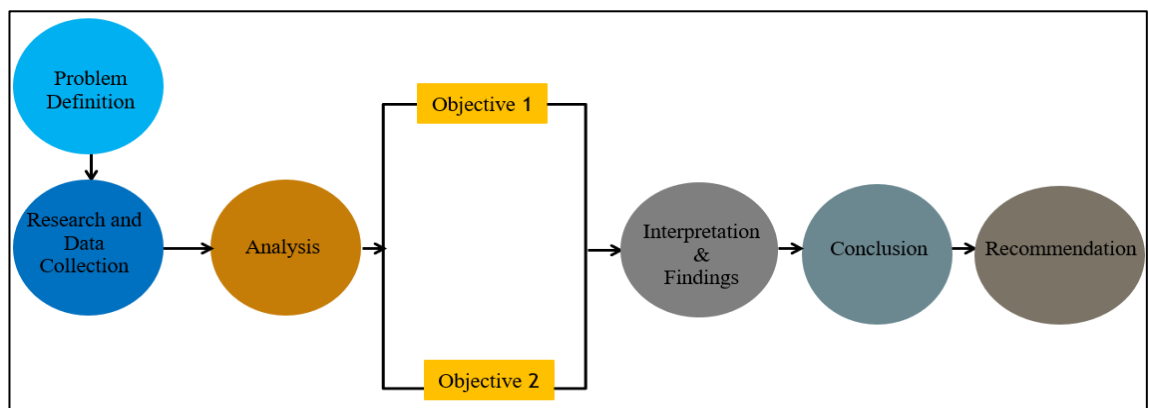
FIGURE 3.3: Project Flowchart

FIGURE 3.4: Scope of Work

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Summary of 'Survey on Effects of COVID-19 Pandemic on Travel Behaviour in Malaysia' Dataset

The respondents' social and mental health were assessed using health-related quality of life (QOL) questions which derived from Short-Form 36 (SF-36). Social and mental health were assessed using a variety of category, including limitations on role functioning due to physical health (RP), limitations on role functioning due to emotional problems (RE), social functioning (SF), general health (GH), bodily pain (BP), vitality (VT) and mental health (MH).

Social health is defined by RP, SF and RE while mental health defined as BP, VT, GH, MH and SF. The survey's responses in the health section were based on a 7-point Likert scale, with intensity levels ranging from 1 (none at all) to 7 (very intense). The summary of 'Survey on Effects of COVID-19 Pandemic on Travel Behaviour in Malaysia' dataset is shown in **Table 4.1** and **Table 4.2**.

TABLE 4.1: Respondents' socio-demographic and spatial characteristics, N=438

Variables	Percentage	Variables	Percentage
Gender		**Working in essential services**	
Male	33.50	Not working in essential services	69.10
Female	66.40	Health services	5.70
Age		Banking and finance	4.10
<22 years old	10.90	Food Supply and Services	3.70
23-45 years old	84.50	Internet and Communications	3.00
46-55 years old	3.90	Electricity	2.70
>56 years old	0.70	Hospitality	1.80
Education		Retail	1.60
High School	6.60	Safety	1.40
Diploma	15.30	Fuels	1.10
Degree	48.60	Logistics	1.10
Master	21.20	Waste Management	1.10
Doctorate	8.20	Online Shop	0.90
Employment		Broadcaster	0.90
Full time	59.30	Transportation	0.70
Part time	3.40	Courier	0.70
Student	30.60	Water services	0.20
Housewife	2.50		
Not working	4.10		

TABLE 4.2: Respondents' socio-demographic and spatial characteristics, N= 438
(Continued)

Variables	Percentage	Variables	Percentage
Marital status		**Household number**	
Married	38.10	<3	24.90
Single	61.40	4-6	57.30
Single Parents	0.50	8-9	11.90
Car numbers		>10	5.70
0.00	6.90	**Income (RM)**	
1-2	83.00	<3000	28.30
>2	35.60	3001-7000	32.60
Motorcycle numbers		7001-10,000	17.30
0.00	32.00	>10,000	21.70
1-2	56.40		
>2	11.60		

Majority of the respondents are females (66.4%). Most of the respondents are in the age range of 23-45 years old (84.5%) where most of them have Degree as their highest level of education (48.6%). In terms of employment, the majority of respondents (59.3%) work full-time, with 69.1% of them not working in essential services. The monthly income distribution is dominated by respondents within 3001 to 7000 Ringgit Malaysia (32.6%). In relation of marital status, the majority of respondents (61.4 %) are single and married (38.1 %). The respondents are mainly from households with four to six members (57.3%), and they own one to two cars and motorcycles, with 83 % and 56.4 %, respectively.

4.2   Overall Social and Mental Health during PKP/PKPB and PKPP

Figure 4.1 shows the overall social and mental health during COVID-19 outbreak, specifically during PKP/PKPB and PKPP timeline. Individuals with high social and mental health refers to social and mental health score of greater than zero (>0). Low social and mental health, on the other hand, refers to those who have a social and mental health score of equal to or less than zero (<0). Since socialising and discretionary trips tend to correlate on better well-being and social and mental health (Dharmowijoyo, Susilo, & Syabri, 2020), in general, higher number of socialising and discretionary trips will improve social and mental health. Since the change in comparison of social and mental health during PKP/PKPB and PKPP is statistically not significance (p value more than 0.1), this study will focus only on the timeline of PKP/PKPD to allow more critical analysis to be conducted on the dataset.
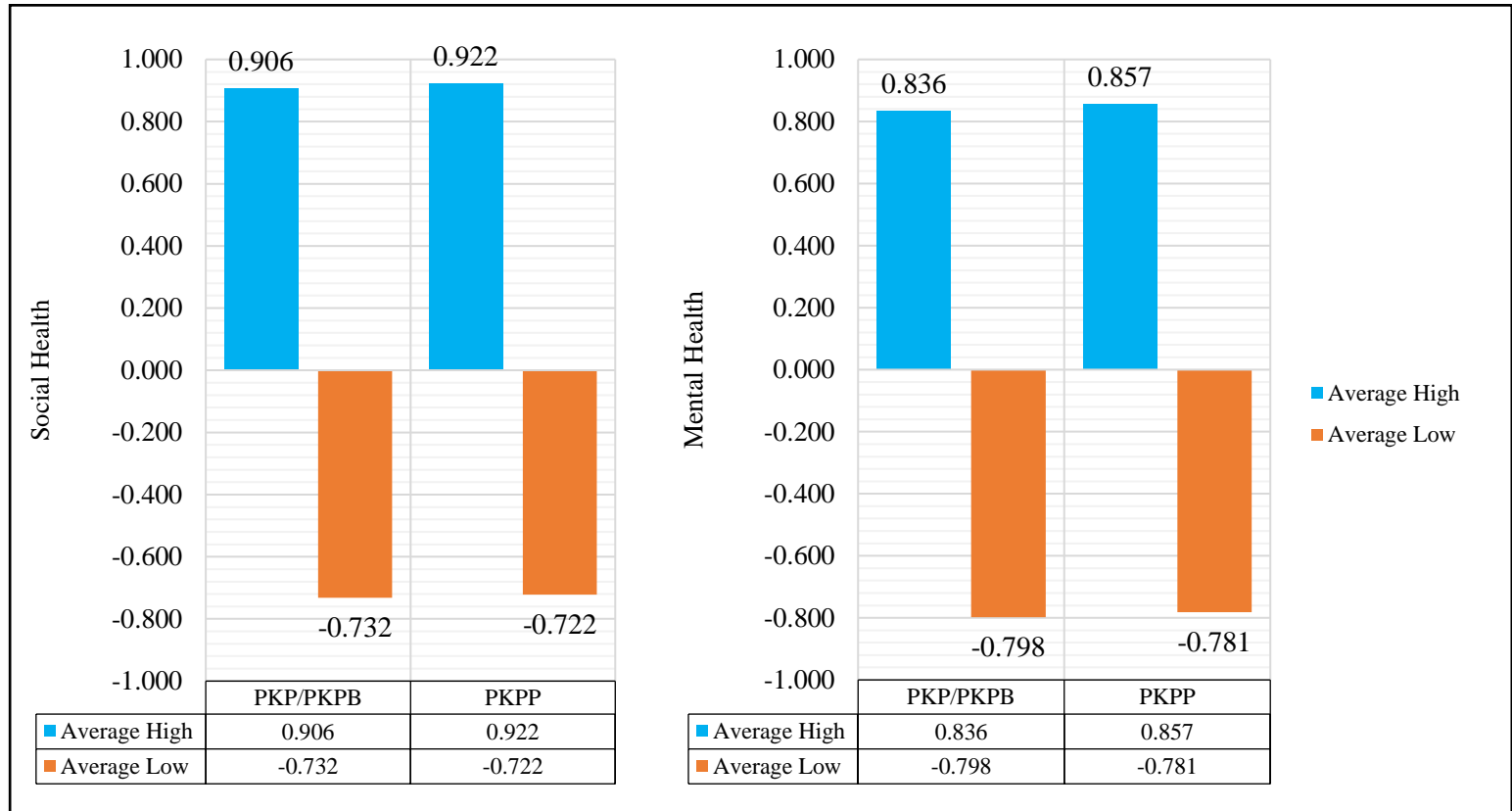
FIGURE 4.1: Overall Social and Mental Health during COVID-19 Outbreak

4.3 Descriptive Analysis of Social and Mental Health Based on Trip Comparison Before and After PKP/PKPB

Analysis of Variance (ANOVA) is used in this study to analyse the categorical factor of the independent variable and the continuous response of the dependant variable. For both social and mental health, the independent variable which is the travel frequency comparison before and after COVID-19 pandemic was categorized into three groups for each type of trip during weekdays and weekends. The categorization of the groups is based on comparison of number of trips before and during the PKP/PKPB. The first group is those respondents who did lower number of trips during PKP/PKPB. Second group is those respondents who performed similar number of trips before and after PKP/PKPB. Last but not least is those individuals who did higher number trips during PKP/PKPB. The ANOVA was used to determine the range of values for the difference in means within each pair of the group which illustrated in **Figure 4.2.**
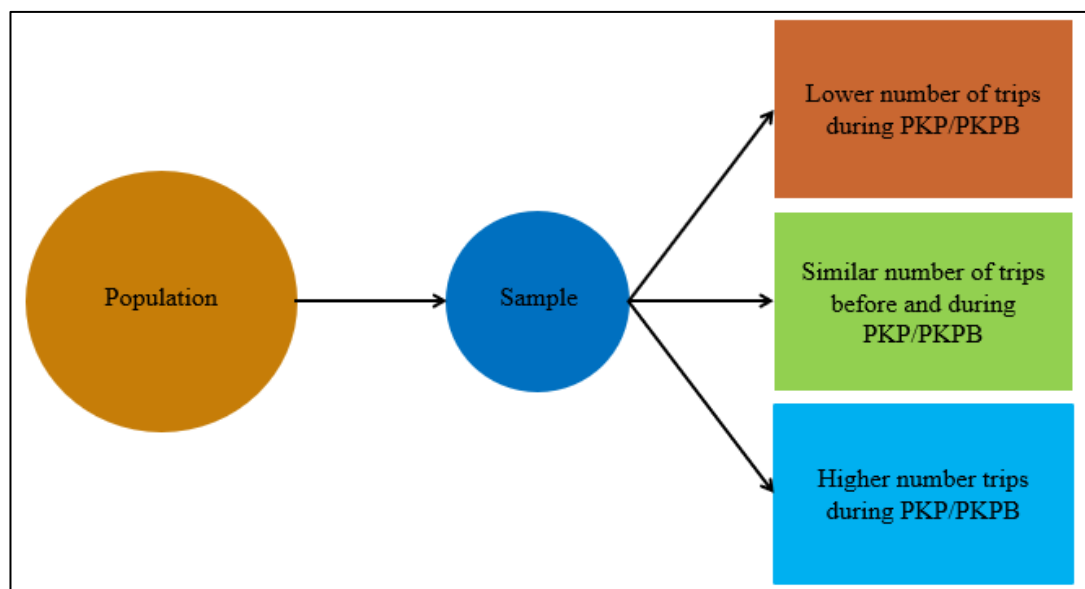
FIGURE 4.2: One-Way-ANOVA – 3 independent groups based on trip frequency comparison before and after PKP/PKPB

4.3.1   Social and Mental Health During PKP/PKPB (Weekdays)

Based on **Figure 4.3**, all types of trips: grocery shopping, dining, socialising, sport and healthcare performed during weekdays have significance correlation with social health based on the p values. The study shows that individuals who performed higher socialising and discretionary trips during weekdays, have a better social health compared to those who do not. It is consistent with all types of trips except healthcare trips. Individuals who performed high number of healthcare trips tend to have poor health conditions which captured by the intermediate variables of social health which are limitations on role functioning due to physical health and emotional problems (RP and RE). Health is a constant limitation that limits activity-travel participation and characteristics, according to previous research related to this topic (Mujahid, et al., 2021). Since they have poor health conditions especially during the COVID-19 pandemic, it translates to additional capability constraints which limit the individual's ability to participate in daily activity and travel in time-space-prism. Therefore, lower number of trips for healthcare purposes will have higher social health score as the individual is assumed to be healthier. As shown in **Figure 4.3**, individuals who performed higher weekdays healthcare trips have lower social health score compared to those who had less frequent weekdays healthcare trips with score of 1.105 and 1.252 respectively.

Individuals who performed higher weekdays socialising trips and dining trips during PKP/PKPB have the highest social health score with score of 1.462 and 1.386 respectively. This is due to the nature of the trip as socialising and dining trips strongly linked to higher social engagement in developing meaningful relationship with others resulting positive effects on social health. During the COVID-19 pandemic, perceived social isolation (lower social engagement) had a huge global impact, with significant emotional consequences for social health (Pietrabissa & Simpson, 2020). This is supported by this study where in the group pairs of Trip Frequency: Lower during PKP/PKPB, weekdays socialising and dining trips during PKP/PKPB have the lowest social health score which are 1.32 and 1.107 respectively as shown in **Figure 4.3**.

Only weekdays grocery shopping, dining, socialising and healthcare trips have significance impact with mental health based on the p values. For mental health model, socialising trips have highest and lowest mental health within their travel frequency group pairs with score of 1.356 and 1.101 respectively. Weekdays sport trips have no significance impact towards mental health model. Sport trips tends to correspond to greater physical health as it involved with physical activity. However, when it comes to mental health, it does not establish a cause-and-effect relationship because there is not enough information to indicate that greater levels of depression and anxiety which related to mental health, are caused by a lack of physical activity (Tyson, Crone, Brailsford, & Laws, 2010). Kroesen & Vos, 2020 argued that the relationship works the other way around where the more depressed and anxious an individual becomes, the less likely they are to engage in physical activity and it is certainly supported in the case of depression, as depressed people are less likely to want to engage in physical activities. Moreover, Giuntella, Hyde, Saccardo, & Sadoff, 2021 argued that although there is a substantial link between physical exercise and mental health, restoring physical activity through a short-term intervention does not necessarily improve mental health. This study supports these findings which shown in **Figure 4.3** where sport trips are statistically insignificance on mental health model.

During weekdays PKP/PKPD, individuals who had higher number of grocery shopping trips, dining trips, and healthcare trips had a lower mental health score than those who performed lower number of trips. Higher number of these trips means those individuals are most likely to have a more compact time-space-prism since they need to attend more trips (trades more of their time budget in time-space-prism) in addition to mandatory activities such as work or school which are considered as primary activities during the weekdays. Besides, there is possibilities that their travel behaviour such as travel mode and duration of trips gives arise to negative well-being from their terrible travel experiences (Wee & Ettema, 2016). Since positive well-being is an important component of mental health (Dharmowijoyo & Joewono, 2020), negative well-being will translate to poor mental health especially in the context of repetitive trips.

	Grocery Shopping		Dining		Socialising		Sport		Healthcare	
	MH**	SH**	MH*	SH**	MH**	SH*	MH	SH**	MH**	SH**
■ Trips Frequency: Lower during PKP/PKPB	1.158	1.123	1.132	1.07	1.101	1.132	1.16	1.177	1.204	1.252
■ Trips Frequency: Similar between before and during PKP/PKPB	0.658	0.628	0.658	0.575	0.558	0.535	0.647	0.644	0.766	0.75
■ Trips Frequency: Higher during PKP/PKPB	1.034	1.309	1.025	1.386	1.356	1.462	1.354	1.23	1.154	1.105

Types of Trips

■ Trips Frequency: Lower during PKP/PKPB   ■ Trips Frequency: Similar between before and during PKP/PKPB   ■ Trips Frequency: Higher during PKP/PKPB
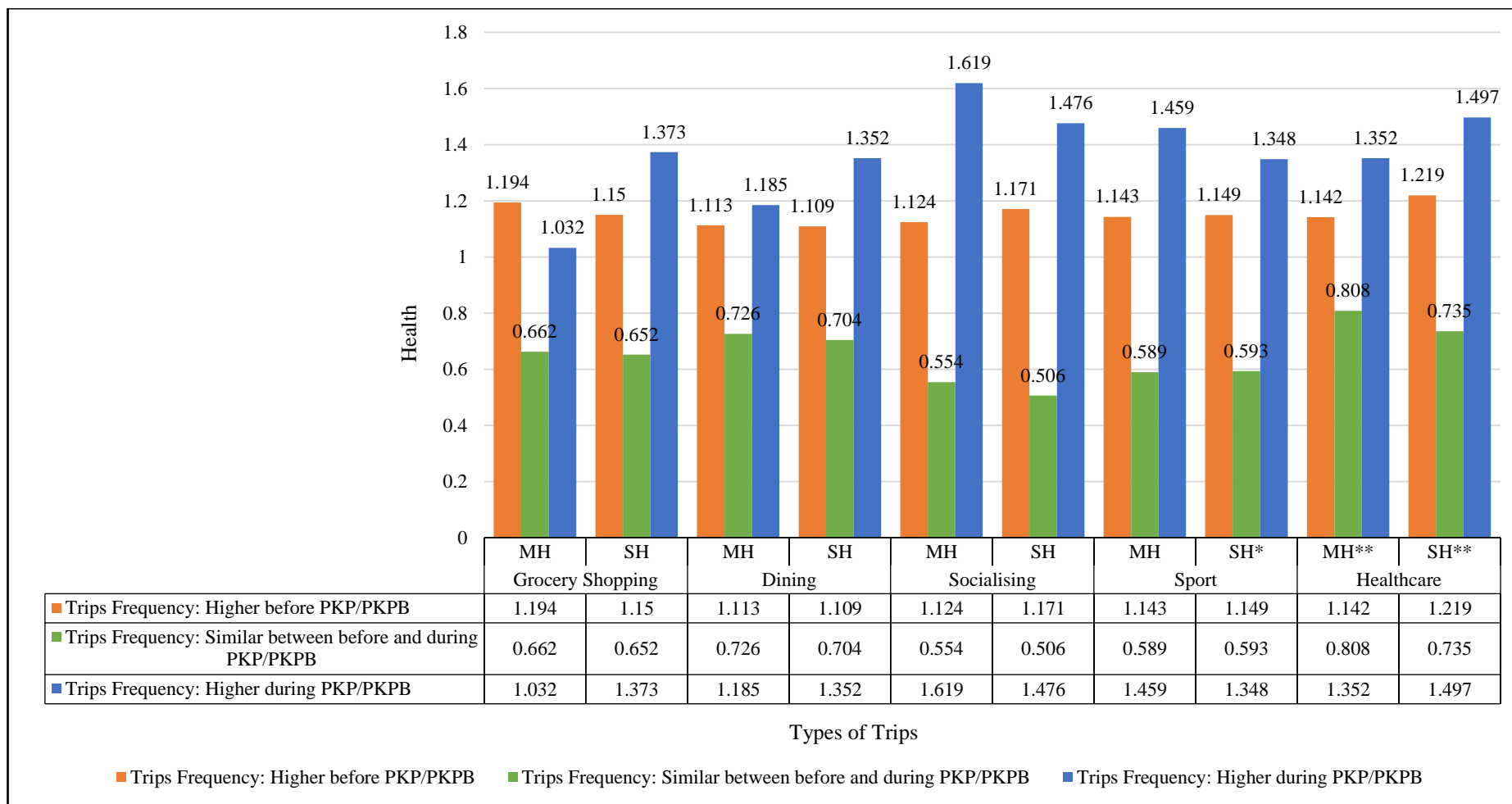
Note: ** means very significance, $p < 0.05$, * means significance, $p < 0.1$

FIGURE 4.3: Mean Square of Trips Frequency Comparison Within Groups on Social and Mental Health during PKP/PKPB **(Weekdays)**

4.3.2   Social and Mental Health During PKP/PKPB (Weekends)

Based on **Figure 4.4**, weekends sport and healthcare trips are significant towards social health. Meanwhile, only weekends healthcare trips that are significant towards mental health. While the other types of trips do not influence social and mental health as those relationships are insignificance based on the p values. Based on the overall activity travel participation between weekdays and weekends, it is concluded that socialising and discretionary trips during weekdays have stronger impact towards our social and mental health during COVID-19 pandemic. This suggests that most of the respondents may have spent higher amout of time for in-home activities which improves their social and mental health during the weekends thus reducing their out-of-home travel participation. This is higly the reasoning on whys the weekends socilising and discretionary trips are not significance towards social and mental health model. It follows the same trendline as another study which is based on the American Time Use Survey data, the estimated joint models found that individuals who engaged in less out-of-home activities were more likely to spend their leisure and personal time at home (Shabanpour, Golshani, Langerudi, & Mohammadian, 2018).

The imbalance between activity participation between weekdays and weekends is supported in other researches related to travel behaviour where individual will perform less travels or less size of activity space on weekends when they undertake other way around on weekdays (Yamamoto, T., Kitamura, R., 1999 as cited in Ramli & Dharmowijoyo, 2018). As a consequence, it will correpond to different state of weekdays and weekends social and mental health. Since this study does not support findings from previous research where the person trip rates during the weekends are marginally lower than those during the weekdays (Lockwood, 2005) and its purposes tend to be non-mandatory or discretionary (e.g., leisure and social) (Gim, 2018), as this findings only valid during the timeline before the COVID-19 pandemic. From the generic comparison, we can conclude that COVID-19 pandemic caused an activity-travel behavior change specifically in out-of-home activity travel participation which follows similar pattern from study conducted by in Indonesia (Irawan, et al., 2021).

	Grocery Shopping		Dining		Socialising		Sport		Healthcare	
	MH	SH	MH	SH	MH	SH	MH	SH*	MH**	SH**
Trips Frequency: Higher before PKP/PKPB	1.194	1.15	1.113	1.109	1.124	1.171	1.143	1.149	1.142	1.219
Trips Frequency: Similar between before and during PKP/PKPB	0.662	0.652	0.726	0.704	0.554	0.506	0.589	0.593	0.808	0.735
Trips Frequency: Higher during PKP/PKPB	1.032	1.373	1.185	1.352	1.619	1.476	1.459	1.348	1.352	1.497

Types of Trips

■ Trips Frequency: Higher before PKP/PKPB   ■ Trips Frequency: Similar between before and during PKP/PKPB   ■ Trips Frequency: Higher during PKP/PKPB

Note: ** means very significance, p < 0.05, * means significance, p < 0.1

FIGURE 4.4: Mean Square of Trips Frequency Comparison Within Groups on Social and Mental Health during PKP/PKPB
(Weekends)

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4.4   Linear Regression Model Estimation Result

The linear regression model, which is the method used in multivariate analysis, was adopted in this study. A linear regression is a form of regression test that examines the direct relationship between a continuous dependent variable and at least one independent variable that can be of any measurement level, such as nominal, ordinal, interval, or ratio. The coefficients, which indicate the model's outcome, can be used to determine the extent to which the change of socialising and discretionary trips during COVID-19 pandemic and social and mental health are related.

The strength of each independent variable's effect on the dependent variable is assessed using a **standardized beta coefficient**. The standardized beta coefficient is determined by using the Z-score of both the independent and dependent variables to run the linear regression model, where the mean and standard deviation of the each of the data observation is set to 0 and 1 respectively. By standardizing the variables before running the linear regression model, it facilitates a comparison of the effect magnitudes where all the variables are considered on the same scale and easily be ranked. This is because it eliminates the units of measurement and now it is measured in units of standard deviation. The bigger the impact, the greater the **absolute value** of the beta coefficient.

Based on **Table 4.3**, only dining trips is significant towards social health with coefficients 0.122 during weekdays and 0.174 during weekends. All types of trips are statistically insignificance in the mental health model. COVID-19 has pushed people to spend more time at home due to the closure of businesses, recreation centres, offices, and schools, as well as local and international travel restrictions. As a consequence, it is estimated that individuals have begun to look for ways to substitute their out-of-home activities with in-home activities.

However, based on **Table 4.3**, it shows that only online shopping has a statistically significant impact on both social and mental health with coefficient of 0.195 and 0.191 respectively. Meanwhile, online groceries are significant for mental health model, with coefficients of 0.134, respectively. These findings follow a similar trend where a research conducted in Toronto, Chicago, about 17% of respondents reported an increase in online order acquisition, indicating a significant shift away from traditional shopping, for clothing, household products and groceries (Fatmi, Thirkell, & Hossain, 2021).

Shopping through online channels brings abundance benefits to consumers, such as the resource savings, time and space independence and availability of options (Forsythe, S., et al., 2006, as cited in Nguyen & Bui, 2019). Online shopping has emerged as a viable option to make in-store purchases without having to travel, and it is unquestionably a splendid stress relief because online shopping has a positive influence on feelings and reduces stress (Nguyen & Bui, 2019). The reduced stress effects correlates to the increase of social and mental health state where our well-being acts as intermediate variable. This is also supported by Koch et al. (2020) whose finding is pleasure and satisfaction encountered from online shopping influenced teleshopping behavior during the COVID-19 pandemic (Rizki, et al., 2020).

TABLE 4.3: Standardized Beta Coefficients of Social and Mental Health Before and After PKP/PKPB (N=438) (full model)

	SOCIAL HEALTH						MENTAL HEALTH					
Variables	Overall		Weekdays		Weekends		Overall		Weekdays		Weekends	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Grocery Shopping Trips			0.061	0.347	-0.096	0.205			0.071	0.279	-0.01	0.898
Dining Trips			0.122*	0.087	0.174**	0.034			0.092	0.198	0.124	0.132
Socialising Trips			-0.084	0.339	-0.034	0.719			-0.119	0.177	-0.057	0.553
Sport Trips			0.022	0.785	0.124	0.163			0.014	0.864	0.078	0.381
Healthcare Trips			-0.006	0.922	-0.068	0.340			0.035	0.558	-0.044	0.541
W/SFH	-0.091	0.199					-0.096	0.174				
E-Grocery	0.109	0.165					0.134*	0.088				
E-Shopping	-0.195**	0.013					-0.191**	0.015				
E-Meeting	0.071	0.340					0.097	0.190				
Food Delivery	0.098	0.156					0.004	0.957				
Streaming Movies	-0.051	0.439					0.029	0.655				

Note: ** means very significance, $p < 0.05$, * means significance, $p < 0.1$

Coef. = coefficient, Sig. = significance (p value), W/SFH = work or school from home

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1   Conclusion

In a nutshell, the effects of change of socialising and discretionary trips during COVID-19 pandemic on social and mental health in this study are vary depending on the trip purposes, which includes grocery shopping, dining, socialising, sport and healthcare, as well as whether the trips are made on weekdays or weekend. From the bivariate analysis, all of the weekday types of trips are statistically significance towards social health model. Only weekdays sport trips are not correlate to mental health model. Conversely, during weekends, only healthcare trips affecting social and mental health while sport trips fundamental to social health only. Based on the comparison of overall activity travel participation between weekdays and weekends, it is concluded that socialising and discretionary trips during weekdays have stronger impact towards our social and mental health during COVID-19 pandemic.

Based on the multivariate analysis, only dining trips is significant towards social health with coefficients 0.122 during weekdays and 0.174 during weekends. All types of trips are statistically insignificance in the mental health model. In this study, it is estimated that individuals have begun to look for ways to substitute their out-of-home activities with in-home activities. However, only online shopping has a statistically significant impact on both social and mental health with coefficient of 0.195 and 0.191 respectively. The reduced stress effects correlates to the increase of social and mental health state where our well-being acts as intermediate variable.

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5.2   Recommendations

As for future works, several improvements can be implemented to improve the quality of research related to the project's topic. As recommendations to improve the quality of research related to the topic, the data analysis should use a more complex dataset such as individuals time-use diary over a time period as it provides a better understanding of individuals' daily time spent in activity participations with respect to time-space-prisms. Besides, it is essential to include other types of activities such as mandatory activities (e.g., work, school) to provide a more extensive analysis on how change in travel behaviour affects our health during COVID-19, specifically social and mental health. In the health-related quality of life (QOL) approaches, it is important to recognize health as three factor structure which are physical, social and mental health. By including physical health in the research, linkage between change in travel behaviour and overall health can be explored.

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