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The Preferences for Daily Travel Mode Selection During the Era of The Covid-19 Pandemic in Urban and Suburban Areas within Indonesia

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The COVID-19 pandemic led to a significant shift from the use of public transportation to private vehicles. This study, therefore, aims to investigate the challenges of the daily commute mode preferences, during this period, as a crucial aspect of future urban planning management in the face of the New Normal era. Data collection was carried out using a questionnaire comprising questions on the respondent's age, gender, private vehicle ownership, daily commute distance, time, preference, and the reasons for this preference. Subsequently, the data obtained were subjected to statistical analysis with the binomial logistic regression method using the SPSS V26.0 program. The results showed an increase in the community's tendency to select public transportation as a daily commute mode during the COVID-19 pandemic. However, this required an increase in comfort and security against the possibility of virus infection. Besides the impact on traffic problems in the city and suburban centres, the increasing use of private vehicles is also less environmentally friendly. Hence, there is an urgent need to improve the public transportation mode during the pandemic.

Keywords: commute mode; urban; suburban; pandemic

I. INTRODUCTION

The existence of suburban areas is a major characteristic of Asian cities. According to Rukmana *et al.* (2019), population density influences people's daily commute mode from urban to suburban areas and vice versa. Recently, there has been an increasing trend in people's daily commute, and this is related to traffic problems, especially within urban and suburban areas, due to the increased dependence on transportation modes and road infrastructure (Setyodhono, 2017). This has caused the use of vehicles as a daily commute mode to become a general need (Matsuyuki *et al.*, 2018). However, to achieve an environmentally friendly city, mass transportation modes must be implemented (Roggema, 2017). The preference for commute daily mode is influenced by gender, vehicle ownership, income (Indriany *et al.*, 2019), distance, commute time, and destination (Al-Salih & Esztergár-Kiss, 2021), as well as health and availability of mode preferences (Rosida *et al.*, 2019). These preferences also vary depending on location. For instance, in Thailand, the preference for public transportation mode is influenced by age, income, and vehicle ownership (Witchayaphong *et al.*, 2020).

The decline in users of public transportation modes is caused by long commute times, inefficient and difficult access (BPS, 2019). During the COVID-19 pandemic, daily commute mode is related to economic, social, environmental, and quality of life. The role of shared transportation for commuting purposes during a pandemic is often considered from the perspectives of safety, economy, environment, and public benefit (Yoshida & Ye, 2021). For instance, people now tend to avoid congested commute modes (Rahman *et al.*, 2021). Therefore, sustainability is crucial in increasing the attractiveness of future modes (Ogryzek *et al.*, 2020).

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Transportation policies ought to be directed at promoting the use of non-automobiles, reducing traffic congestion, and improving environmental quality (Clark *et al.*, 2016). The use of non-automobiles is bound to be increased through urban planning focused on population density, mixed land use, bicycle and pedestrian paths (Ye & Titheridge, 2017). However, Chen *et al.* (2020) believe the urban sprawl phenomenon shows people's dependence on private vehicles.

In urban and suburban areas, the distance from residential areas to workplaces and public facilities helps to select daily commute modes (Næss, 2012). For instance, in Nigeria, 15-20 minutes are required to commute to the city centre (Ogunyemi *et al.*, 2021). Meanwhile, in Montreal, the distance from residences, workplaces, and stations reduces the use of private vehicles for low-income people (Vermesch *et al.*, 2021). In Florida, intermodal connectivity determines the preference of daily commute mode, and connectivity between roads with pedestrian and bicycle paths increases non-automobile mobility (L. Chen & Felkner, 2020). The low-class and middle-class residents of Thailand tend to live near stations because trains are the most preferred daily commute mode (Pongprasert, 2020). Meanwhile, in the UK, 20.5 % of public transport users and 10.1 % of private car users switched to walking or cycling after the pandemic restrictions were lifted (Harrington & Hadjiconstantinou, 2020). In Shanghai, women prefer walking, cycling, or taking city buses (Chen *et al.*, 2021). Station-oriented roads promote the use of public transport (García-Palomares *et al.*, 2018), but user interest is influenced by changes in the commute mode, as well as the distance to public transportation stations (Liu *et al.*, 2020). However, residents generally tend to prefer integrated daily commute modes (Rodriguez & Vergel-Tovar, 2018).

Mobility around stations in the suburban regions of Beijing reduces the commute intensity in the urban area (Yao & Wang, 2014). The preference for commute mode is influenced by convenience, income, age, education, and distance factors (Bastarianto *et al.*, 2019; Indriany *et al.*, 2019; Irjayanti *et al.*, 2021; Mayo & Taboada, 2020; Puan *et al.*, 2019; Tuan, 2015; Witchayaphong *et al.*, 2020). However, private vehicles are often preferred by elderly people, as well as educated residents and high-income earners (Al-Salih & Esztergár-Kiss, 2021; Setyodhono, 2017). In Greece, 46 to 65-year-olds showed a preference for public transportation since the pandemic restrictions were gradually reduced (Kopsidas *et al.*, 2021). The coronavirus spread also influenced the commute mode preference in certain areas (Politis *et al.*, 2021). For instance, in Japan, distance and commute time influence the level of anxiety regarding infection with the COVID-19 virus (Ando *et al.*, 2021). Meanwhile, in Indonesia, people outside Java had a higher frequency of commutes during the early periods of the COVID-19 pandemic (Irawan *et al.*, 2021). A study by Abdullah *et al.* (2020) reported a significant shift from public transportation to private vehicles during the pandemic. This occurred due to concerns about infection with the COVID-19 virus when commuting by public transportation (Shibayama *et al.*, 2021). However, the low use of shared transportation can be improved through better publication as an effective means of maintaining social distance and reducing the risk of infection, especially during the pandemic (Yoshida & Ye, 2021).

Based on the discussion of the article above, it can be concluded that there are several considerations in choosing a mode of transportation during a pandemic where safety, efficiency, and economic factors may be related. Safety refers to how people avoid public crowds as much as possible so that the trend of using private vehicles increases.

II. DESCRIPTION OF LOCATION AND PROBLEM

This study was carried out within Yogyakarta and its surrounding areas because these areas are close to an education city as well as a work centre, which had a high number of daily commutes as well as positive COVID-19 cases in 2021 (Figure 1). Based on the population statistics, the number of commuters in Yogyakarta and its surrounding areas was 2.4 % and 14 %, respectively (Badan Pusat Statistik, 2021). Therefore, this study aims to investigate the residents' preferences for daily commute modes during the pandemic as a critical aspect in planning future disaster-resilient urban transportation modes.

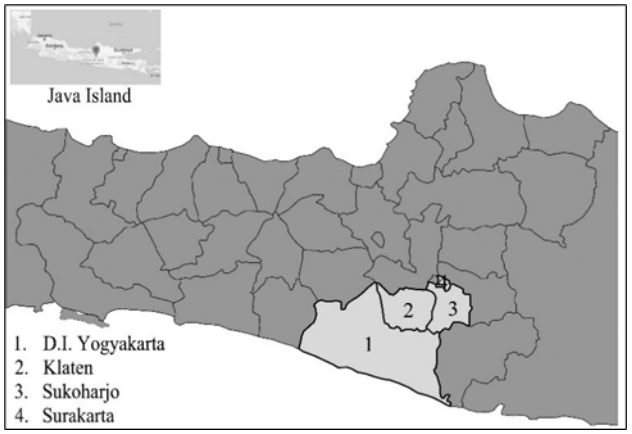

Figure 1. Research Location (Source: Author, 2022)

III. RESEARCH METHODS

The survey method uses a questionnaire in the format of Google Forms, sent via email to 250 respondents. During the COVID-19 pandemic, direct interviews were not possible—the number of respondents answered as many as 197 people. Respondents were selected by purposive sampling based on adult age (25-55 years). The research sample was taken with the following considerations: a) met the research objective criteria, and b) was categorised based on age, gender, vehicle ownership, daily travel distance, daily travel time, and daily travel costs. Based on the explanation above, it can be concluded that the purposive technique carried out on these 197 respondents was a sampling technique by selecting samples according to the needs of researchers by establishing unique characteristics or special requirements to be able to answer research questions, as well as being representative.

This study used a questionnaire survey method to collect respondents' opinions because the COVID-19 restrictions prevented the conducting of direct interviews during the pandemic. A total of 197 respondents were obtained using the inclusion criteria of personal characteristics (X1) comprising domiciliation, age, and gender. The questionnaires were used to collect data on the respondents' age and gender, private vehicle ownership, as well as the daily commute distance, time, preferences, and reasons for preferences.

Subsequently, the data were subjected to statistical analyses using the descriptive and binomial logistic regression model (binomial logistic regression analysis) with the SPSS V26.0 program. The variable X used nominal and ordinal data types with personal-economic characteristics (X1, X2), as well as the Commuting Attribute variable, to observe the respondents' commute mode preferences during the COVID-19 pandemic.

IV. RESULTS AND ANALYSIS

The results showed that the majority (86.1 %) of the respondents lived in the urban area of Yogyakarta, while 13.9 % lived in the suburban area. Furthermore, most respondents were aged between 45 and 55 years old (41.2 %), while in terms of gender, most respondents were male (59.8 %). Under economic characteristics, the respondents (X2) were categorised based on vehicle ownership and the nature of the residence. In terms of vehicle ownership, most respondents' own motorbikes and cars (66.5 %). Meanwhile, in terms of the nature of residence, most respondents are permanent residents (96.9 %), while 3.1% are not permanent residents.

The commuting attributes (X3) comprise the average daily commute time (in minutes), distance (in kilometres), costs (in rupiah), and reasons for selecting the commute mode, which was discovered to be 1-60 minutes (64.4 %), 1-50 km (83.0 %) or 31.06 miles and 1-50,000 IDR (82 %), respectively. In addition, about 78.9 % of respondents use private and official vehicles (government or office-owned) as their daily commute mode, and the reason for this preference is mainly convenience (28.4 %) (Table 1).

Table 1. Descriptive statistics

Characteristics	Variables	Percentage (%)
$X_{1.}$ Personal Characteristics		
$X_{1.1.}$ Domicile	Yogyakarta (1)	86.1
	Surakarta and its surroundings (0) (as ref.)	13.9
$X_{1.2.}$ Age	25-34 (0) (as ref.)	13.9
	35-44 (1)	17.5
	45-55 (3)	41.2
	<55 (2)	27.3
$X_{1.3.}$ Gender	Males (1)	59.8
	Females (0) (as ref.)	40.2
$X_{2.}$ Economic Characteristics		
$X_{2.1.}$ Vehicle Ownership	Motorcycle and Car (2)	66.5
	Motorcycle (1)	19.6
	Car (0) (as ref.)	13.9
$X_{3.}$ Commuting Attributes*		
$X_{3.1.}$ Average Daily Commute Time	<60 minutes (2)	64.4
	60-100 minutes (1)	27.3
	>100 minutes (0) (as ref.)	8.2
$X_{3.2.}$ Average Daily Commute Distance	<50 km (2)	83.0
	50-100 km (1)	14.9
	>100 km (0) (as ref.)	2.1
$X_{3.3.}$ Average Daily Commute Costs	<50,000 IDR (2)	82.0
	50,000-100,000 IDR (1)	15.5
	>100,000 IDR (0) (as ref.)	2.6
$X_{3.4.}$ Reasons for Commute Mode	Comfortable (6)	28.4
	Safe from possible transmission of the COVID-19	25.3
	Fast (4)	16.5
	Affordable (3)	10.3
	Don't want to be stuck in traffic (2)	10.8
	No need to change mode (1)	5.7
	There is no other option (0) (as ref.)	3.1
Y. Daily Commute Mode	Private/official vehicle (1)	78.9
	Combination of private and public vehicles (0)	21.1

Source: Author, 2022

Table 2 shows the Binomial Regression Logistics analysis, where the dependent variable (Y) used has two (2) categories:

Y = 1 for users of private/official vehicles.

Y = 0 for users of a combination of private and public vehicles.

Table 2. Binomial Regression Logistics Analysis

Variable	B	S.E.	Wald	df	Sig.	EXP (B)
Domicile (1)	-1.471	0.626	5.523	1	0.019	0.230
Residence (1)	0.699	1.223	0.326	1	0.568	2.012
Age			5.126	3	0.163	
Age (1)	0.742	0.699	1.127	1	0.289	2.100
Age (2)	-0.912	0.565	2.603	1	0.107	0.402
Age (3)	-0.453	0.514	0.778	1	0.378	0.636
Gender (1)	0.476	0.424	1.261	1	0.261	1.610
Vehicle Ownership			3.299	2	0.192	
Vehicle Ownership (1)	-0.303	0.578	0.275	1	0.600	0.739
Vehicle Ownership (2)	-0.952	0.527	3.265	1	0.071	0.386
Commute Time			0.404	2	0.817	
Commute Time (1)	0.548	0.947	0.334	1	0.563	1.729
Commute Time (2)	-0.034	0.487	0.005	1	0.944	0.966
Commute Distance			0.012	2	0.994	
Commute Distance (1)	19.894	19747.364	0.000	1	0.999	436503451.826
Commute Distance (2)	-0.067	0.600	0.012	1	0.912	0.936

Commute Cost			0.465	2	0.793	
Commute Cost (1)	-0.156	1.492	0.011	1	0.917	0.856
Commute Cost (2)	-0.442	0.651	0.462	1	0.497	0.642
Reasons for Selecting Mode			7.538	6	0.274	
Reasons for Selecting Mode (1)	0.245	1.281	0.037	1	0.848	1.278
Reasons for Selecting Mode (2)	-0.160	0.911	0.031	1	0.861	0.852
Reasons for Selecting Mode (3)	-1.472	0.657	5.023	1	0.025	0.229
Reasons for Selecting Mode (4)	0.020	0.769	0.001	1	0.979	1.020
Reasons for Selecting Mode (5)	-0.234	0.680	0.119	1	0.730	0.791
Reasons for Selecting Mode (6)	0.099	0.602	0.027	1	0.869	1.105
Constant	2.097	0.605	12.031	1	0.001	8.142
-2LL						175.451[a]
Model chi-square						24.651
Cox and Snell R Square						0.119
Nagelkerke R Square						0.185
Hosmer and Lemeshow Chi-square						17.783
Number of observations						194
Percentage correct						81.4

The omnibus test analysis obtained a value of 24,651 with a significance value of 0.215. Based on the Nagelkerke R Square value, economic characteristics and commuting attributes influence the commute mode preference by 18.5 %, while other factors outside the research model influence the commute mode preference by 81.5 %. Furthermore, the percentage model accuracy in classifying observations is 81.4 %, with a significance value of 5 %. Table 2 shows that domiciliation and reasons for selecting mode (3) significantly influence the preference of commute mode. However, Wald's analysis can be described in terms of Domiciliation (X1.1.), which has a value of 5.523 and a significance of 0.019. Based on this factor, respondents living in Yogyakarta prefer to use private/official vehicles. According to the Wald's analysis, the major reason for selecting the mode (X3.4.) is affordability, which has a value of 5.023 and a significance of 0.025. This value indicates cheaper commute modes, particularly private/official vehicles, are more preferred by the respondents.

These results are in line with the findings of the Economic and Social Commission for Asia and the Pacific (2017), which reported a significant increase in the use of private vehicles, public transport users have decreased over the years. This study's findings also show conformity with the phenomenon of mobility in other big cities (Jakarta-Bogor-Depok-Tangerang-Bekasi). The average commute time with private/official vehicles is 1 to 60 minutes, which is shorter compared to public transportation use (>60 minutes). In addition, with private/ official vehicles, most respondents (53.7 %) feel comfortable and safe from the possibility of infection with the COVID-19 virus. The respondent's domicile in the city centre tends to influence using a private vehicle during a pandemic. The trend of increasing positive cases of COVID-19 tends to be at the epicentre of the city centre. The movement of the spread of the COVID-19 virus is also found in urban public transportation, which tends to be more crowded. This phenomenon is thought to encourage respondents who live in the city centre not to take risks in using a combination of private and public vehicles. The cheapness (affordability factors) of driving with a private vehicle is also related to the needs during a pandemic that forces a person to adapt to the increasing prices of necessities, such as medicines, food, electricity, and internet needs because most work from home and distance learning.

V. CONCLUSION

Based on this study's findings, the government ought to improve public transportation modes, in terms of comfort and safety against COVID-19 virus infection. The findings of the domicile in the city centre and the low price are factors that respondents consider in choosing a private vehicle during the pandemic. Some things that the city government can pay attention to, especially for public transportation providers in the city centre, are how the implementation of the Covid Health protocol on public transportation can be compromised with cheap ticket fares or discounts for students and workers who live in the city centre who still have to travel for WFO (work from the office) so that

respondents can consider these two things to be able to feel comfortable choosing alternative public transportation. This is bound to increase the use of public transportation as a daily commute mode and consequently, reduce the high use of private vehicles, which tend to result in high traffic density along the roads connecting the urban and suburban areas. A study by Roggema (2017) showed this can influence the quality of urban and suburban environments, considering the daily commute mode is a fundamental in supporting an environmentally friendly city.

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