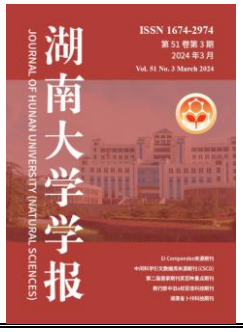

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Impact of Commute Time on Health Status in Jabodetabek Metropolitan Area

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Abstract: Increasing the volume of commuters in Jabodetabek metropolitan area has resulted in higher traffic congestion and longer commute time from the place of residence to that of work. Longer travel time also affects the health of commuters. The purpose of this study was to identify the health status of commuters in Jabodetabek metropolitan area and the effect of commute time on their health status. In addition, control variables will also have an effect on the health status of commuters. The data source of this study is the micro data of the 2019 Jabodetabek Commuter Survey, which was conducted by the Central Bureau of Statistics (CBS) of the Republic of Indonesia. The analysis is conducted in two ways, namely descriptive and inferential analysis. Descriptive analysis used in this study was bivariate cross tabulation between each independent variable and health status as a dependent variable. The inferential analysis used was a binary logistic regression model. The two methods of analysis show the consistency of the results, where the longer duration of commute time, the more frequency of riding vehicle, those who with the status as drivers, stress experience, increasing age, male commuters, low levels of education, and working commuters tend to have lower health status.

Keywords: commute time, health status, binary logistic regression, Jabodetabek metropolitan area.

贾博德塔别克大都市区通勤时间对健康状况的影响

摘要：贾博德塔别克大都市区通勤量的增加导致交通拥堵加剧，从居住地到工作地点的通勤时间更长。较长的出行时间也会影响通勤者的健康。本研究的目的是确定贾博德塔别克大都市区通勤者的健康状况以及通勤时间对其健康状况的影响。此外，控制变量也会对通勤者的健康状况产生影响。本研究的数据来源是印度尼西亚共和国中央统计局（哥伦比亚广播公司）进行的2019年贾博德塔别克通勤调查的微观数据。分析有两种方式，即描述性分析和推理性分析。本研究中使用的描述性分析是每个自变量和作为因变量的健康状况之间的双变量交叉表。使用的推理分析是二元逻辑回归模型。两种分析方法结果一致，通勤时间越长，乘车频率越高，驾驶员身份、压力经历、年龄增长、男性通勤者、文化程度低、通勤者的健康状况往往较低。

关键词：通勤时间、健康状况、二元逻辑回归、贾博德塔别克大都市区。

1. Introduction

Jabodetabek metropolitan area is the largest metropolitan area both in terms of population and area, and to this day, the area continues to grow [1]. Most residents live in suburban areas and have a place of activity in the central part of the metropolitan area [2]. With the expansion of this metropolitan area, the distance and travel time from the place of residence to the place of activities increases, coupled with the increasingly severe traffic congestion [3].

The longer travel time from the place of residence to the place of activity or vice versa has an impact on economic losses of around 65 trillion rupiahs by 2020 [4]. On the other hand, commuting activities also impact the development of residential areas and areas of activity in the metropolitan area [5]. Individually, the length of travel time for a commuting trip also has an impact on increasing stress [6].

This paper identified the impact of commute duration, other variables related to experiences during the trip, and individual characteristics on the health status experienced by commuters.

2. Literature Review

There are many studies on the impact of commuting activities on health, some of which link travel time and other variables to health. The relationship between health level and the distance from residence to the location of work is reported by [7]. Commuter workers have varying degrees of health, depending on the mode of transportation chosen. The availability of free time and health levels are affected by the mode of transportation chosen [8].

One's long trip to work will have an impact on their health, which is related to healthy living. In many cases, the shuttle workers are tired and running out of time, so they cannot maintain their fitness because of work, work pressure, and work shifts. Moreover, a long travel trip not only decreases physical activity but also causes sleep problems [9].

Citizens who travel by public transportation are healthier than those who travel by private cars, and those who travel on foot or by bike with good activities will be healthier because of cardiovascular activity [10]. Commuter worker behavior is influenced by distance between home and office and between home and the nearest public transportation station or terminal, age, and gender. Female commuter workers prefer transportation modes with higher security and comfort than men. Older commuter workers also choose the same as female commuter workers [11].

3. Methods

This study used microdata from the 2019 Jabodetabek Commuter Survey, which was conducted by BPS. This survey covers 13 regencies/cities that are included in Jabodetabek metropolitan area: South Jakarta City, East Jakarta City, Central Jakarta City, West Jakarta City, North Jakarta City, Bogor Regency, Bogor City, Depok City, Tangerang Regency, Tangerang City, South Tangerang City, Bekasi Regency, and Bekasi City.

The objectives of this survey were as follows: 1) to determine the number and pattern of commuters; 2) to collect information on commuter characteristics; 3) to collect information on the characteristics of commuter households; (4) to identify various problems related to commuter activities, such as transportation, health complaints, experiences during travel, and so on.

The 2019 Jabodetabek Commuter Survey includes 12,960 household samples obtained from 1,296 Census Blocks. With these household samples, 43,532 individual samples were obtained [5]. From these individual samples, 4,585 respondents commuted daily for the main activities of work (3,717 respondents), attending school (856 respondents), and course activities (12 respondents). These three groups of commuter activities are included in the analysis and even become one of the independent variables in the regression model proposed in this study.

In accordance with the objectives of the study, the dependent variable of the model proposed in this study is the health status of commuters. Health status is made up of two categories: healthy (HS = 1) and unhealthy (HS = 0). Healthy status is that the respondent did not experience any health complaints in the last 1 month from 9 types of complaints asked: fever, cough/cold, headache, sore throat, sore eyes, hard to breathe/asthma, colds, aches, and other complaints. Unhealthy status is that respondents had at least one disease complaint in the last 1 month.

The main independent variable in this model is commute time. Actually, this survey data provide two types of commute time: that from the place of residence to the place of activity and vice versa. However, these two variables almost correlate perfectly ($r = 0.918$ with α less than 1%); therefore, the authors decided to use only one commute time variable: commute time from the place of residence to the place of activity.

Other variables are related to commuters' travel experience, such as frequency of riding a vehicle to continue the trip to the place of activities. In this study, this variable is divided into four categories: 0 - commuters do not use a vehicle (as a reference category), 1 - 1 time, 2 - 2 times, and 3 - 3 times or

more. The next variable is whether a commuter acts as a driver or passenger during his/her trip. This variable consists of two categories: 1 - driver and 2 - passengers. The third variable related to commuter experience is the stress experienced due to travel conditions. This variable consists of two categories: 0 - no stress and 1 - stress.

The next four variables are related to individual characteristics: age, gender, level of education, and main activities of commuters. Age consists of four groups: 1. Gen Z (<= 25 years old); 2. Gen Y (26-39 years old); 3. Gen X (40-55 years old); 4. baby boomers (> = 56 years old). Gender consists of 1. males and 2. females. The education level is categorized into three groups: 1. graduated from a junior high school or below; 2. senior high school graduates; 3. graduated with Diploma I and above. The main activities of commuters, as explained above, actually consist of three groups, but because the number of respondents who are in the third group (which has courses) is too small, only 12 individuals, this variable is recoded into two groups: 1. working and 2. schooling/course.

Statistical analysis was carried out in three ways: univariate, bivariate, and multivariate. Univariate analysis only examined the health status patterns of commuters without being associated with other variables. Bivariate analysis was carried out by cross-tabulating each independent variable proposed in this study and the commuter health status. Measurement of the correlation between two nominal variables was conducted by the coefficient of contingency using $\chi 2$, and ordinal variables were measured by Kendall's Tau-b [12].

Multivariate analysis was conducted through binary logistic regression modeling because the dependent variable consists of two categories [2], [13]: healthy (HS = 1) and unhealthy (HS = 0). In the multivariate analysis, eight independent variables were included in the model: commute time, frequency of using vehicles, driver/passenger status, stress experience, age, sex, level of education, and main activity of commuters. This regression model is expressed as follows:

$$ln\left(\frac{HS=1}{HS=0}\right) = \beta_0 + \beta_1 * CT_1 + \beta_2 * CT_2 + \beta_3 * FUV_1 + \beta_4 * FUV_2 + \beta_5 * FUV_3 + \beta_6 * DS + \beta_7 * SE + \beta_8 * AG_1 + \beta_9 * AG_2 + \beta_{10} * AG_3 + \beta_{11} * Sex + \beta_{12} * Ed_1 + \beta_{13} * Ed_2 + \beta_{14} * MA \quad (1)$$

where HS = 1 is for individuals with healthy status, and HS = 0 is for individuals who are unhealthy. All independent variables in this model are categorical variables with each number of categories between two and four. Dummy variable CT1 is commute time of 3-60 min, and CT2 is commute time of more than 60 min. The reference category is commute time of 30 min and less. Dummy variable FUV1 is for individuals with a frequency of riding vehicle once; FUV2 is the frequency of riding vehicle two times, and FUV3 is the frequency of riding vehicle three times or more. The reference category for this variable is FUV = 0, which is for an individual who does not use a vehicle during a commuting trip. The DS variable is driving status, which indicates whether the respondent acts as a driver (DS = 0) or passenger (DS = 1). The SE variable is the stress experienced by a commuter during his/her trip. If he/she experiences stress, SE = 1, and if not stressed, SE = 0.

The next is the age variable, which has four categories, where the youngest age is the reference category. The dummy variable of AG1 is for individuals included in the age group of Gen Y, that of AG2 is for Gen X, and that of AG3 is for baby boomers. Sex variable = 1 is for males, and the reference category is sex = 0 for females. Educational variables consist of three categories, with the lowest education as the reference category. The dummy variable of Ed1 is for senior high school educated individuals, and the dummy variable of Ed2 is for individuals with Diploma I and above education. Finally, the MA variable, as the main activity of the commuter, is 1, for working commuters, and MA = 0 for commuters with school/course activities.

4. Results and Discussion

Data analysis shows that the number of commuters in Jabodetabek metropolitan area is 3,259,894. Most of them (59.2 percent) are in unhealthy status. As explained above, this unhealthy status shows that they have at least one health complaint among the nine asked complaints in the questionnaire. Only 40.8% of commuters in Jabodetabek have healthy status, having no complaints during the past month.

Table 1 shows the bivariate analysis of each independent variable that is hypothesized to affect commuter health status. It appears that all variables are significantly associated with health status. Travel time has a negative impact on the percentage of healthy commuters. The longer the trip, there is a decrease in the percentage of healthy commuters. Even more so if the trip takes more than 1 h. Correlation test with Kendall's Tau-b parameter shows a negative direction and significant effect at α = 1%.

Table 1 Numbers and percentages of commuters' health status (The authors)

Category	Freq.	%
Unhealthy	1,928,590	59.2
Healthy	1,331,304	40.8
Total	3,259,894	100.0

Note: The sample data were weighted.

The frequency of vehicle use during trips also contributes to the decline in the health status of commuters. If commuters do not use vehicles, around 62% are in good health. This might be related to the distance traveled. Not using a vehicle means that the commuter can walk from the place of residence to the place of activity, which means that it can also be

reached by foot. Commuters who change vehicles more than three times have a much lower level of health, which is 32%. Frequently commuting up and down using alternating vehicles expends considerable energy and can result in physical fatigue, which can decrease health.

Rahayu et al. showed that the first group, affluent men, preferred private vehicles but showed concern for the environment and openness in adopting new technology. They show a desire to use high-quality public transportation services such as the MRT. The second group, millennial rokers, relied primarily on public transportation, seeking convenience, shorter trip durations, and reduced risk. The final group, easy-going and active women, had no particular preference for public or private transportation as long as they could get to their destination quickly. However, they had significant health problems, especially during the COVID-19 pandemic. Surprisingly, all three segments showed similar future intentions toward post-pandemic public transportation use, raising governance challenges in promoting public transportation and integrating the transport system in Jabodetabek [14].

Being a driver during a trip can also cause fatigue, especially intensified by jammed traffic conditions. This can decrease the quality of health. Driving commuters constitute only 39.4% in healthy status, while commuters as passengers account for 43.3%. Because this variable is nominal, the association between driver/passenger status and health status is measured by the coefficient of contingency (cc). The cc value is indeed low (0.038), but has a significant association at $\alpha = 1\%$. The cc value cannot indicate the direction of the association (positive or negative) but only indicates the magnitude of the association.

Stressful experiences during a trip also impact health status. Commuters who experience stress have healthy status at 33.8%, lower than commuters who do not experience stress (44.6 percent). The association measurement of Kendall's Tau-b shows a negative direction and significant effect at $\alpha = 1\%$. This is supported by previous research, namely Porwandari, which stated that traffic jams cause increased costs and losses and cause distress. However, subjective perception of time management allows passengers to adapt to the situation. The adaptability of the Jabodetabek commuter community is proven by its ability to find various ways to adapt to traffic jams. Although effective policies are needed to reduce congestion, the good news is that many opportunities for adjustment await people when they are stuck in traffic [15].

Commuter age affects their health status negatively; the older the generation, the lower the health status. At the youngest generation (Gen Z), commuters with healthy status are 46.9%, while at the baby boomers generation, this figure dropped to 36.8 percent. The association between age and health status is negative and significant at $\alpha = 1\%$.

Gender also affects commuter health status. Female commuters tend to be healthier. The percentage of healthy female commuters was 43.9%, higher than that of male commuters (39.3 percent). Because gender is a nominal type of variable, the association is measured by cc, which appears to be of low value but has a significant effect $\alpha = 1\%$.

The level of education has a U-shaped effect on health status. In low education, health status tends to be high, decreases in secondary-educated commuters, and rises again in higher education. Educational variables and health status are positively and significantly associated.

The main activity of commuters affects their health status. Working commuters tend to have lower healthy status than schooling/course commuters. This means that the burden of work activities is more burdensome in the lives of commuters than the burden of school/course activities. Commuters who go to school, nearly 53% are in good health, far higher than commuters who go to work. The association between the main activity and health status had the highest value among the other independent variables and was significant.

Table 2 Percentages of commuters with healthy status by independent variables (The authors)

Ind. Var.	**Category**	**%**
Commute Time	<= 30 min	43.70%
	31-60 min	42.40%
	> 60 min	34.70%
Corr. Measr.	Kendall's Tau-b	-0.063$^{**)}$
Freq. Using	Do not use a vehicle	62.10%
Vehicle	Once	41.70%
	2 times	38.30%
	3 times	32.20%
Corr. Measr.	Kendall's Tau-b	-0.053$^{**)}$
Drive/Pass.	Driver	39.40%
Status	Passenger	43.30%
Corr. Measr.	Coeff. of Cont.	0.038$^{**)}$
Stress Exp.	Not Stress (0)	44.60%
	Stress (1)	33.80%
Corr. Measr.	Kendall's Tau-b	-0.105$^{**)}$
Age	Gen Z (<= 25)	46.90%
	Gen Y (26-39)	38.70%
	Gen X (40-55)	36.80%
	Baby Boomers	36.80%
Corr Measr.	Kendall's Tau-b	-0.079$^{**)}$
Sex	Male	39.30%
	Female	43.90%
Corr. Measr.	Coeff. of Cont.	0.044$^{**)}$
Level of Educ.	≤ Jr. High School	44.20%
	Sr. High School	37.60%
	≥ Diploma I	44.00%
Corr. Measr.	Kendall's Tau-b	0.011$^{**)}$
Main Activity	Working	37.90%
	Schooling/Courses	52.80%
Corr. Measr.	Coef. of Cont.	0.119$^{**)}$

$^{**)}$ Significant at $\alpha = 1\%$

In general, multivariate analysis with binary logistic regression shows that the impact of variables is consistent with bivariate analysis. Nearly all the

independent variables have a similar direction and a significance level under 1%. The stress experience variable, for example, shows the same direction between bivariate and multivariate analyses, i.e., commuters who have stressful experiences tend not to be healthier than commuters who are not stressed, with the odds ratio (OR) = 0.66, meaning that stressed commuters have a 0.66 times higher chance of being healthier than commuters with no stress. Independent variables that have a consistent direction of impact on health status are frequency of riding vehicle, driving/passenger status, stress experiences, age, and main activities of commuters.

The commute time variable has a slightly different pattern of impact between bivariate and multivariate analyses. In bivariate analysis, the longer the commute time, the lower the health status. In multivariate analysis, commuters who traveled for 30-60 min seemed 1.11 times healthier than commuters whose travel time was less than 30 min (OR = 1.11). However, the health of commuters who traveled longer than 1 h decreased by 0.867 times compared with that of commuters whose trips took less than 30 min.

The sex variable shows an insignificant impact, meaning that there are no differences in health status between males and females when other variables are included in the model. Referring to Table 3, OR = 0.99 (almost 1) means that there was no difference in the probability of being healthy between males and females.

Table 3 Parameter estimates of the probability of being healthy (The authors)

Equation Variables	β	OR
Commute Time		
Commute Time (1)	0.105**	1.111
Commute Time (2)	-0.143**	0.867
Frequency of Riding		
Frequency of Riding (1)	-0.554**	0.575
Frequency of Riding (2)	-0.871**	0.419
Frequency of Riding (3)	-1.115**	0.328
Driving Status	0.233**	1.262
Stress Experience	-0.416**	0.66
AgeGroup2		
AgeGroup2(1)	-0.074**	0.929
AgeGroup2(2)	-0.131**	0.877
AgeGroup2(3)	-0.118**	0.888
Sex	-0.001	0.999
Educational Level		
Educational Level(1)	0.004	1.004
Educational Level(2)	0.482**	1.62
Main Activity	-0.574**	0.563
Constant	0.68**	1.973

** Significant at α = 1%

The effect of education on health status is somewhat different between bivariate and multivariate analyses. In the bivariate analysis, commuters graduated from senior high schools had lower health status than commuters graduated from junior high schools and below. In the multivariate analysis, there is no difference in health status between commuters educated in junior high schools and below and senior high schools. This statement is supported by showing OR = 1,004, which means that the chance of being healthy among senior high school commuters is about 1 time higher than that among commuters with junior high school education and below, so it is not significant at α = 1%. For commuters with higher education, the chance of being healthy is 1.62 times higher than for low educated commuters; hence, this effect is significant at α = 1%.

5. Conclusions

Based on the results of the analysis above, several conclusions can be drawn from this research as follows: 1) travel time tends to have a negative impact on the health status of passengers; 2) frequency of driving a vehicle during the trip has a negative impact on the health status of commuters; 3) commuters who act as passengers tend to be healthier than commuters who act as drivers; 4) commuters who experience stress while traveling tend to be no healthier than commuters who do not experience stress; 5) the age of commuters has a negative impact on health status; the older the commuter, the lower their health status; 6) gender tends not to have a significant impact on the commuter's health status. There is no difference in health status between male and female passengers; 7) commuters with higher education tend to be healthier than commuters with secondary education; 8) commuters with work activities are not healthier than commuters with school/course activities.

Similar studies have been conducted in other metropolitan areas around the world. These studies can provide insight into how different travel patterns and urban environmental conditions influence population health. The findings from this research can form the basis for the development of more sustainable and health-oriented transportation policies. For example, local governments could consider measures to improve the efficiency of public transport, reduce traffic congestion, and promote sustainable modes of transport such as walking and cycling. This research can combine approaches from various disciplines such as public health, transportation, and the environment to provide a more holistic understanding of the relationship between travel time and health status. Research findings may be influenced by temporal contexts such as seasons, changes in transportation policies, or special events that influence population mobility. This needs to be considered to avoid conclusions that are too general or inappropriate. Future research could compare the impact of travel time on health between individuals who use public transportation and those who use private transportation. This can provide insight into the ways in which different types of transport affect population health.

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References

[1] RUSTIADI E., PRIBADI D. O., PRAVITASARI A. E., INDRAPRAHASTA G. S., and IMAN L. S. Jabodetabek Megacity: From City Development toward Urban Complex Management System. In: SINGH R. (ed.) *Urban Development Challenges, Risks and Resilience in Asian Mega Cities. Advances in Geographical and Environmental Sciences.* Springer, Tokyo, 2015: 421-445. https://doi.org/10.1007/978-4-431-55043-3_22

[2] CHOTIB. Spatial Distance and Mode of Transportation Choices in Jabodetabek Metropolitan Area: A Sakernas 2017 Micro-Data Analysis on Commuting Pattern of Workers. *IOP Conference Series: Earth and Environmental Science*, 2020, 436: 012021. https://doi.org/10.1088/1755-1315/436/1/012021

[3] HARMADI S. H. B., YUDISTHIRA M. H., and KOESRINDARTONO D. P. How does congestion matter for Jakarta's citizens? *Journal of Indonesian Economy and Business*, 2015, 30(3): 220-239. https://doi.org/10.22146/jieb.10312

[4] YUDHISTIRA M., KOESRINDARTONO D., HARMADI S., and PRATAMA A. How congested Jakarta is? Perception of Jakarta's citizen on traffic congestion. *Economics and Finance in Indonesia*, 2017, 62(3): 141-151. https://doi.org/10.47291/efi.v62i3.553

[5] CENTRAL BUREAU OF STATISTICS. *Survei Komuter 2019 Jabodetabek dan Mebidang: Pedoman Pencacahan*. Jakarta, 2019.

[6] RIYADI G. A., & YUDHISTIRA M. H. Pola perilaku komuter dan stres: Bukti dari Jabodetabek. *Jurnal Ekonomi Kuantitatif Terapan*, 2020, 13(1): 185-210. https://doi.org/10.24843/JEKT.2020.v13.i01.p10

[7] BADLAND H., MILNER A., ROBERTS R., and GILES-CORTI B. Are Area-Level Measures of Employment Associated with Health Behaviours and Outcomes? *Social Indicators Research*, 2017, 134(1): 237–251. https://doi.org/10.1007/s11205-016-1417-z

[8] CLARK B., CHATTERJEE K., MARTIN A., and DAVIS A. How commuting affects subjective wellbeing. *Transportation*, 2020, 47(6): 2777-2805. https://doi.org/10.1007/s11116-019-09983-9

[9] HALONEN J. I., PULAKKA A., VAHTERA J., PENTTI J., LASTRÖM H., STENHOLM S., and HANSON L. M. Commuting Time to Work and Behaviour-Related Health: A Fixed-Effect Analysis. *Occupational and Environmental Medicine*, 2020, 77: 77–83. https://doi.org/10.1136/oemed-2019-106173

[10] ZHU Z., LI Z., CHEN H., LIU Y., and ZENG J. Subjective Well-Being in China: How Much Does Commuting Matter? *Transportation*, 2019, 46(4): 1505–1524. https://doi.org/10.1007/s11116-017-9848-1

[11] PAUL D. R., DENG Y., and COOK P. S. Cross-Sectional and Longitudinal Analysis of the Active Commuting Behaviors of U.S. Department of the Interior Employees. *BMC Public Health*, 2019, 19(526): 2–11. https://doi.org/10.1186/s12889-019-6746-9

[12] MIRKIN B. Eleven ways to look at the chi-squared coefficient for contingency tables. *The American Statistician*, 2001, 55(2): 111-120. https://doi.org/10.1198/000313001750358428

[13] CHOTIB C. Analisis pemilihan moda angkutan umum atau pribadi pekerja mobilitas non-permanen di sepuluh wilayah metropolitan Indonesia. *Journal of Regional and Rural Development Planning*, 2019, 3(2): 142-156. https://doi.org/10.31098/quant.1902

[14] RAHAYU W. A., PUTRO U. S., HERMAWAN P., and SUNITIYOSO Y. Analyzing Factors Influencing Commuter Behavior in Jabodetabek through Factor Analysis. *Applied Quantitative Analysis*, 2023, 3(2): 68-85. https://doi.org/10.31098/quant.1902

[15] POERWANDARI E. K. Chats about Daily Traffic: Agentic Adaptability of Jabodetabek Commuters to Minimize Stress and Transcend Everyday Lives. *Psychological Research on Urban Society*, 2020, 3(1): 14. https://doi.org/10.7454/proust.v3i1.86

参考文:

[1] RUSTIADI E.、PRIBADI D.O.、PRAVITASARI A.E.、INDRAPRAHASTA G.S. 和 IMAN L.S. 贾博德塔别克特大城市：从城市发展到城市综合体管理系统。见：SINGH R.（主编）亚洲大城市的城市发展挑战、风险和弹性。地理和环境科学的进展。施普林格，东京，2015年：421-445。https://doi.org/10.1007/978-4-431-55043-3_22

[2]乔提布。贾博德塔别克大都市区的空间距离和交通方式选择：萨克纳斯2017年工人通勤模式微观数据分析。眼压会议系列：地球与环境科学，2020年，436：012021。https://doi.org/10.1088/1755-1315/436/1/012021

[3] HARMADI S. H. B.、YUDISTHIRA M. H. 和 KOESRINDARTONO D. P. 拥堵对雅加达公民有何影响？印度尼西亚经济与商业杂志，2015，30(3)：220-239。https://doi.org/10.22146/jieb.10312

[4] YUDHISTIRA M.、KOESRINDARTONO D.、HARMADI S. 和 PRATAMA A. 雅加达有多拥堵？雅加达市民对交通拥堵的看法。印度尼西亚经济与金融，2017，62(3)：141-151。https://doi.org/10.47291/efi.v62i3.553

[5]中央统计局。2019年贾博德塔别克和棉兰通勤调查：枚举指南。雅加达，2019年。

[6] RIYADI G. A., & YUDHISTIRA M. H. 通勤行为模式和压力：来自大雅加达地区的证据。《特拉潘经济杂志》，2020，13(1)：185-210。https://doi.org/10.24843/JEKT.2020.v13.i01.p10

[7] BADLAND H.、MILNER A.、ROBERTS R. 和 GILES-CORTI B. 地区层面的就业衡量标准与健康行为和结果相关吗？社

会指标研究，2017，134(1)：237–
251。https://doi.org/10.1007/s11205-016-1417-z
[8] CLARK B.、CHATTERJEE K.、MARTIN A. 和 DAVIS A. 通勤如何影响主观幸福感。交通运输，2020, 47(6): 2777-2805。https://doi.org/10.1007/s11116-019-09983-9
[9] HALONEN J. I.、PULAKKA A.、VAHTERA J.、PENTTI J.、LASTRÖM H.、STENHOLM S. 和 HANSON L.M. 上班通勤时间和行为相关健康：固定效应分析。职业与环境医学，2020，77：77–
83。https://doi.org/10.1136/oemed-2019-106173
[10]朱Z.，李Z.，陈华，刘Y.，曾J.中国的主观幸福感：通勤有多重要？交通运输，2019，46（4）：1505–
1524。https://doi.org/10.1007/s11116-017-9848-1
[11] PAUL D. R.、DENG Y. 和 COOK P. S. 美国内政部员工积极通勤行为的横断面和纵向分析。BMC公共卫生，2019年，19(526)：2–
11。https://doi.org/10.1186/s12889-019-6746-9
[12] MIRKIN B. 查看列联表卡方系数的十一种方法。美国统计学家，2001，55(2)：111-
120。https://doi.org/10.1198/000313001750358428
[13] CHOTIB C. 印度尼西亚大都会区非永久流动性分析。区域农村发展规划, 2019, 3(2): 142-156. https://doi.org/10.31098/quant.1902
[14] RAHAYU W. A.、PUTRO U. S.、HERMAWAN P. 和 SUNITIYOSO Y. 通过因子分析分析贾博德塔别克通勤者行为的影响因素。应用定量分析，2023，3(2)：68-
85。https://doi.org/10.31098/quant.1902
[15] POERWANDARI E.K. 谈论日常交通：贾博德塔别克通勤者的代理适应性，以最大限度地减少压力并超越日常生活。城市社会心理学研究，2020，3(1)：14。https://doi.org/10.7454/proust.v3i1.86