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Behavioral Framework of Attitude, Service Quality, Environmental Health Concerns and Intention to Use Rail Transport among Private Motor Vehicle Users

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ABSTRACT

Introduction: Public transit is a sustainable transport mode that can improve the health and well-being of urban population. Following the development of mass rapid transits (MRT) in Greater Kuala Lumpur, this study aims to empirically test the behavioral framework behind the intention to use rail transport among private motor vehicle users.

Methods: Data was obtained through a cross sectional travel survey (N=509) conducted on the catchment population of an upcoming MRT line in Greater Kuala Lumpur. The factors in the hypothesized framework were service quality, environmental health concerns, attitude and the intention to use. The data was modeled using the Maximum Likelihood (ML) estimation in structural equations. **Results:** The validated model indicated that service quality and environmental health concerns significantly affected respondents' intention to use rail transport, mediated by attitude. Reliability, convenience and comfort were the most valued service qualities, while environmental concerns were more valued than health concerns. There were significant moderation by age, income, and having children below 18 years old on the framework. Higher age groups valued more on service quality, while attitude had larger determining effects on the higher income groups. Besides, the lower direct effect of service quality on attitude among higher income groups implied possibility of other affective factors for the subgroup. **Conclusion:** This study demonstrated the importance of service quality, attitude, and environmental health concerns in encouraging rail transport usage among private motor vehicle users. Certain subpopulations may be targeted for promotion strategies to improve rail transport use in the city.

Keywords: Rail transport, Service quality, Environmental health, Attitude, Modal shift

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INTRODUCTION

In facing increasing emissions of greenhouse gases and environmental pollution from urban motor vehicles, many transport policies have been formulated to encourage modal shift from private vehicles to alternative public transports such as rail and bus. Numerous studies have also advocated the use of public transit as a measure for improving population health in a city (1,2). In Malaysia, the government is striving to increase public transport modal share especially in the urban areas. A number of urban rail infrastructure development projects are underway to establish an integrated public transport system in the Kuala Lumpur metropolitan area. The projects include the extension of the two existing major light rail transit (LRT) lines, and the third LRT line in the city to provide better connectivity and encourage transit

oriented development. Besides, the government has also embarked on the development of a high technology mass rapid transit (MRT) system which will be the largest mega transport infrastructure in the city.

Nonetheless, the establishment of these urban rail infrastructures does not guarantee its ridership and modal shift from private vehicles. Many post transport infrastructure implementation studies found that most modal shift had occurred from existing public transport users such as bus to metro, while only a small portion of private vehicle users shifted to the new public transport service (3,4). Therefore, there is a need to understand the factors that are important in encouraging the use of rail transport among the private vehicle commuters. Public transport ridership is particularly crucial to fulfill the health co-benefits and return of investments that could be generated from the high cost infrastructures (5).

Previously, transport predictive choice model had been studied separately from two perspectives: utility such as

time, and constraints, and behavior such as perception (6). A hybrid model that integrated cognitive elements such as attitude, and motivation was then introduced, recognizing the equal importance of behavioral model in choice decision making (6). The modal choice between private vehicles and public transport has been widely studied using the Ajzen's (1991) theory of planned behavior (TPB) which consists of attitude, subjective norm, and behavioral control (7–11). In TPB, behavioral intentions have been identified as the closest precursor of actual behaviors (7). In this study, we applied three factors in the behavioral framework: attitude, service quality (behavioral control), and environmental health concerns (subjective norm) of using rail transport. As the importance of behavioral factors might differ based on different samples and extent of establishment of public transport service in a locality (12), this study aims to analyze the factors behind the behavioral intention to use rail or shift mode among private vehicle users, and the moderating effects of socio economic background among the commuters in Kuala Lumpur metropolitan area.

Attitude is one of the three factors in general TPB and has been the most strongly related factor to the intention to use public transport compared to subjective norm and behavioral control (13). Chen and Chao (2011) found that attitude significantly mediated between perceived usefulness and ease of use (behavioral control) on the intention of modal shift to public transport (8). The model suggested by Borhan et al. (2014) also demonstrated that the intention to use public transport was influenced by service quality but not environmental concern (14). In this study, we included both service quality and environmental health concerns as the behavioral factors that affect attitude on using rail transport.

For rail transport, service quality is an important determinant of modal shift from private vehicles. Service quality has been interpreted in various dimensions due to its subjectivity involving tangible and intangible attributes including comfort, safety, accessibility, reliability, and convenience (15,16). Grujicic's (2013) study on public transport service quality in Serbia highlighted that vehicle ventilation, cleanliness and cost should be improved to retain or increase ridership (17). dell'Olio et al. (2011) found that public transport users valued service quality in terms of waiting time, cleanliness and comfort while potential users emphasized more on waiting time, journey time and occupancy level (18). A systematic review by Redman et al. (2013) revealed that service reliability, frequency and accessibility of public transport service were the most important attributes in encouraging modal shift by car users (19). The study also stated that the particular service quality that attracts car users depends on the specific motivation of individuals for using private vehicles.

The mediating effects of attitude between service quality

and intention were inconsistent across literatures. Some studies have revealed significant effects from service quality or perceived usefulness on the intention to shift mode, both directly and indirectly through the mediating effect of satisfaction or attitude (8,20–22). Whereas, Sumaedi et al. (2014) and Fu and Juan (2016) found that the service quality had non-significant effect on attitude and intention (16,20). Murray et al. (2010) who classified attitude as a form of prejudice towards public transport stated that improving service quality does not necessarily influence attitude towards public transport unless the prejudice was first resolved (23). Apparently, this relationship was strongly influenced by localities.

With increasing concern on the environmental impacts due to social behaviors such as using cars, many studies have looked into what caused pro-environmental behaviors in finding a way to promote sustainable environment. Both reviews by Steg and Vlek (2009) and Bamberg and Moser (2007) revealed that pro-environmental behaviors were the results of self environmental values such as beliefs and concerns, and social normative motives (24,25). The awareness and knowledge on environmental problems were important factors of pro-environmental behaviors that directly affected the attitude (25). Previous studies have also shown the significant influence of environmental awareness towards attitude and behavioral intention. However, the results were not consistent due to varying construct across behaviors and study samples (25).

Bamberg and Schmidt (2003) found that the ascription of environmental consequences of using cars such as air pollution and noise have significant effect on personal norm which determined the actual car use (26). In Fujii and Van's (2009) study, moral concerns showed significant effects on the intention to use buses (22). A study by Murray et al. (2010) also found that personal beliefs on the environment influence attitudes towards public transport (23). On the contrary, Donald (2014) found no significant effect of environmental concerns on the intention to use both car and public transport (27). de Groot and Steg (2008) also found that environmental awareness had no significant effect on attitude towards pro-environmental behavior (28).

In this study, the importance of perceived health benefits from using public transport was included in the measurement of environmental health concerns. This is due to the increasing evidence of public health benefits from using active transport, which forms a part of public transport use (1,2). Besides, perceived benefit is one of the antecedent in the health belief model in promoting disease preventive measures (29).

We build the model hypothesis based on the general framework of attitude, service quality, and environmental health concerns. In addition, we analyzed the moderating effects of the population's socio-economic characteristics

in the model construct. Below are the hypotheses of the model formed in this study.

H1: Environmental health concerns have positive effect on the intention to use rail transport.

H2: Service quality has a positive effect on the intention to use rail transport.

H3: Attitude mediates the effect of environmental health concerns towards the intention to use rail transport.

H4: Attitude mediates the effect of service quality towards the intention to use rail transport.

H5: The effect of latent construct on the intention to use differs between gender.

H6: The effect of latent construct on the intention to use differs between age groups.

H7: The effect of latent construct on the intention to use differs between income groups.

MATERIALS AND METHODS

Questionnaire design

The questionnaire was adapted from the template of travel diary used in Boulder Valley (30). Questionnaire was back translated from English to Malay and back to English, and tested to check its validity and practicality before the actual survey. The reliability analysis of the questionnaire pretest obtained a Cronbach-Alpha value of above 0.70.

Data collection

This study was conducted through a cross sectional travel survey on the population within the corridor of an upcoming mass rapid transit (MRT) line in Greater Kuala Lumpur. The survey was carried out at seven local supermarkets located near to eight systematically sampled MRT stations. Most of the respondents were from the residential areas nearby who would be potential users of the MRT system. The survey was conducted face to face with respondents using the intercept sampling method. All the respondents were above 18 years of age. Data was collected between February and June 2015. All respondents were given a small token of appreciation after they completed the survey. A final sample of 509 respondents was obtained for analysis without any missing value. The response rate was above 85%. The data obtained through the survey included socio economic background of individual respondent, their household vehicle ownership and the measurement items. The questionnaire had been pretested to ensure clear understanding of the statements before actual application.

Measures and model analysis

The measurement items of our framework consisted of service quality, environmental health concerns, attitude, and intentions. For service quality, we included operating schedule, travel time, convenience, reliability, comfort, cost, safety, and weather. For environmental health concerns, we included the impacts on environment,

climate change, and health. Attitude was measured by perception of using MRT or LRT. For intention, we included the general intention to use rail transport and the intention to shift based on trip purposes (work/school and socio/recreational). The respondents were asked to rate the statements on a five point Likert scale from 1 to 5 (strongly disagree, disagree, neutral, agree, strongly agree).

Before testing the hypothesized model, we used confirmatory factor analysis (CFA) to find out the factor loadings, reliability and validity of the measurement model. At first, the measurement model was re-specified using modification indices to increase model fit, after considering the conditions such as the meaningfulness of the additional parameters and model parsimony. The model fit criteria are listed in Table I based on Hu and Bentler (1999) (31). The reliability of the model was measured based on Cronbach's alpha and composite reliability (CR) values (Table II). Convergent validity was measured by referring to the standardised estimates, average variance extracted (AVE) and the CR values. Both CR and AVE were obtained using Excel tools developed by Gaskin (2016) (32). Discriminant validity was tested using Chi-square difference test between constrained and unconstrained models (33,34). The data set was also subjected to descriptive analysis for examination of normality, kurtosis, outliers, means and standard deviations.

Table I: Fit indices of confirmatory factor analysis (CFA) model

Indicators	Criteria	Model (original)	Model (after re-specification)
χ^2 (df), p-value	$p > 0.05$	373.875 (113), $p < 0.001$	299.09 (110), $p < 0.001$
χ^2/df (cmin/df)	< 3	3.309	2.719
SRMR	≤ 0.08	0.051	0.049
TLI	≥ 0.95	0.907	0.931
CFI	≥ 0.95	0.923	0.944
RMSEA	< 0.06	0.067	0.058

χ^2 : Chi-square; SRMR: Standardized root mean square residual; TLI: Tucker-Lewis index; CFI: Comparative fit index; RMSEA: Root mean square error of approximation

All analyses and tests on the hypothesized framework were conducted using SPSS (AMOS) version 22 with Maximum Likelihood (ML) estimation method. Bootstrapping and Bayesian estimation were used to ensure validity of the model upon violation of assumptions. The socio economic characteristics were used for multi-group comparisons in the structural equations.

RESULTS

Measurement model

Initial CFA shows that the model did not fit the data perfectly ($\chi^2 = 373.875$ (113), $p < 0.001$). To increase the model fit, the model was re-specified by adding three additional parameters based on high modification indices. The parameters added were correlations between

Table II: Validity and regression weights of CFA model

Questions/Statements	Unstandardized Estimate	Standardized Estimate	SE	Critical Ratio
Attitude (CR= 0.753, AVE= 0.604, Cronbach's Alpha= 0.747)				
Q1 Good transport choice	0.751	1.000		
Q2 Good idea	0.803	1.247	0.082	15.133*
Intention (CR= 0.727, AVE= 0.475, Cronbach's Alpha= 0.718)				
Q3 Intend to use (general)	0.783	1.000		
Q4a For work/school	0.701	1.177	0.084	13.948*
Q4b For socio-recreational	0.565	0.863	0.075	11.461*
Environmental health concerns (CR= 0.755, AVE= 0.508, Cronbach's Alpha= 0.741)				
Q5 Benefit health and fitness	0.622	0.861	0.071	12.065*
Q6 Reduce environmental impact	0.755	0.902	0.066	13.722*
Q7 Tackle climate change	0.754	1.000		
Service quality (CR= 0.865, AVE= 0.421, Cronbach's Alpha=0.867)				
Q8a Flexible schedule	0.623	1.000		
Q8b Save travel time	0.653	1.032	0.075	13.737*
Q8c Convenient	0.761	1.154	0.085	13.654*
Q8d Reliable	0.760	1.207	0.088	13.646*
Q8e Comfortable	0.695	1.066	0.083	12.790*
Q8f Affordable and good value	0.563	0.757	0.070	10.842*
Q8g Safe from crime	0.663	1.093	0.089	12.324*
Q8h Safe from accidents	0.558	0.811	0.076	10.712*
Q8i Bad weather does not matter	0.513	0.864	0.086	10.016*

* p <0.001

the error terms for item 8a (flexible schedule) and 8b (save travel time), item 8b and 8c (convenient), and item 8g (safe from crime) and 8h (safe from accidents). These additions were justified as both item 8a and 8b were related to time while both item 8g and 8h were related to safety. Item 8b (save travel time) was correlated to the belief of item 8c (convenience). As the substantial rationale for the inclusion of the other parameters was weak, they were not included in the model. After the model re-specification, the model fit improved. Table I shows comparison of the indices for the original and improved model.

The reliability, convergent validity and discriminant validity of the measurement model are shown in Table II. The Cronbach's alpha and CR of the factors were above the suggested threshold (CR > 0.7) indicating reliability of the model according to Hair et al. (2010) (34). However, the AVEs for service quality and intention were below the suggested threshold (AVE > 0.5) which indicated convergent validity problem in both factors. However, AVE is a strict and more conservative measure of convergent validity compared to CR (35). Therefore, the convergent validity of the construct could be considered acceptable based on CR. Besides, the loadings or standardized estimates for all items were > 0.5 suggesting that the items converged well in the model (34). Discriminant validity using Chi-square difference test showed significant difference (p<0.001)

between the constructs.

As kurtosis affects test of variances and covariances which structural equation model analyses are based on, assessment of normality was done. Result shows that the factors were univariate normal with kurtosis values for all items ranging between -0.144 and -1.106 which are below 7 based on Byrne (2010) (36). However, the critical ratio (C.R.) which represents normalized estimate of multivariate kurtosis exceeded the value (> 5.0) which indicates non-normal distribution in sample data among multiple factors (C.R.= 49.06). This issue was addressed by running test using bootstrapping method. A comparison between original estimates and bootstrapping values suggested no significant discrepancy between the normal theory based analysis and the bootstrapping analysis results. Assessment of multivariate outliers using computation of squared Mahalanobis distance (D2) shows minimal evidence of serious multivariate outliers.

Latent model

Table III shows the descriptive statistics of the covariance structure analysis. Safety from crime showed the lowest mean value while reduced environmental impacts scored the highest mean value. The model fit of the latent construct was acceptable (χ^2 (df), p-value = 299.09 (110), p<0.001, SRMR=0.05, TLI=0.93, CFI=0.94, RMSEA= 0.06). Results showed that with attitude as

Table III: Mean, standard deviation and Pearson correlation of measurement items

	Q1	Q2	Q3	Q4	Q4	Q5	Q6	Q7	Q8a	Q8b	Q8c	Q8d	Q8e	Q8f	Q8g	Q8h	Q8i
Q1	1																
Q2	.603**	1															
Q3	.458**	.461**	1														
Q4a	.327**	.474**	.544**	1													
Q4b	.264**	.291**	.422**	.438**	1												
Q5	.302**	.364**	.340**	.341**	.297**	1											
Q6	.311**	.315**	.420**	.289**	.273**	.444**	1										
Q7	.280**	.343**	.371**	.289**	.247**	.438**	.602**	1									
Q8a	.376**	.410**	.312**	.346**	.355**	.316**	.209**	.268**	1								
Q8b	.411**	.436**	.361**	.361**	.292**	.320**	.242**	.292**	.553**	1							
Q8c	.502**	.533**	.456**	.434**	.350**	.365**	.263**	.292**	.535**	.634**	1						
Q8d	.421**	.403**	.324**	.253**	.248**	.326**	.207**	.271**	.474**	.506**	.585**	1					
Q8e	.404**	.364**	.378**	.265**	.259**	.318**	.244**	.302**	.383**	.393**	.469**	.593**	1				
Q8f	.363**	.371**	.357**	.280**	.196**	.296**	.301**	.273**	.291**	.344**	.431**	.415**	.410**	1			
Q8g	.301**	.344**	.292**	.255**	.249**	.323**	.178**	.272**	.401**	.428**	.449**	.555**	.557**	.334**	1		
Q8h	.306**	.336**	.339**	.272**	.236**	.302**	.259**	.256**	.300**	.373**	.361**	.406**	.386**	.369**	.511**	1	
Q8i	.303**	.284**	.306**	.251**	.265**	.282**	.277**	.287**	.314**	.280**	.379**	.354**	.334**	.268**	.374**	.429**	1
Mean	4.00	3.776	3.998	3.648	3.574	3.564	4.096	3.784	3.503	3.764	3.739	3.487	3.473	3.815	3.171	3.690	3.426
SD	0.806	0.940	0.767	1.008	0.916	0.864	0.745	0.828	0.891	0.880	0.842	0.882	0.852	0.746	0.916	0.807	0.935

**p<0.001

the mediator, the relationship was reduced from 0.393 to 0.304 between environmental health concerns and intention, and from 0.452 to 0.185 between service quality and intention (Table IV). As the standardized coefficients between environmental health concerns and service quality with intention with or without mediator were significant, this indicates that attitude partially mediated the effects of the two factors on intention in the structure. Table V shows that the hypothesized model was supported by the significant relationships between

Table IV: Mediation test with bootstrapping

Factors / Relationships	Standardized beta (p-value)			Mediation type
	Direct without mediator	Direct with mediator	Indirect	
EnvH => Attitude => Intention	0.393 (.001)	0.304 (0.001)	0.086 (0.010)	Partial mediation
Service => Attitude => Intention	0.452 (.001)	0.185 (0.011)	0.271 (0.001)	Partial mediation

EnvH: Environmental health concerns; Service: Service quality

Table V: Effect estimates of structural paths

Structural paths	Unstandardized estimate	Standardized estimate	SE	Critical Ratio	p-value
EnvH => Attitude	0.247	0.204	0.073	3.397	<0.001
Service => Attitude	0.874	0.643	0.095	9.242	<0.001
Attitude=> Intention	0.335	0.422	0.075	4.458	<0.001
EnvH => Intention	0.292	0.304	0.062	4.731	<0.001
Service => Intention	0.200	0.185	0.093	2.160	0.031

EnvH: Environmental health concerns; Service: Service quality

the factors. Based on the standardized estimates (Fig. 1.), service quality had a high effect on the attitude of the respondents (b= 0.64) compared to the effect of environmental health concerns (b= 0.20) while attitude also had high effect on the intention to shift (b= 0.42). However, the direct effect that service quality exhibited on intention (b= 0.18) was lower than the effect of environmental health concerns on intention (b= 0.30). The squared multiple correlation (R2) for attitude and intention were 0.60 and 0.63, respectively.

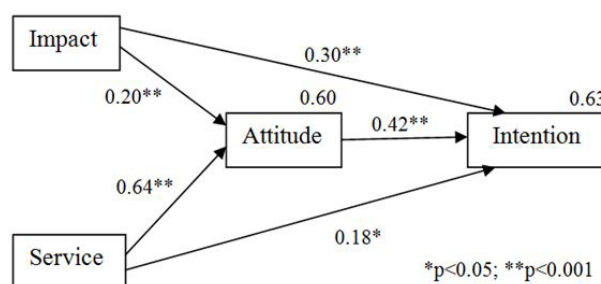


Figure 1: Structural equation model for the intention to use rail transport

Due to the consistent argument on the error contributed by Likert scale data i.e. the categorization error from splitting continuous scale into categorical scale and the transformation error from categories of unequal widths (37), Bayesian estimation, which is the approach used for analysis of categorical data, was conducted to compare the estimated values of the same model. Comparisons of the unstandardized factor loading estimates for Maximum Likelihood and Bayesian posterior distribution estimates found close estimates between both methods, which indicates validity of the hypothesized structure. Review of the diagnostics plots suggested that the model was specified correctly.

Multigroup moderation

A multi-group analysis using Chi-square difference test of constrained and unconstrained model was used to test whether the effects of the pathways in the model were invariant across age, gender, ethnicity, education level, income level, marital status, having children below 18 years old and vehicle ownership. Significant moderating effects were found for age groups, income levels and having children below 18 years old.

For age groups, significant difference was found between respondents within the age group of 18-29 and 30-39 for the effect of attitude on intention ($\chi^2 = 5.046(1)$, $p=0.025$). Based on the unstandardized estimates of unconstrained model for the pathways, the effect for the attitude on intention pathway was larger among age group 30-39. Another significant difference was found for the direct effect of service quality on intention ($\chi^2=3.953(1)$, $p=0.047$) between age group 18-29 and 40-49 with larger effect among the later age group.

For income level, significant difference was found between respondents with income \leq RM2000 and RM2001-4000 for the effect of attitude on intention ($\chi^2 = 5.391$, $p=0.02$), and environmental health concerns on intention ($\chi^2 = 4.382$, $p=0.04$) and attitude ($\chi^2 = 4.053$, $p=0.04$). Based on the unstandardised estimates, the effect of all the three pathways were larger for those with income RM2001-4000 than those with income \leq RM2000 (Table VI). For the comparison between those with income \leq RM2000 and RM4001-6000, significant difference was found for the effect of attitude on intention ($\chi^2 = 10.204$, $p=0.001$), service quality on attitude ($\chi^2 = 6.150$, $p=0.013$) and environmental health concerns on attitude ($\chi^2 = 5.675$, $p=0.017$). Respondents with income RM4001-6000 had larger effect of attitude on intention and environmental health concerns on attitude, but smaller effect of service quality on attitude. A significant difference was also found between those with income \leq RM2000 and RM6001+ in the effect of attitude on intention ($\chi^2 = 7.572$, $p=0.006$) with larger effect among those with income RM6001+. No significance was found between respondents with income RM2001-4000 with income level RM4001-6000 and RM6001+. However, the effect of service quality on attitude was significant ($\chi^2 = 4.047$, $p=0.044$) between those with income RM4001-6000 and RM6001+ with larger effect from the later.

For having and not having children below 18 years old, a significant difference was found for the effect of attitude on intention ($\chi^2 = 5.095$, $p=0.024$). Based on unstandardised estimates, respondents with children below 18 years old had larger effect on the pathway than respondents without (Table VI).

DISCUSSION

In general, all responses to the social perception statements were positive with marginal differences in mean values. Most people were supportive of the use of rail transport with high agreement that using rail transport was a good choice or a good idea. Although high percentage of individuals expressed general intention to use the MRT (question 3), lower scores were recorded when trip purposes were specified (work or socio-recreational purposes) (question 4). Such situation might need to be interpreted carefully as the general intention might not reflect the actual usage of MRT. This is reflected in a study in the United States which reported that American supporters for transit viewed transit as a solution to social problems like traffic congestions, but expressed less interest to want to use it themselves (38). For the environmental health concerns (question 5 to 7), most people were aware of the environmental benefits in general from using rail transport. However, people were less aware of the positive health impacts that could be brought upon by using rail transport, and some doubted how it could help tackle climate change issue. Nonetheless, it has been reported that rail transport could reduce large greenhouse gas emissions while bringing health co-benefits to the urban population (5,39,40).

Based on the scoring from the service quality of rail transport, safety from crime had the lowest score which reflected the high security concern among population. Such feeling of insecurity could be explained by the multiple cases of crime reported near rail stations which was then exacerbated by the spread in social media. Although crime rates might have gone down over the years, the "reality-perception" gap among the public needs to be closed (41). Safety from crime is an important social factor to encourage active transport among children, parents and the young (42). A study in the United States found that female commuters were more likely to be dropped off at the transit stations in fear of crime (43). To ensure public safety, both formal

Table VI: Unstandardized estimates of structural paths moderated by age groups, income, and having children below 18

Factors/ Structural paths	Age				Income (RM)				Presence of small children	
	18-29	30-39	40-49	50+	\leq 2000	2001-4000	4001-6000	6001+	Yes	No
Attitude=> Intention	0.222*	0.600**	0.114	-0.448	-0.068	0.317*	0.637**	0.620*	0.177*	0.504**
Service =>Intention	0.081	0.205	0.606*	1.376	0.375	0.052	0.143	0.167	0.229*	0.195
Service => Attitude	0.812**	0.769**	0.851**	1.667*	1.279**	0.769**	0.436*	1.057**	0.897**	0.853**
EnvH => Intention	0.316**	0.162	0.223*	0.490	0.104	0.410**	-0.008	0.259*	0.380**	0.153
EnvH => Attitude	0.181	0.549**	0.185	0.221	-0.111	0.277*	0.514*	0.241*	0.152	0.335**

* $p<0.05$; ** $p<0.001$

EnvH: Environmental health concerns; Service: Service quality

(authorities) and informal (society) prevention measures should be taken (41). Next, weather had the second lowest scoring as Malaysia is a tropical country with rich sunlight and unpredictable rainfalls throughout the year. The impact of weather might be related to climate change. As temperature rises, people might be more inclined to use private cars which is normally fully air-conditioned, and encourages sedentary lifestyle. Infrastructures such as covered or enclosed pedestrian pathways play a fundamental role in protecting pedestrian from nature elements. Correspondingly, the next lowest score was the comfort of taking rail transport. Many complaints had been received during the survey on the extensive usage of rail services by foreign laborers which entailed a feeling of insecurity and issue of hygiene among commuters. Such situations could perhaps be tackled with tighter security monitoring and air ventilation system on the platform and in the rail cars.

From the structural equation model which correlated several factors in this study, all construct pathways were significant. The intention to shift was significantly influenced by attitude. Both service quality and the environmental health concerns significantly affected intention directly and indirectly through attitude. The results suggest that service quality had the highest effect on private vehicle users' intention to use rail transport. The service quality evaluated refers to the perception of current private transport users towards the service attributes of rail transport service, either from past experiences (current light rail transit system) or future expectations (MRT).

Among the measurement items for service quality, the reliability of service, the convenience and comfort of taking rail transport were the most essential qualities to attract the current private vehicle users. Although cost was one of the important attributes that encourage modal shift (19,44), it was not reflected in this study as the current rail fares are affordable to most people. These findings can assist the MRT operator in prioritizing the efforts to improve attitudes towards rail transport among private vehicle users. However, the MRT service could only take people so far, compared to the door-to-door advantage of private vehicles. Therefore, the availability of transport mode in the first and last mile of the MRT system plays an extremely important role for connectivity and increasing ridership from private car users.

Using public transport due to environmental reasons is emerging as a factor of modal choice (45). The influence of environmental health concerns on attitude and intention were significant in this study, contrary to another study in Malaysia that found no significant effect for bus commuting (14). Based on the results, the environmental health concerns have more direct effect on the intention than on attitude. In addition, the effect of health concerns on intention was low compared to environmental impact and climate change. This

indicated that people were less aware or less likely to relate rail transport mode to the health impacts compared to the direct effects on the environment. A study in Taiwan suggested that increasing the level of interests in or importance of transit among commuters had large influence on the behavioral intention (21). The health benefits might be one of the promotional points to attract more private vehicle users to switch to the MRT system.

Comparison between age groups showed significant difference of effects on the direct pathway from service quality to intention. Although the only significance was found between age group 18-29 and 40-49, the regression coefficients apparently increased with the age groups. This implies that the older age group emphasized more on the service quality i.e. the instrumental value (speed, flexibility, convenience) which determined their intention to use the rail public transport (46). In line with a Malaysian study on transport policy which found older people more likely to use public transport, this study also found that older people were more demanding on service quality (47). For the significant difference found for attitude to intention, the regression coefficients for age group 30-39 were significantly different from age group 18-29, and also obviously higher than all the other age groups. However, attitude could be influenced by many other factors. Based on the theory of planned behavior, attitude refers to the behavioral beliefs of individuals towards the behavior which was formed by associating it with other objects, characteristics or events (7). Further studies on other factors might need to be done to understand this significance. Nonetheless, as age group 30-39 is one of the important target users of rail transport, their attitude towards the transport mode is important for increased ridership (48).

For income, a significant difference was found between income level \leq RM2000 and all the other higher income groups on the effect of attitude to intention. Individuals from higher income levels had larger effect of attitude on intention than the lower income groups. This result is reasonable as the higher income groups were more financially free to choose the other option of transport, i.e. their private vehicles. On the other hand, the age group 30-39 who had significantly higher effect of attitude on intention as mentioned earlier might be related to the income level in this study. A cross tabulation between age groups and income levels showed that the age group of 30-39 constituted the highest percentage in the higher income groups, i.e. RM4001-6000 (43.5%) and RM6001 (35.5%) compared to other age groups in this study. This justifies that the age group 30-39 had significantly larger effect on the pathway as they were of the higher income group in this study.

Next, the effect of environmental health concerns on attitude was also significantly larger for higher income groups, probably because they were more educated and therefore more aware of the positive impacts that

might be brought about by the use of rail transport. In addition, there was significantly lower direct effect of service quality on attitude particularly among the income level RM4001-6000. This might imply that there could be other factors not included in this study, which might have influenced the attitude of the higher income group other than the service quality. For example, the symbolic (status) and affective (independence, sense of identity) functions of private vehicle to the higher income group could contribute to the attitude towards modal shift (46,49). Corresponding to carbon emissions, the high income groups were usually responsible for the most share of emissions compared to the lower income groups as they travelled further and more frequently (50). Therefore, it is important that efforts are taken to improve the attitude of the high income population and encourage them to use rail transport system instead of private vehicles.

It is noted that the current MRT system is the first in Malaysia and many people would base their beliefs on their experience with the current existing light rail transit (LRT) system in Kuala Lumpur. This study presented results from the combined influence of previous experiences and future expectations of the MRT system from the respondents. Results indicated that all the hypotheses were supported except for H5 where no significant difference was found for the effect of construct between gender.

CONCLUSION

This study was conducted as the new MRT system was expected to fully operate in the Kuala Lumpur metropolitan area and the ridership is the important determinant to ensure that the infrastructure is fully leveraged through social, environmental and health benefits. This study suggests that behavioral factors of the service quality and environmental health concerns had significant effects on the intention to use rail transport among private motor vehicle users, and this effect was significantly mediated by attitude. There also seems to be a higher service quality demand among the older age groups and those in the higher income levels, but no significant difference was found between genders. All the hypotheses in this study were accepted except for the hypothesis on gender difference (H5). Besides, the low effect of service quality on attitude among the higher income groups might be explained by other affective factors which were not included in this study. Further study could be done on the factors that influence the attitude among the higher income groups as the effect of their attitude on intention to use rail transport was large. The users' attributes found important in this study could assist in promoting modal shift to rail transport among the aged and higher income groups who usually travel using their private motor vehicles in the city.

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