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Development and Validation of Perception of Seating Ergonomics Questionnaire: A Study on Klang Valley Drivers in Malaysia

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Abstract

Driving is an instrumental activity of daily living that has become an essential mode of transportation. Good ergonomic practices are vital to ensure successful driving. This study aimed to develop and validate a questionnaire that could be used to determine how personal, environmental, and occupational factors influence drivers' perceptions of seating ergonomics. This cross-sectional study was conducted in June-July 2022 among 250 drivers in the Klang Valley, Malaysia, recruited via an online survey. The participants completed the questionnaire by assessing different constructs in the Person-Environment-Occupation model and perceptions of seating ergonomics. Exploratory factor analysis (EFA) was conducted, followed by a path analysis. Test-retest reliability was assessed in 30 participants. The final EFA generated a four-factor structure that accounted for 61.69% of the variance. The final version of the questionnaire contained 19 items. The Cronbach's alpha values for all the constructs were above 0.7, and all the intraclass correlation coefficients were above 0.8. Based on the path analysis results, personal and occupational factors emerged as significant predictors for drivers' perceptions of seating ergonomics. The developed questionnaire was valid and reliable.

Keywords: musculoskeletal disorders, occupational therapy, Person-Environment-Occupation model, psychometric properties, rehabilitation

Introduction

According to the International Ergonomics Association, the scientific discipline of ergonomics aims to develop the understanding of interactions among humans and other system elements.[1] An ergonomist applies theory, principles, data, and methods to design to optimize human behavior, well-being, and overall system performance.[1] The term "human factor" is often used interchangeably or as a unit with the term "ergonomics."[1] Ergonomics leads to safe and sustainable work systems by considering the interrelatedness of human, technical, and environmental components, as well as the potential effects of work system design changes on all parts of the system.[1]

Ergonomics is essential in reducing the risk of injury and increasing productivity.[1] Therefore, good ergonomic practices should be incorporated into daily activities, such as cooking, reading, and driving. As a developing country, Malaysia is experiencing significant population expansion, road length, and the number of registered vehicles.[2] According to the Census and Economic Information Center, 17,486,589 vehicles were registered in Malaysia in December 2020.[3] This was a rise compared to the 17,283,951 units identified in September 2020.[3] Driving has become an essential mode of transportation. As car ownership increases, drivers' seating ergonomics becomes increasingly necessary to ensure community safety and health.

Driving is an instrumental activity of daily living that requires complex cognitive processes and motor coordination.[4] Successful driving can positively influence one's health-related quality of life.[5] Good driving performance may rely on credible drivers, optimum vehicle conditions, and smart road design.[4] Driving posture is a critical factor impacting a driver's seating comfort.[5] As the science of ergonomics is essential to making road driving safe and comfortable, drivers should adopt a more active role in addressing the different ergonomics issues that may occur while driving.

Perception is defined as the distinctive way an individual or group views an occurrence, making it a potent driving force for action.[6] Although perception has been widely studied, capturing the concept meaningfully is problematic as it depends on self-reports of covert attri-

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butes. The most popular strategy for estimating perception is to use quantitative surveys, especially Likert-type scales.[6] A study by Yitayal, *et al.*, found that ergonomics awareness was a significant determinant of lower-back pain among drivers.[7] Moreover, AL-Dubai, *et al.*, found that lower-back pain was significantly associated with an awareness of ergonomics factors among taxi drivers in Malaysia (p-value<0.001).[8] Most participants (52.5%) stated they were unaware of good sitting posture and its importance.[8] In another study by Mohamad, *et al.*, 77% of survey subjects agreed that driving posture might influence discomfort while driving.[9] Furthermore, ergonomically designed drivers' car seats were crucial as they could enhance drivers' safety and comfort while driving and controlling the car.[9]

This study applied the Person-Environment-Occupation (PEO) model to assess drivers' perceptions of seating ergonomics. This was developed to provide a framework for delivering services that embrace a client-centered approach.[10] The model emphasizes occupational performance shaped by interactions between person, environment, and occupation.[10] A better fit of the three constructs indicates more meaningful participation. The outcome of the fit between the transaction of three components is defined by the quality of experience concerning individual levels of satisfaction and functioning.[10]

Hutchinson, *et al.,* conducted a qualitative study to understand the lived experiences of drivers with disabilities.[11] The PEO model was applied to develop and interpret the analysis, which had been extensively applied as an orientating framework when evaluating occupational performance issues and previously used in the transportation context.[11] The study suggested that the model was beneficial for conceptualizing how individuals interact with the environment.[11] The PEO model can be applied to identify occupational performance issues, strengths, and problems by, first, evaluating environmental conditions and, second, analyzing client performance components and occupational elements.[10] In this study, driving was regarded as the occupation, and the driver was the person. Driving occurred in a context that comprised physical, social, cultural, and socioeconomic factors.

Ergonomics was first introduced in Malaysia in 1992 when an ergonomics division was established within the National Institute of Occupational Health (NIOSH).[12] The Social Security Organization (SOCSO), a government agency under the Ministry of Human Resources, was established to administer and implement social security schemes under the Workers' Social Security Act 1969.[13] According to an annual SOCSO report, the total number of cases involving musculoskeletal problems recorded in 2015 was 1,123. This figure increased in the following four years (2016: 1,607 cases; 2017: 2,035 cases; 2018: 2,099 cases; and 2019: 2,352 cases).[13] A summary of the occupational accidents reported by the International Labour Organization, SOCSO, and the Department of Occupational Safety and Health revealed the general deficiency of the health and safety situation of workers worldwide.[14] The number of reported cases has been rising in recent years.[14] In general, little is known about ergonomics perception and practice among drivers in Malaysia.

Several studies have investigated how ergonomic practices affect the driving performance of professional drivers.[15] However, to date, a limited number of studies have focused on global perceptions of seating ergonomics among general drivers. Moreover, no study has applied the PEO model to analyze drivers' perceptions of seating ergonomics. Thus, this study aimed to develop and validate a questionnaire based on the PEO model and investigate how person, environment, and occupation factors influenced the perception of seating ergonomics among drivers in the Klang Valley, Malaysia. This study may improve the current driving rehabilitation practice in Malaysia and worldwide.

Method

This quantitative study, which used a cross-sectional design, was conducted in September 2021-July 2022 to, first, develop the questionnaire related to drivers' perceptions of seating ergonomics and, second, determine the influence of person, environment, and occupational factors on drivers' perceptions of ergonomics. This study was divided into two phases. The first focused on the questionnaire development, while the second focused on determining its reliability and validity and examining the constructs' relationships.

During the first phase, the Drivers' Perception of Seating Ergonomics Questionnaire was developed based on the practice guidelines recommended by Ikart.[16] Relevant literature on driving ergonomics and the PEO model was reviewed to construct the questionnaire items. Before developing the questionnaire, each construct being examined was defined to facilitate the item construction and content validation process.[17] The initial version of the questionnaire was distributed to six content experts with in-depth knowledge of this domain.[18]

Academic experts with a doctorate of philosophy in a field related to rehabilitation or ergonomics (n = 2); clinicians with at least five years of clinical experience in the physical rehabilitation field (n = 2); and professional drivers with at least two years of work experience (n = 2) were recruited via purposive sampling. After approaching the experts and obtaining their consent, a content validation form was distributed. Modifications were made based on their recommendations.

The modified version of the questionnaire was again subjected to the content experts' judgment to determine

its validity. As a result, the questionnaire showed excellent content validity. The item-level content validity indexes (I-CVIs) and modified kappa values of all 28 items were excellent, with all the values scoring above 0.80 for relevance, simplicity, and clarity.[17]

The questionnaire was then distributed to target-population judges (n = 10) as part of a feasibility test.[19] The inclusion criteria were as follows: (a) Malaysians living and working (if applicable) in the Klang Valley; (b) aged 18 years or above; (c) holding an active and valid license; (d) with a minimum of one year of driving experience and (e) had driven at least once a week in the past month. The face validation form was created using Google Forms and distributed to the target-population judges. A quantitative analysis of the percentage of agreement was conducted, along with qualitative analysis, to determine the clarity of wording, feasibility, readability, and questionnaire layout. After reviewing the feedback, minor changes were made. The finalized questionnaire was then administered to drivers in the Klang Valley.

The second phase was conducted among drivers in the Klang Valley in June-July 2022. The required sample size was calculated according to the recommendation given by Beavers, *et al.*,[20] for exploratory factor analysis (EFA) to feature at least 100 cases, and a subjects-to-variables (STV) ratio of no less than five was achieved.[20] The following inclusion criteria were applied in the study: (a) Malaysians living and working (if applicable) in the Klang Valley; (b) 18 years old or above; (c) holding an active and valid license; (d) having a minimum of one year of driving experience and (e) had driven at least once a week in the past one month. Individuals over 60 years and OKU card holders (a document for persons with disabilities) were excluded.

An informed consent form and a copy of the finalized questionnaire were converted into Google Forms, links for which were distributed publicly through online platforms. The survey invitation text included a brief explanation of the purpose. Eligible drivers could either ignore the invitation or self-decide to take the survey by clicking on the survey link in the text. The respondents had to read and agree to points on the consent form before starting the survey. A total of 263 responses were collected via convenience sampling. The demographic data of the respondents were screened. Thirteen responses were excluded for two reasons: five respondents were 60 years old or above, while eight had no valid driving license. After the screening, 250 respondents were recruited for the study.

In the second phase, participants were required to complete the self-administered questionnaire, which contained questions regarding their demographic data, driving profile, person constructs, environment construct, occupation construct, and perception of seating ergonomics construct. The questionnaire was divided into six sections. The first part of the questionnaire collected information on sociodemographic characteristics, such as each participant's age and sex. The second part included a driving profile (with features like years of driving and daily driving hours). The remaining four parts included items for different constructs, which were weighed by a 10-point Likert scale ranging from "Totally Disagree" to "Totally Agree." Seven items were used to measure each construct, and the participants were asked to indicate their level of agreement with each statement in the context of driving.

Descriptive statistics were conducted to analyze the participants' demographic information using IBM SPSS Statistics version 26 under license from the Universiti Kebangsaan Malaysia. Using the same software, EFA was performed using the principal component (PC) method and varimax rotation. The minimum factor loading criterion was 0.50.[21] The internal consistency of the questionnaire was tested using Cronbach's alpha. Subsequently, path analysis was conducted using IBM SPSS AMOS version 26 to investigate the relationships between the PEO factors and drivers' perceptions of seating ergonomics. The result obtained was compared with the bootstrapping results, in which the resampling number had been set to 1,000 times.[22] Finally, the test-retest reliability of the questionnaire was assessed after two weeks with a sample of 30 participants; to do this, a two-way mixed effects model, single measurement, and absolute agreement were used.[23]

Results

The sociodemographic characteristics of the participants are shown in Table 1. A sample numbering 250 drivers aged between 20 and 58 years participated in this study. The mean age was 27.29±7.67 years old. Most participants were female (72.0%) and Chinese (77.6%). The respondents had relatively high educational levels, with 83.6% completing undergraduate studies or above. The distribution of the drivers by location was as follows: 54.8% were from Selangor, 44.8% were from the Federal Territory of Kuala Lumpur, and 0.4% were from the Federal Territory of Putrajaya. Most (92.4%) had a class D license. The participants' mean years of driving were 7.75±6.79 years. Most drivers drove a five-seater vehicle (86.8%). The mean daily driving hours during weekdays were 2.09±2.21, while the mean daily driving hours during the weekend were 3.40±4.11.

The 28 original questionnaire items were submitted for EFA (n = 250) to assess the factor structure. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.916, and Bartlett's Test of sphericity was statistically significant (p-value<0.001). Both tests indicated that it was appropriate to conduct EFA. In addi-

Table 1. Descriptive Statistics of the Questionnaire (n = 250)

Variable	Category	n (%)	Mean ± Standard Deviation
Age (years)			27.29±7.67
Sex	Male	70 (28.0)	
	Female	180 (72.0)	
Ethnicity	Chinese	194 (77.6)	
	Malay	42 (16.8)	
	Indian	13 (5.2)	
	Sikh	1 (0.4)	
Highest educational level	Diploma and lower	41 (16.4)	
	Undergraduate	202 (80.8)	
	Postgraduate	7 (2.8)	
Living location	Selangor	137 (54.8)	
	Federal Territory of Kuala Lumpur	112 (44.8)	
	Federal Territory of Putrajaya	1 (0.4)	
Employment status	Employed	164 (65.6)	
	Currently a student	82 (32.8)	
	Currently unemployed	1 (0.4)	
	Had retired	3 (1.2)	
Type of driving license	D	231 (92.4)	
	DA	15 (6.0)	
	E	1 (0.4)	
	E2	3 (1.2)	
Number of years of driving			7.75±6.79
Daily driving hours during weekday			2.09±2.21
Daily driving hours during weekend			3.40±4.11
Type of vehicle transmission	Automatic	232 (92.8)	
	Manual	18 (7.2)	
Engine size of vehicle (in cc)	1,000 cc and below	52 (20.8)	
	1,001 cc to 1,200 cc	30 (12.0)	
	1,201 cc to 1,400 cc	48 (19.2)	
	1,401 cc to 1,600 cc	93 (37.2)	
	1,601 cc to 1,800 cc	11 (4.4)	
	1,801 cc to 2,000 cc	9 (3.6)	
	2,000 cc and above	7 (2.8)	
Number of seats in the vehicle	2 seats	10 (4.0)	
	4 seats	1 (0.4)	
	5 seats	217 (86.8)	
	7 seats	21 (8.4)	
	7+1 seats	1 (0.4)	
Body part that feels pain during driving	Neck	95 (38.0)	
	Shoulder	72 (30.0)	
	Upper back	34 (13.6)	
	Upper arm	13 (5.2)	
	Elbow	8 (3.2)	
	Wrist	14 (5.6)	
	Finger	9 (3.6)	
	Lower back	54 (21.6)	
	Hips	45 (18.0)	
	Thigh	11 (4.4)	
	Knees	20 (8.0)	
	Calf	23 (9.2)	
	Ankle	20 (8.0)	
	Foot	22 (8.8)	

tion, five factors had Eigen-values >1, indicating that the factor solution derived from this analysis produced five factors for the questionnaire.

In this initial EFA, an item was loaded in a factor alone. It was thus excluded, and the EFA was repeated with the remaining 27 items. The factor solution derived from the second analysis produced four factors for the questionnaire. An item with a commonality below 0.4 was excluded. To assist the factor interpretation and naming, four items loaded onto a factor other than its underlying factor were excluded. Lastly, three items that failed to load significantly on any dimension were removed.

The final analysis results produced four factors for the questionnaire. The Person, Environment, Occupation, and Perception of Seating Ergonomics constructs were

the four factors determined by the EFA. The KMO measure of sampling adequacy was 0.905, and Bartlett's Test was significant (p-value<0.001). All the commonalities were above 0.4. These factors could explain 61.69% of the total scale variance. Therefore, the construct validity of the questionnaire was established. The final version of the Drivers' Perception of Seating Ergonomics Questionnaire consisted of 19 items. The commonalities and factor loadings are presented in Table 2.

The Cronbach's alpha coefficients were computed to assess the internal consistency of the final version of the questionnaire. The Drivers' Perception of Seating Ergonomics Questionnaire had an overall Cronbach's alpha of 0.9. The Cronbach's alpha values for the Person, Environment, Occupation, and Perception of Seating Ergonomics constructs were 0.817, 0.704, 0.879, and 0.811, respectively. All these values were above the acceptance value of 0.7. For test-retest reliability, the differences between the total scores for both measurements for each construct were plotted against the average score of the two measures, with an upper and lower limit of agreement. An exemplary Bland and Altman plot was obtained for the Occupation Construct, as shown in Figure 1. For a 95% confidence interval, the intraclass correlation coefficients (ICC) for the Person, Environment, Occupation, and Perception of Seating Ergonomics constructs were 0.848, 0.893, 0.834, and 0.874, respectively. All four constructs displayed good reliability, as all

Table 2. The Results of Exploratory Factor Analysis and Reliability Testing

Factor	Item	Communality	Factor Loading	Cronbach's alpha	ICC	SEM
Factor 1: Person construct	P1	0.632	0.717	0.817	0.848	0.539
	P4	0.606	0.612			
	P6	0.729	0.783			
	P7	0.644	0.696			
Factor 2: Environment construct	E2	0.503	0.573	0.704	0.893	0.664
	E3	0.493	0.658			
	E4	0.737	0.802			
	E5	0.561	0.633			
Factor 3: Occupation construct	O1	0.678	0.534	0.879	0.834	0.930
	O3	0.683	0.726			
	O4	0.722	0.784			
	O5	0.762	0.827			
	O6	0.616	0.684			
Factor 4: Perception of seating ergonomics construct	SE1	0.518	0.599	0.811	0.874	0.957
	SE2	0.623	0.756			
	SE3	0.572	0.664			
	SE4	0.539	0.719			
	SE6	0.527	0.592			
	SE7	0.577	0.604			

Notes: ICC = Intraclass Correlation Coefficient, SEM = Standard Error Measurement

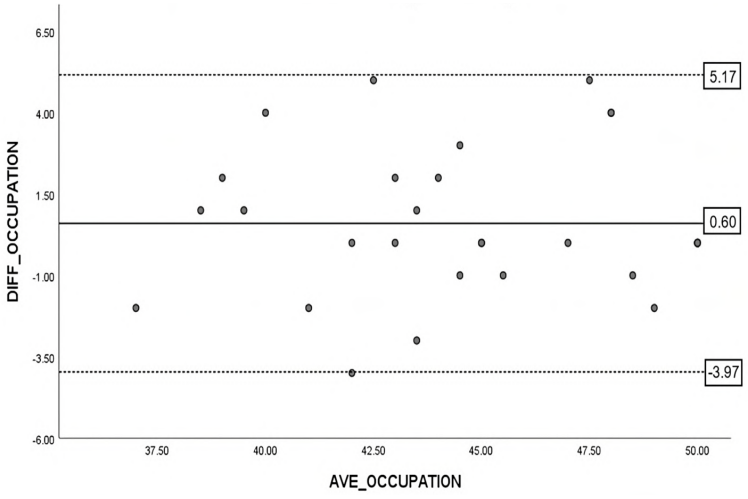


Figure 1. Bland and Altman Plot for Occupation Construct

the ICC values were above 0.75. The standard error of measurement (SEM) for the four constructs ranged from 0.54 to 0.96, with the Person construct having the SEM lowest value. The reliability testing results are shown in Table 2.

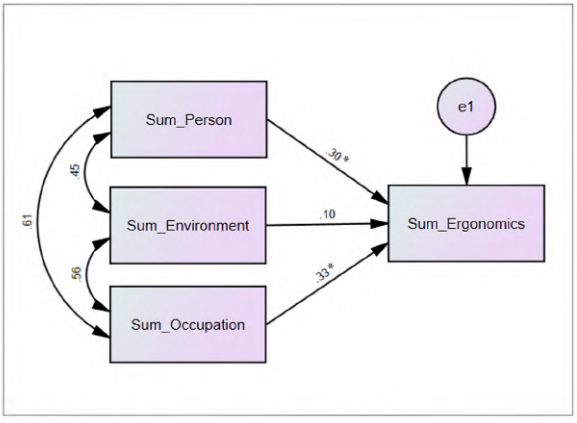
A path analysis was conducted to examine the association between the Person, Environment, Occupation, and Perception of Seating Ergonomics constructs. The first three were used as observed indicators of a latent variable: the perception of seating ergonomics. The path model is shown in Figure 2, while the bootstrapping results are reported in Table 3, with the Person and Occupation constructs emerging as significant predictors. According to the results, the Occupation construct (Sum_Occupation) had the most excellent significant relationship with drivers' perceptions of seating ergonomics ($\beta = 0.333$, p-value<0.05), followed by the Person construct (Sum_Person) ($\beta = 0.298$, p-value<0.05). On the other hand, the Environment construct (Sum_Environment) did not have a significant relationship with the drivers' perceptions of seating ergonomics ($\beta = 0.099$, p-value = 0.118, p-value>0.05).

Discussion

This study described the development and validation of the Drivers' Perception of Seating Ergonomics Questionnaire. The finalized questionnaire contained 19 items. This is the first questionnaire to apply the PEO model to explore predictors of drivers' perceptions of seating ergonomics in the development process. The PEO model has previously been used when developing instruments to examine the dynamic relationships between person, environment, and occupation in different contexts,[24] thus supporting the appropriateness of using the model as the theoretical foundation of the questionnaire development process in this study. This study examined the relationships between drivers, driving activities, environments, and drivers' perceptions of seating ergonomics. The proposed model incorporated the finalized items in the PEO constructs as direct predictors of drivers' perceptions of seating ergonomics. The psychometric properties within the questionnaire were examined using a sample of 250 Malaysian drivers in the Klang Valley.

The initial version of the questionnaire consisted of 28 items. However, modifications would be needed for new instruments.[17] Content validity is essential for researchers to realize whether the instruments they use are appropriate for the constructs, population, and sociocultural background of their particular studies.[17] Face validity is used as a subsidiary form of validity to support content validity.[17] It concerns item judgments after an instrument has been constructed. Hence, the questionnaire's validity was first confirmed using the content and face validity approaches. After conducting the initial EFA, the questionnaire items were found to be categorized into five factors. The factor analysis and item deletion procedures were then performed based on the recommendations and guidelines from previous studies.[25] During factor analysis, nine items from the initial questionnaire that had been content-validated were excluded. The EFA revealed that three items were deemed useless for measuring the specific constructs due to their low factor loading.[22] Based on the final EFA results, the components were named based on the PEO model. The first three constructs in the questionnaire referred to a range of personal, environmental, and occupational factors in the context of driving. Through EFA, the questionnaire's construct validity was established.

The reliability of the Drivers' Perception of Seating Ergonomics Questionnaire was confirmed by examining its internal consistency and test-retest reliability. The internal consistency among the 19 items for the whole questionnaire was 0.9, while Cronbach's alpha values for



*p-value <0.05

Figure 2. The Proposed Model for Path Analysis

Table 3. Bootstrapping Results of Path Analysis

Hypothesis	Estimate	Standard Error	Lower Bound	Upper Bound	p-value	Result
Sum_Ergonomics <--- Sum_Person	0.298	0.076	0.167	0.421	0.003	Significant
Sum_Ergonomics <--- Sum_Environment	0.099	0.068	-0.007	0.211	0.118	Non-significant
Sum_Ergonomics <--- Sum_Occupation	0.333	0.083	0.207	0.475	0.001	Significant

the four constructs ranged from 0.704 to 0.879; thus, all were within an acceptable range.[26] The questionnaire had good test-retest reliability as all four constructs had ICC values over 0.75.[27] Some outliers ranging from one to three were detected in the Bland and Altman plots for the four constructs. After investigation, the outliers were found to have arisen from data collected from Chinese participants. Therefore, the presence of these outliers may have been due to the differences when interpreting items in Malay after two weeks. Previous studies have identified how Malaysian Chinese tend to use Mandarin as their primary language in their daily lives.[28]

From the path analysis, the Occupation construct emerged as the most significant predictor of the perceptions of seating ergonomics. In this questionnaire, the Occupation construct consisted of items concerned with drivers' self-perceptions of driving-related occupation demands, organization, time, change, and routines. The findings suggested that such occupational factors significantly influenced drivers' perceptions of seating ergonomics. First, it is essential to note that according to the International Ergonomics Association definition of ergonomics,[1] cognitive ergonomics, which aims to support human well-being when executing tasks, studies human cognitive capacities (including memory, attention, and problem-solving) and performance outcomes (including the time taken when performing a task).[29] Therefore, the occupational factors included in the finalized version of the questionnaire developed in this study aligned with the focus on cognitive ergonomics. Furthermore, a previous study suggested that human error while driving could be understood based on individual differences in abilities to process information.[30] These findings supported the view that occupational factors concerned with human cognitive capacities and performance outcomes could be vital in influencing drivers' perceptions of seating ergonomics.

Besides the Occupational construct, the Person construct had a significant relationship with drivers' perceptions of seating ergonomics. The findings indicated that personal factors, including drivers' perceptions of their role, self-conceptualization, health, physical performance, and sensory capabilities, significantly influenced their perceptions of seating ergonomics. Deng, *et al.*,[31] supported these results, stating that visual abilities are essential for driving, especially driving safely. A similar result was observed in a study by Karali, *et al.*,[32] mentioning that a decline in physical capabilities could affect those driving a vehicle. Besides the need for drivers to have sufficient ability, Xu, *et al.*[33] stated that the factors of motivation, beliefs, and personal values were also important for driving safely as they could determine one's driving habits. A previous study further verified these notions, stating that individual perceived control to perform driving was significantly related to driving status.[34] These findings justified the results from the present study, which also revealed that personal factors had a significant relationship with drivers' perceptions of seating ergonomics.

In this study, the Environment construct was an insignificant predictor of the perception of seating ergonomics. This might have been due to personal and occupational factors having a more powerful influence on perceptions of seating ergonomics, which subsequently overshadowed the impact of environmental factors on drivers' perceptions while driving. This explanation could be supported by the argument of Hughes, *et al.*,[35] claiming that current road safety strategies could not cope with the impact of societal issues on road safety. However, the relationship between environmental factors and drivers' perceptions of seating ergonomics must be interpreted with caution as the findings of the present study contrasted with those of previous studies, which revealed that environmental factors, including weather conditions, were related to a driver's health, mental state, and driving performance.[36]

One strength of the current study was the sample size recruited. This was considerable, ensuring the adequacy of sampling for conducting factor analysis. However, this study had several limitations to consider when interpreting the results. First, convenience sampling was used to recruit drivers in the Klang Valley. Although the online survey permitted access to a larger respondent population, the disadvantage of conducting an online survey through convenience sampling was the risk of self-selection bias, as all the individuals were fully allowed to decide whether to participate.[37]

Furthermore, there was limited literature on developing an instrument based on the PEO model. Thus, it is recommended that the psychometric properties of the Drivers' Perception of Seating Ergonomics Questionnaire should be investigated further via confirmatory factor analysis. Additionally, the low percentage of males (28%) might limit the generalization of the results to male drivers.[5] Furthermore, the large proportion of Chinese respondents (77.6%) might affect the applicability of the findings in Malaysia's multi-ethnic population. Last, the cross-sectional design did not permit investigation of the eventual causal relationship between the three constructs and the drivers' perceptions of seating ergonomics. Although drivers' perceptions of seating ergonomics were explored using the newly developed questionnaire, the results were not quantified or interpreted by cut-off scores. Hence, further study is recommended to determine the questionnaire cut-off scores.

Conclusion

The questionnaire developed and validated in this

study could be used as a reliable instrument to measure and determine how personal, environmental, and occupational factors influence drivers' perceptions of seating ergonomics, which can, in turn, influence their ergonomic practices while driving. However, further study is recommended to examine the questionnaire's psychometric properties. As ergonomic driving posture is especially essential for drivers, future investigations may build upon this study by utilizing the questionnaire to guide investigations or interventions in study and clinical settings.

Abbreviations

PEO: Person-Environment-Occupation; NIOSH: National Institute of Occupational Health; SOCSO: Social Security Organization; EFA: Exploratory Factor Analysis; KMO: Kaiser-Meyer-Olkin measure; ICC: Intraclass Correlation Coefficients; SEM: Standard error of Measurement.

Ethics Approval and Consent to Participate

This study received ethical approval from the Research Ethics Committee of Universiti Kebangsaan Malaysia (Reference number: UKM PPI/111/8/JEP-2021-909). Before filling in the questionnaire, respondents must read and agree to the consent form to participate in this study.

Competing Interest

The authors declare no significant competing financial, professional, or personal interests might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' Contribution

HFR, DH, and YCM contributed to the design and implementation of the research and the analysis of the results. YCM and HFR verified the analytical methods, while DH and HFR supervised the findings of this work. HFR, DH, YCM, and LWX were responsible for the preparation of the manuscript, as well as the accuracy of all content in the proof, including the co-authors, addresses, and affiliations. All the authors discussed the results and contributed to the final manuscript.

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