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THE HEALTH IMPACT OF PROLONGED TRICYCLE (KEKE) DRIVING WITH INAPPROPRIATE SITTING POSITION IN FREETOWN, SIERRA LEONE

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ABSTRACT

This study investigates the health impact of prolonged tricycle (Keke) driving with inappropriate sitting positions among drivers in Freetown, Sierra Leone. Tricycle transportation is a vital mode of public transportation in the city, and many drivers are exposed to long hours of suboptimal seating postures. The primary objective of this research is to assess the health consequences of such conditions and identify potential interventions to improve the well-being of Keke drivers. To achieve the objective, an extensive literature was reviewed and a unique research model was developed. We collected data from 513 Keke drivers and employed the structural equation model (SEM) approach to test the research hypothesis and consequently address the objectives. The results show that, prolonged inappropriate sitting position and ergonomic factors have negative health impacts on Keke drivers. The results further show that, increased levels of mental stress exacerbate the negative health outcomes associated with prolonged and poor sitting ergonomics. The findings also show that taller drivers experience heightened discomfort and health impacts compared to shorter drivers. For policy, it is suggested that implementing ergonomic features such as proper lumbar support, adjustable seat height, and optimal seating angles will mitigate physical strain and discomfort experienced by drivers, thereby reducing the incidence of chronic back pain, spinal deformities, and other musculoskeletal issues. This recommendation underscores the potential of ergonomic interventions to improve the health and well-being of Keke drivers, emphasizing the importance of prioritizing ergonomic considerations in tricycle design and maintenance.

Keywords: Prolonged Keke driving, Ergonomic factor, inappropriate sitting position, mental stress, health impact.

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INTRODUCTION

In Freetown, Sierra Leone, tricycles commonly referred to as "Keke," have become essential in public transportation. These Keke vehicles consist of a motorcycle coupled with a passenger cab, offering a cost-effective and accessible mode of traveling. Despite their popularity, the design of Keke vehicles often prioritizes beauty over the comfort, safety, and well-being of both drivers and passengers.

Keke transportation plays a pivotal role in Freetown's public transportation system, providing affordable and convenient mobility to a wide range of residents. However, many Keke drivers endure long working hours seated in Kekes with inadequate seating positions. Prolonged exposure to improper ergonomic conditions can lead to adverse health consequences, particularly affecting the musculoskeletal system (Hughes & Ferret, 2013). Unfortunately, comprehensive research on the health impacts of prolonged Keke driving with inappropriate sitting positions in Freetown is notably lacking.

The safety of Keke drivers goes beyond just operating the vehicle safely; it extends to ensuring that their posture while sitting is both safe and comfortable. Poor seating postures can lead to injuries and musculoskeletal disorders (MSD) among drivers (van Veen *et al.,* 2015). Musculoskeletal disorders are often attributed to poorly designed workstations. As the demand for Keke usage continues to rise in Sierra Leone, there is an urgent need to investigate and improve the sitting postures of Keke drivers. The increase in Keke usage, especially for extended periods, has made this study particularly relevant.

Keke drivers typically spend a significant amount of time in a static sitting position while navigating the city. This prolonged static sitting can lead to physical fatigue and an increased risk of musculoskeletal complaints. Therefore, it is essential to conduct a comprehensive study and analysis of the sitting postures of Keke drivers to ensure their well-being and comfort during their driving experiences.

The primary hypothesis of this research is to determine whether there are existing ergonomic risks associated with the sitting postures of Keke drivers. Ergonomics is the science of fitting the workplace to the worker, aiming to prevent work-related musculoskeletal disorders by identifying, evaluating, and controlling physical workplace risk factors (Stack *et al.*, 2016, Abdisa *et al.,* 2022). The main objective of this research is to establish whether there are significant ergonomic risks for drivers due to their static sitting positions in Kekes. The adoption of awkward and incorrect sitting postures is expected to lead to notable ergonomic risks, while the adoption of proper and correct sitting postures should result in a reduction of such risks.

Understanding the health consequences and ergonomic risk factors associated with Keke driving in Freetown is essential for improving the well-being of drivers and ensuring the sustainability of the broader transportation system. This research aims to address the current knowledge gap in the field and provide evidence-based recommendations to enhance the health and working conditions of Keke drivers.

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LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Prolonged inappropriate sitting in Keke and Health Impact

Prolonged inappropriate sitting in tricycles is a pressing concern with significant implications for the health and well-being of drivers (Muhammad *et al.,* 2012). Research has highlighted the detrimental effects of prolonged sitting in inadequately designed seats on the musculoskeletal health of tricycle drivers (Ipingbemi & Adebayo, 2016). Studies indicate that continuous pressure on the spine and lower back due to poor posture while driving tricycles can lead to chronic back pain, spinal deformities, and intervertebral disc degeneration (Declan, 2012). Additionally, inadequate lumbar support and improper positioning of the legs contribute to musculoskeletal discomfort and lower limb disorders, ultimately impacting the physical capacity and quality of life of tricycle drivers (Bhatt & Seema, 2012; Kyung & Maury, 2009).

Furthermore, prolonged inappropriate sitting in tricycles is associated with circulatory problems that pose additional health risks to drivers. Poor seat design and improper posture impede blood flow to the lower extremities, leading to venous stasis, varicose veins, and peripheral edema (Agarwal *et al.,* 2017). Over time, compromised circulation increases the risk of deep vein thrombosis and cardiovascular complications among tricycle drivers. These circulatory issues not only exacerbate physical discomfort but also underscore the systemic health implications of ergonomic deficiencies in tricycle seating (Park, *et al.* 2013; Singh, 2021). In lieu of the above, we hypothesized that:

H_1: *prolonged inappropriate sitting has a negative health impact on Keke drivers*

In other words, the longer the duration of daily driving, the higher the likelihood of experiencing chronic back pain, spinal deformities, and other musculoskeletal issues associated with poor seating ergonomics. This hypothesis suggests that the cumulative effects of prolonged inappropriate sitting intensify over time, resulting in more severe health impacts among tricycle drivers who spend extended hours behind the wheel.

Ergonomic Factors and Health Impact

The impact of ergonomic factors on the health of tricycle drivers is a significant area of concern, as evidenced by a growing body of literature (Lucas & Onawumi, 2013; Liu *et al.,* 2017; Ilah & Ahmad, 2019; Estember & Espinosa, 2020; Cruz, 2022). Ergonomic considerations play a crucial role in determining the physical well-being of drivers, particularly concerning seating arrangements and posture. Studies consistently demonstrate that ergonomic deficiencies in tricycle design contribute to a range of health issues among drivers (Hakim & Mohsen, 2017). Poor seat ergonomics, characterized by inadequate lumbar support, lack of adjustability, and improper seating angles, have been linked to an increased risk of musculoskeletal disorders such as chronic back pain, spinal deformities, and lower limb discomfort (Gumasing & Liao, 2021).

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Moreover, ergonomic factors also influence the prevalence and severity of circulatory problems among tricycle drivers (Gumasing, & dela Cruz, 2018). Inadequate seat design and prolonged sitting contribute to reduced blood circulation to the lower extremities, predisposing drivers to venous stasis, varicose veins, and peripheral edema (Gowtham *et al.,* 2018). The compromised circulation increases the risk of cardiovascular complications and deep vein thrombosis, highlighting the systemic health consequences of ergonomic deficiencies in tricycle seating (Finestone *et al.,* 2018). The circulatory problems not only worsen physical discomfort but also highlight the wider health hazards linked to inadequate ergonomic design in tricycles. Based on the above, we hypothesized that:

H_2: *Poor ergonomic design of Keke has a negative health impact on Keke drivers*

The Mediating Role of Mental Stress on the relationship between Prolonged Inappropriate Sitting, Ergonomic Factors and Health Impact

Recent literature has underscored the mediating role of mental stress in the complex relationship between prolonged inappropriate seating, ergonomic factors, and health outcome among tricycle drivers. Studies have revealed that prolonged sitting in inadequately designed seats leads to physical discomfort and musculoskeletal issues, which subsequently elevate levels of mental stress among drivers (Cueto, Uy, and Diaz, 2021). This heightened psychological distress can further exacerbate the negative health outcomes associated with poor seating ergonomics (Estember and Espinosa, 2020), creating a vicious cycle wherein physical discomfort and mental stress mutually reinforce each other, and ultimately compromising driver well-being.

Moreover, the mediating effect of mental stress extends to the association between ergonomic factors and health impacts among tricycle drivers. Ergonomic deficiencies, such as lack of lumbar support and improper seat design, contribute to physical strain and discomfort, which in turn, elevate levels of mental stress (Cruz, 2022). The resulting psychological burden may exacerbate the adverse health effects of poor seating ergonomics, amplifying the impact on driver well-being (Beneciuk, et al., 2019). Therefore, interventions targeting mental stress may serve as a crucial avenue for mitigating the negative health consequences of ergonomic deficiencies among tricycle drivers. Two hypotheses arising from the literature review could be as follows:

***H_{3a}*:** *Mental stress mediates the relationship between prolonged inappropriate sitting and adverse health impacts among tricycle drivers, such that increased levels of mental stress exacerbate the negative health outcomes associated with poor seating ergonomics.*

H_{3b}: *Mental stress mediates the association between ergonomic factors and health impacts among tricycle drivers, indicating that the detrimental effects of ergonomic deficiencies on driver well-being are partly mediated by heightened levels of mental distress.*

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The Moderating Role of Height on the relationship between Prolonged Inappropriate Sitting, Ergonomic Factors and Health Impact

Recent literature has begun to explore the moderating role of height in the relationship between prolonged inappropriate sitting, ergonomic factors, and health impacts among tricycle drivers (Adeyemi & Yusuf, 2022). Height variations among drivers can significantly influence how they interact with tricycle seats, potentially exacerbating or mitigating the health consequences associated with poor seating ergonomics. Studies suggest that taller drivers may experience heightened discomfort and musculoskeletal issues when seated in inadequately designed tricycle seats, as their longer limbs may not be properly supported (Beckerly *et al*, 2018). Conversely, shorter drivers may face different ergonomic challenges, such as inadequate legroom and difficulty reaching the pedals, which can also contribute to adverse health outcomes (Babamiri, & Sohrabi, 2021).

Furthermore, the moderating effect of height on the relationship between prolonged inappropriate sitting and health impacts extends to its influence on the association between ergonomic factors and driver well-being. Ergonomic deficiencies, such as seat height and lumbar support, may affect taller and shorter drivers differently, potentially exacerbating or mitigating physical discomfort based on individual height variations (Arma *et al.,* 2022). For instance, taller drivers may experience increased strain on their spine and lower back due to inadequate lumbar support, while shorter drivers may struggle with discomfort arising from improper seat height and leg positioning (Adeyemi and Yusuf, 2022). Understanding how height moderates the relationship between ergonomic factors and health outcomes is crucial for designing targeted interventions that cater to the diverse needs of tricycle drivers across different height ranges. In lieu of the above, we developed two moderating hypotheses as follows:

H_{4a}: *Height moderates the relationship between prolonged inappropriate sitting and musculoskeletal issues among tricycle drivers, such that taller drivers experience heightened discomfort and health impacts compared to shorter drivers.*

H_{4b}: *Height moderates the association between ergonomic factors and driver well-being, such that taller drivers are more susceptible to adverse health outcomes resulting from ergonomic deficiencies, while shorter drivers may exhibit more resilience to these effects.*

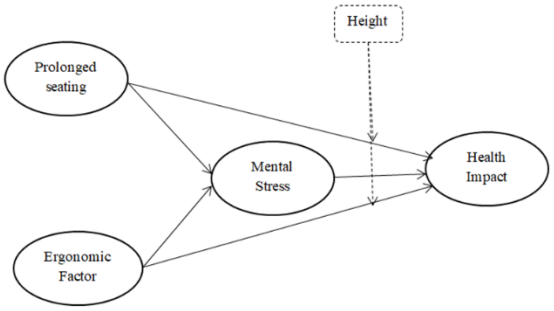

Figure 1 Research Model

METHODS

The study's theoretical model underwent practical testing via an investigation involving Keke riders in Sierra Leone. To collect data on

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factors such as prolonged sitting, ergonomic conditions, mental stress, and health impacts, the researchers opted for a quantitative survey method. This approach was selected to minimize researchers' bias and external interference, as noted by Abusamhadana et al. (2021). Research assistants were trained to approach 513 Keke drivers across Freetown Municipality, which was selected due to its status as the area with the highest concentration of Keke riders in Sierra Leone.

Questionnaire Instrument

The surveys were constructed by drawing from existing studies that have focused on analyzing similar variables in various research endeavors. The survey questionnaire was written in English and administered in ***'Krio'*** and comprised two main sections: The first section gathered demographic information about the participants, encompassing details such as age, gender, educational qualifications, and height. The second section contained 12 items related to the key constructs of the study. To measure the variables, we employed 3 items each adapted from Estember & Espinosa (2020). The responses were recorded on a 5-point Likert scale, with options ranging from 1 for "strongly disagree" to 5 for "strongly agree."

Method of Data Analysis

Before collecting the final data, a pilot study was done to validate the questionnaire instrument and confirm the feasibility of the study. The findings of the pilot study have indicated that the questionnaire utilized to collect the data is valid, thereby affirming its reliability and suitability. Statistical analysis, including descriptive statistics, and advanced statistical analysis via Structural Equation Model was used to explore relationships between variables and identify significant predictors of health impacts on Keke drivers.

Analysis of Results

Table 1 provides an overview of the demographic information gathered from the respondents who participated in the survey. This table includes details about the heights and other demographics of the respondents. A noteworthy observation in the table is that, on average, a majority of the participants have been driving Keke for 1-5 years.

Table 1 Demographic information of respondents

Demographics	Frequencies	Percentage (%)
Gender		
Male	499	97.3
Female	14	2.7
Age		
≤ 20	46	9.0
20-30	233	45.4
31-40	192	37.4
41-50	40	7.8
> 50	2	0.2
Educational Qualification		
No formal education	96	18.7
Primary education	77	15.0
Secondary education	272	53.0
Tertiary education (college or university)	68	13.3
Tenure (in years)		
< 1 year	124	24.2
1-5 years	304	59.3
6-10 years	83	16.2
>10 years	2	0.4

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Demographics	Frequencies	Percentage (%)
Height		
Short	77	15.0%
Average	242	47.2%
Tall	194	37.8%

The findings presented in Table 1 reveal a pronounced gender disparity within the Keke driving profession, with males overwhelmingly dominating at 97.3%, while females only constitute a mere 2.7% of respondents. This stark contrast underscores the male-dominated nature of the profession.

Estimation of the Measurement Model

The credibility of the data collected in the survey was assessed through the evaluation of construct reliability and validity. To measure the reliability of the scales, we utilized Cronbach's alpha and composite reliability metrics, aligning with the Structural Equation Modeling (SEM) framework developed by Hair *et al* (2014). According to established standards by Hair et al (2011) and Henseler *et al* (2015), a Cronbach's alpha value of 0.7 or higher is considered acceptable for a construct; all our constructs met this reliability criterion, as shown in table 2.

To establish construct validity, we examined the Average Variance Extracted (AVE) metric. According to Hair *et al* (2022), an AVE of 0.50 or higher is the minimum threshold, indicating that the construct explains at least 50% of the variance in the indicators that make up the construct. All of our constructs met this validity criterion, as detailed in table 2.

Moreover, to validate the predictors used for the analysis of the constructs under study, we performed factor analysis in accordance with the SEM procedures outlined by Hair *et al* (2014). "As shown in table 2, all measurement indicators received high factor scores, indicating that the variables under investigation can effectively predict the outcomes of unobserved constructs. With a valid dataset in hand, we proceeded to examine the relationships between variables within the hypothetical model".

Table 2 Test of construct validity and reliability

Construct	KMO	Bartlett's Test	Items	Standardized Loading	CR	Cronbach's Alpha	AVE
Prolonged seating position	.736	0.000	WSPS1	.913	.915	.863	.719
			WSPS2	.814			
			WSPS3	.904			
Ergonomic factor	.729	0.000	EF1	.901	.904	.817	.722
			EF2	.912			
			EF3	.881			
Mental Stress	.688	0.000	MS1	.901	.886	.796	.713
			MS2	.893			
			MS3	.874			
Health Impact	.704	0.000	SI1	.920	.917	.875	.704
			SI2	.913			
			SI3	.882			

Note: WSPS= prolonged sitting position, EF= Ergonomic factor, MS= Mental stress, HI= Health impact.

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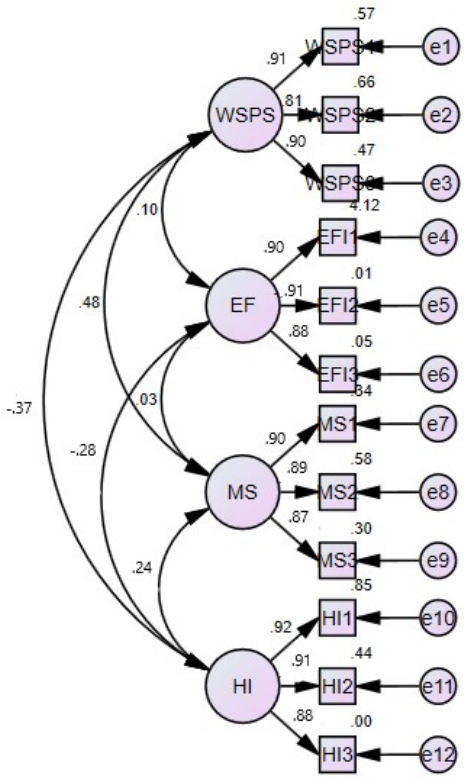

Figure 2 Measurement model

Discriminant validity pertains to the extent to which measurements of distinct theoretical constructs do not exhibit strong correlations with each other. According to Fornell & Larcker's (1981) guidelines, to demonstrate discriminant validity, the square root of the Average Variance Extracted (AVE) for a construct should exceed the correlations between that construct and other constructs within the model. As revealed in the findings presented in table 3, the correlations between a given construct and all other constructs in the model were consistently smaller than the square root of the shared variance between the said construct and its constituent items. Consequently, the results indicate that the model successfully satisfies the discriminant validity test.

Table 3 Correlation Matrix and Discriminant Validity

Constructs	1	2	3	4
1 Health Impact	**.876**			
2 Mental Stress	.243	**.842**		
3 Ergonomic Factor	-.282	.033	**.815**	
4 Prolonged seating position	-.370	.481	.104	**.806**

Estimation of the Structural Model

We employed Structural Equation Modeling (SEM) to analyze the data, aiming to uncover the relationships between the variables within our model. The structural model underwent evaluation using 5000 subsamples and the bias-corrected, accelerated bootstrapping approach with replacement. For hypothesis testing, one-tailed t-tests were utilized for unidirectional hypotheses, and we utilized AMOS as per the guidance of Hair Jr. *et al* (2012).

In addition to hypothesis testing, we conducted model fit assessments. We employed a battery of fit tests, including the χ^2/df test, Goodness-of-fit Index (GFI), Adjusted Goodness-of-fit Index (AGFI), Comparative Fit

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Index (CFI), Tuker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). As a rule of thumb, it is expected that TLI, GFI, and CFI should be greater than or equal to 0.9, and the χ^2/df should be less than 3, aligning with the guidance from Hair *et al.* in (2012, 2019). Additionally, AGFI should exceed 0.8, and RMSEA should be lower than 0.08, as per Hair *et al* (2019). The results demonstrated that the values for these fit indices met the established criteria, indicating a favorable fit for the estimated model.

Furthermore, the coefficient of determination (R^2) was calculated, yielding a value of 0.783 for "Mental stress" and 0.831 for "Health impact." These R^2 values indicate a robust explanatory power of the structural model. For a visual representation of the results and further details on the hypothesized relationships, please refer to figure 3 and table 4.

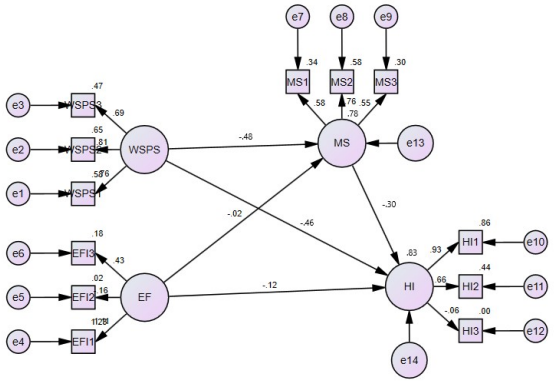

Figure 3 structural model

Table 4 Path Coefficients of the Standardized Model

Variable	Path	Variable	Estimate	S.E.	C.R.	P
WSPS	→	HI	-.460	.069	-8.067	***
EF	→	HI	-.120	.050	-3.077	***
MS	→	HI	-.301	.091	-4.943	***
WSPS	→	MS	-.024	.011	-2.182	.024
EF	→	MS	-.482	.055	-7.052	***
Explained variance for each dependent variable (**R^2**)						
		MS	HI			
		.783	.831			
Mediating Effects of MS						
Path		Estimate	SE	Sobel Z-Value	P-value	
WSPS → MS→ HI		-.024 -.301	.011 .091	1.821	0.034	
EF→ MS→ HI		-.482 -.301	.050 .091	3.128	0.000	

Note: WSPS= prolonged sitting position, EF= Ergonomic factor, MS= Mental stress, HI= Health impact.

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Hypotheses Testing and Discussion

The central focus of our research revolves around examining the health impact of prolonged sitting position and ergonomics among Keke riders in Sierra Leone. To do so, we analyzed the following variables: Health impact (HI), prolonged sitting position (WSPS), Ergonomic factors (EF), and Mental stress (MS). Additionally, we explored the potential moderating effect of Height (H) on the connection between prolonged seating position, ergonomic factors and health impact.

To structure our analysis, we employed Structural Equation Modeling (SEM), treating WSPS and EF as independent variables, MS as the mediating variable, and HI as the dependent variable. This allowed us to comprehensively assess the relationships between these variables and gain a deeper understanding of their dynamics. Here's a detailed breakdown of our findings:

1. **Prolonged seating position (WSPS) and Health Impact (HI):** The significant negative association between prolonged seating position (WSPS) and health impact (HI) underscores the detrimental effects of extended periods of suboptimal seating posture on the well-being of Keke drivers. This finding aligns with existing literature on the adverse health outcomes associated with prolonged sitting, such as musculoskeletal disorders, circulatory issues, and discomfort. The statistical significance ($\boldsymbol{\beta}$ = -0.460, $\boldsymbol{p}$ < 0.01) supports hypothesis H_1 indicates a strong relationship, suggesting that as Keke drivers spend more time in inadequate seating positions, their susceptibility to negative health impacts increases. This result emphasizes the urgent need for interventions to address ergonomic shortcomings in Keke design and promote healthier work practices among drivers.

2. **Ergonomic factors (EF) and Health Impact (HI):** The significant negative effect of ergonomic factors (EF) on the health impact (HI) of Keke drivers highlights the crucial role of Keke design in influencing driver well-being. This finding suggests that features related to Keke design, such as seat ergonomics, seating posture, and overall comfort, significantly impact driver health. The statistical significance ($\boldsymbol{\beta}$ = -0.120, $\boldsymbol{p}$ < 0.01) supports hypothesis H_2, and indicates that improvements in ergonomic design can lead to tangible health benefits for drivers. Therefore, addressing ergonomic deficiencies through interventions like adjustable seats, lumbar support, and proper seating angles could mitigate the negative health consequences experienced by Keke drivers, ultimately enhancing their overall quality of life and job satisfaction.

3. **The Mediating role of mental stress:** Our findings demonstrate that mental stress plays a notable mediating role in the relationship between prolonged seating position and health impact ($\boldsymbol{z}$ =1.821, $\boldsymbol{p}$ < 0.05) lending support to hypothesis H_{3a}, and between ergonomic

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factors and health impact (z = 3.128, p < 0.01) lending support to hypothesis H_{3b}. Mental stress reinforces the negative impacts of prolonged seating and ergonomic conditions on the health impacts of the Keke drivers.

The identification of mental stress as a notable mediator in the relationship between prolonged sitting position, ergonomic factors, and health impact provides valuable insights into the underlying mechanisms driving adverse health outcomes among Keke drivers. The significant mediating effects of mental stress suggest that psychological factors exacerbate the negative impacts of physical ergonomic deficiencies on driver health. As mental stress intensifies, it amplifies the adverse effects of prolonged sitting and poor ergonomic conditions, potentially leading to heightened discomfort, fatigue, and overall deterioration of health. This highlights the importance of addressing not only physical ergonomic factors but also psychological well-being in interventions aimed at improving the health and well-being of Keke drivers. Strategies to reduce mental stress, such as providing driver support programs, promoting relaxation techniques, and fostering a supportive work environment, could complement efforts to enhance Keke ergonomics and mitigate health risks associated with prolonged Keke driving.

4. The Moderating Role of Height:

In the final stage of our analysis, we explored the moderating effects of height (H) on the relationship between prolonged seating position (WSPS), ergonomic factor (EF) and health impact (HI), figure 8 and 9 supported hypotheses H_{4a} and H_{4b}. This examination aimed to reveal how the heights of the Keke riders influence the strength and direction of the relationship between the WSPS, EF and the subsequent impact on the health of the riders. To conduct this assessment, we employed a slope interaction test, which allowed us to gain valuable insights into the moderating role of height.

Figure 4, a pivotal component of our analysis, vividly portrays the interaction between the rider's height and the relationship between prolonged seating position and health outcome of the riders. In this graph, we observe two distinct lines that delineate the moderating effect of height.

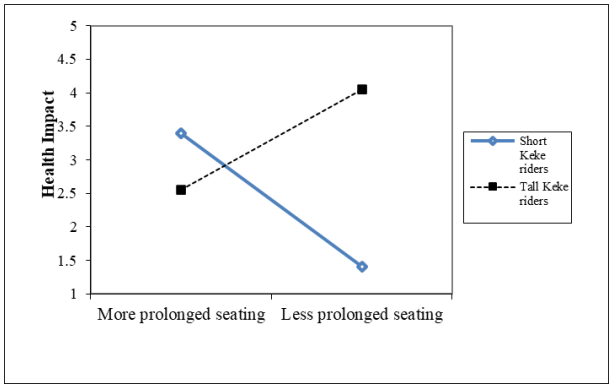

Figure 4 Moderating effects of height between WSPS and HI

The first line signifies tall Keke riders, while the second line represents short Keke riders. These lines on the graph offer visual clarity, demonstrating how height can significantly affect the relationship between prolonged seating position and health impact.

The figure clearly indicates that the height of the rider plays a crucial role in determining the

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moderating effect. When the Keke rider is tall, the moderating effect becomes more pronounced. In practical terms, this means that tall Keke riders are more affected by riding Keke for too long.

Conversely, the second line in the graph represents a scenario where the Keke rider is short. In such instances, the moderating effect of height is less pronounced. This implies that short Keke riders may not fully leverage the potential adverse effect of prolonged seating position, leading to a less significant negative impact on their health. These findings underscore the importance of considering the height of the riders when designing the Kekes.

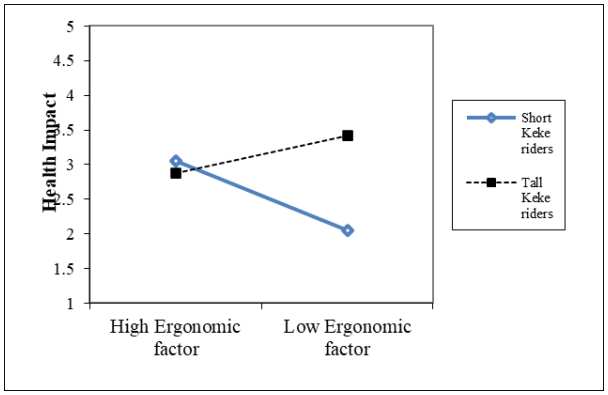

Figure 5 Moderating effects of height between EF and HI

In summary, our research validates the hypotheses, indicating that factors such as prolonged sitting position and ergonomic factors have a direct and negative impact on the health of Keke riders. These results provide valuable insights for policymakers and organizations seeking to enhance well-being of Keke riders.

CONCLUSION

The study underscores the significant health consequences faced by Keke drivers in Freetown, Sierra Leone, due to prolonged periods of driving in inappropriate sitting positions. Through a comprehensive examination of ergonomic factors and their impact on driver health, the research highlights the urgent need for interventions to address these issues. The findings indicate that prolonged suboptimal sitting postures lead to negative health outcomes, exacerbated by mental stress, particularly affecting taller drivers.

RECOMMENDATIONS

1. **Implementation of Ergonomic Features:** Policy-makers and stakeholders should prioritize the integration of ergonomic features such as proper lumbar support, adjustable seat height, and optimal seating angles in tricycle design and maintenance. These features can significantly reduce physical strain and discomfort experienced by drivers.
2. **Education and Training:** Training programs should be developed to educate Keke drivers about the importance of maintaining proper sitting posture and techniques to mitigate ergonomic risks. Providing drivers with knowledge and tools to improve their ergonomic practices can lead to long-term health benefits.
3. **Regular Health Screenings:** Establishing regular health screenings for Keke drivers can help identify early signs of musculoskeletal issues and

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mental stress. Early detection allows for timely intervention and treatment, preventing the progression of health problems.

4. **Regulatory Enforcement:** Government authorities should enforce regulations to ensure compliance with ergonomic standards in tricycle manufacturing and operation. Regular inspections and penalties for non-compliance can incentivize adherence to ergonomic guidelines.
5. **Research and Innovation:** Continued research into ergonomic solutions tailored to the needs of Keke drivers is essential. Collaborative efforts between researchers, policymakers, and industry stakeholders can drive innovation and the development of cost-effective ergonomic interventions.

By implementing these recommendations, stakeholders can promote the health and well-being of Keke drivers, enhancing their quality of life and productivity while contributing to the overall improvement of public transportation services in Freetown, Sierra Leone.

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