Cureus
Part of SPRINGER NATURE

Open Access Original Article

Published via Krishna Vishwa Vidyapeeth (Deemed to be University), Karad.

Prevalence of Occupational Risk Factors and Psychological Stress and Its Association With Quality of Life Among App-Based Drivers

Sakshi S. Chalke [1], Anandh S. [1], Rutuja Bhawad [1]

1. Department of Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth (Deemend to be University), Karad, IND

Corresponding author: Anandh S., anandh73@gmail.com

Received 07/24/2026
Review began 08/31/2026
Review ended 10/15/2026
Published 10/20/2026

© Copyright 2026
Chalke et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.118253

Abstract

Background and objective

The increasing use of digital transportation platforms has expanded app-based driving as an urban occupation. Although this work offers flexibility, drivers may be exposed to prolonged sitting, repetitive driving, extended working hours, traffic congestion, irregular meals, inadequate rest, and limited physical activity, which may contribute to physical discomfort and fatigue. They may also experience psychological stress related to unpredictable income, incentives, customer ratings, time pressure, traffic, and uncertain working hours. These physical and psychosocial demands may adversely affect quality of life (QoL), including physical health, psychological well-being, social relationships, and daily functioning. There is a need to better understand these factors among app-based drivers in India. Therefore, this study aimed to assess the prevalence of occupational risk factors and psychological stress and to investigate their association with QoL among app-based drivers.

Methods

A cross-sectional observational study was conducted among 140 app-based drivers selected using convenience sampling based on predefined inclusion and exclusion criteria. Data were collected using a demographic proforma, a self-structured occupational risk factors questionnaire, the Perceived Stress Scale (PSS-10), and the World Health Organization Quality of Life-Brief Version (WHOQOL-BREF) questionnaire. Descriptive statistics were used to summarize participant characteristics and determine the prevalence of occupational risk factors and psychological stress. Inferential statistics, including Spearman's rank correlation, were used to assess the associations between occupational risk factors, psychological stress, and QoL. A p-value <0.05 was considered statistically significant.

Results

A total of 140 app-based drivers participated in the study. Most participants had moderate occupational risk levels (94, 67.1%), while 92 (65.7%) experienced moderate psychological stress. The mean quality-of-life scores were 3.48 for general QoL, 3.23 for physical health, 3.24 for psychological health, 3.41 for social relationships, and 3.48 for environmental health. The additional work-related quality-of-life item had a mean score of 3.36. Spearman's rank correlation analysis showed a moderate negative correlation between psychological stress and QoL ($\rho = -0.518$, $p < 0.001$) and a weak negative correlation between occupational risk factors and QoL ($\rho = -0.261$, $p = 0.002$).

Conclusion

The findings indicate that higher psychological stress and greater exposure to occupational risk factors were associated with poorer QoL among app-based drivers. These findings highlight the importance of addressing occupational and psychological factors to support drivers' well-being. Strategies such as ergonomic education, stress management, adequate rest, and periodic occupational health screening may help promote the physical and psychological well-being of app-based drivers.

Categories: Therapeutics, Physical Medicine & Rehabilitation, Quality Improvement
Keywords: app-based drivers, occupational risk factors, perceived stress scale, psychological stress, quality of life, whoqol-bref questionnaire

Introduction

Road transportation is essential to modern society, and professional drivers are critical to the smooth, reliable movement of people and goods. However, the demanding nature of professional driving exposes drivers to a range of workplace hazards that can negatively affect both their physical health and psychological well-being [1]. Occupational stress has been recognized as one of the major psychosocial hazards among professional drivers. High workload, strict schedules, prolonged driving hours, traffic

congestion, and continuous attention required during driving contribute significantly to increased stress levels in this occupational group [1]. Long-term work-related stress can have a considerable impact on drivers' mental well-being, reducing their ability to concentrate, make sound decisions, and perform their driving tasks safely and effectively, thereby increasing the risk of unsafe driving behaviors and road traffic accidents [1].

Fatigue is considered an important consequence of prolonged occupational stress among drivers. Evidence suggests that work-related stress contributes to physical and mental fatigue, which subsequently increases the likelihood of occupational crashes and reduces work efficiency [2]. Long-haul and commercial drivers frequently experience limited time for rest and recovery between consecutive work shifts, which often results in accumulated fatigue that can reduce alertness, slow reaction time, and compromise overall driving safety [2]. Research suggests that fatigue serves as a key link between occupational stress and road traffic crashes, emphasizing the importance of addressing both the psychological and physical health of professional drivers [2].

In addition to fatigue, occupational stress has been linked to a wide range of adverse health outcomes, including sleep disturbances, emotional exhaustion, anxiety, reduced job satisfaction, and poorer overall health among professional drivers [3]. Poor psychosocial working conditions can also increase the risk of unsafe driving behaviors by negatively affecting drivers' emotional regulation and cognitive functioning [3]. The interaction between work-related stress and health problems creates a hazardous cycle in which declining health further compromises work performance and road safety outcomes [3].

Apart from psychosocial stressors, drivers are often exposed to demanding work environments characterized by extended working hours, irregular schedules, continuous traffic exposure, and limited opportunities for sufficient rest [4]. Self-reported occupational stress among tram and long-haul truck drivers has been associated with heavy workloads, strict time demands, shift work, responsibility for passenger and road safety, and inadequate recovery following work [4]. These work-related stressors gradually accumulate over time, contributing to chronic psychological strain and declining physical and mental health [4].

Musculoskeletal disorders are among the most frequently reported occupational health conditions affecting professional drivers worldwide [5]. A recent systematic review identified prolonged sitting, awkward postures, repetitive movements, whole-body vibration, manual material handling, and poor ergonomic conditions as major occupational risk factors for work-related musculoskeletal disorders among professional drivers [5]. These occupational exposures may lead to persistent pain, reduced physical function, increased absenteeism, lower productivity, and a poorer QoL [5].

Another systematic review reported that musculoskeletal pain is highly prevalent among professional drivers, with low back pain being the most common complaint, followed by pain in the neck, shoulders, and lower limbs [6]. The high prevalence of musculoskeletal pain among drivers highlights the importance of identifying occupational risk factors at an early stage to support effective preventive measures and ergonomic interventions [6].

The combined burden of occupational stress, fatigue, and musculoskeletal disorders significantly affects the overall health and occupational performance of professional drivers, making occupational health assessment an important priority for this workforce. Professional drivers are at a considerably greater risk of developing musculoskeletal disorders than the general working population because of prolonged sitting, repeated exposure to whole-body vibration, repetitive driving tasks, and sustained static postures [7]. Extended periods of driving place continuous mechanical stress on the spine and surrounding soft tissues, thereby increasing the risk of chronic musculoskeletal disorders and functional limitations [7].

Work-related musculoskeletal disorders in the neck, shoulders, upper back, and lower back have reportedly occurred among bus drivers, who form part of the professional drivers' category, owing to poor driving posture and extended sitting [8]. Poorly designed seating, repeated steering movements, and vibration from the vehicle can also contribute to the development of musculoskeletal pain in this occupational category [8]. Work-related musculoskeletal problems can limit physical ability, lower work performance, and create absenteeism among professional drivers [8].

Different ergonomic strategies have been investigated to reduce musculoskeletal discomfort among occupational drivers. According to a randomized controlled trial, the use of a gel seat cushion significantly decreases chronic low back pain and improves sitting comfort in occupational drivers [9]. Appropriate ergonomic modifications may therefore have an important role in minimizing physical strain on the lower back and improving occupational health outcomes among drivers [9].

Poor workstation ergonomics remain one of the leading occupational risk factors for lower back pain among bus drivers. Factors such as inadequate seat support, prolonged driving duration, awkward trunk posture, and whole-body vibration have been recognized as important contributors to work-related low back pain [10]. Early identification and correction of ergonomic risk factors may reduce the occurrence of musculoskeletal disorders and improve the long-term health of professional drivers [10].

In addition to low back pain, upper body musculoskeletal disorders are frequently reported among professional drivers. Pain involving the neck, shoulders, upper back, and upper limbs has been linked to repetitive steering movements, static muscle loading, and prolonged sitting posture [11]. Upper quadrant pain may affect daily functional activities, reduce occupational efficiency, and negatively affect general QoL among drivers [11].

In addition to physical health, the issue of psychological health has also gained significance as a key aspect of occupational health. Digital health has witnessed new developments with the emergence of mobile interventions targeting the mental well-being of professional drivers [12]. The feasibility test revealed that an application for use by taxi drivers was acceptable and had the capability of enhancing their psychological well-being by promoting self-management and mental wellness [12]. The availability of digital interventions for mental wellness suggests that psychological stress in drivers is becoming an important occupational health issue and needs to be identified in good time and managed properly [12].

The growing evidence regarding musculoskeletal disorders, ergonomic risk factors, and psychological health highlights the need for comprehensive occupational health assessment among professional drivers. However, limited evidence is available regarding these occupational challenges among app-based drivers, whose work environment is quite different from that of conventional professional drivers.

The COVID-19 pandemic highlighted the occupational vulnerabilities of app-based drivers, who continued providing essential transport and delivery services despite increased exposure to health risks and economic uncertainty [13]. App-based drivers reported concerns regarding infection risk, inadequate workplace protection, financial instability, and insufficient occupational health support during the pandemic [13]. These occupational challenges emphasized the necessity of improved health and safety measures to promote the physical and psychological well-being of app-based drivers [13].

A national cross-sectional study conducted among Australian truck drivers demonstrated that poor physical health frequently coexisted with psychological distress, sleep disturbances, obesity, chronic pain, and unhealthy lifestyle behaviors [14]. The study further highlighted that occupational drivers experience multiple health problems simultaneously, reinforcing the importance of comprehensive occupational health assessment and preventive interventions [14]. Physiological evidence has shown that prolonged occupational stress among long-distance drivers results in increased urinary cortisol and catecholamine excretion, indicating activation of the body's stress response system during work [15]. Chronic exposure to occupational stress without adequate recovery may therefore contribute to long-term physical and psychological health problems among professional drivers [15].

Psychosocial work environments characterized by excessive workload, poor organizational support, and limited job satisfaction have been linked to increased occupational stress and poorer psychological well-being among professional drivers [16]. Improving psychosocial working conditions may therefore contribute to better mental health, increased job satisfaction, and improved occupational performance in this population [16].

The rapid growth of the gig economy has transformed the transportation sector by creating employment opportunities through digital platforms that connect drivers with passengers and customers using smartphone applications [17]. Unlike traditional employment, app-based driving is largely controlled through digital algorithms that monitor driver performance, customer ratings, ride acceptance, cancellations, and incentive achievement [17]. Although platform-based employment offers flexibility in working hours, algorithmic management, performance-based incentives, and income uncertainty may increase occupational stress and reduce perceived job autonomy among app-based drivers [17]. Financial insecurity became even more evident among gig workers during the COVID-19 pandemic, with many drivers experiencing reduced income, employment instability, and deterioration in mental well-being. Economic uncertainty and mental stress experienced by gig workers may adversely influence their general QoL and health status [18].

Although numerous studies have investigated occupational stress, fatigue, musculoskeletal disorders, ergonomic risk factors, and driving safety among professional drivers, relatively few studies have specifically examined these factors among app-based drivers. Furthermore, most previous studies have evaluated occupational risk factors, psychological stress, or health outcomes independently, whereas limited research has explored the connection between occupational risk factors, psychological stress, and QoL among the same population.

In India, where the number of app-based drivers has increased substantially in recent years, evidence regarding occupational risk factors, psychological stress, and their influence on QoL remains limited. Finding out the prevalence of occupational risk factors and psychological stress, along with the relationship between these factors and QoL, can help in formulating effective ergonomic strategies, workplace health promotion programs, and stress management approaches for this expanding pool of workers. Hence, the present study aimed to assess the prevalence of occupational risk factors and psychological stress among app-based drivers and to investigate their association with quality of life.

Materials And Methods

This cross-sectional observational study was conducted among app-based drivers in Karad, Maharashtra, India, over six months to assess the prevalence of occupational risk factors and psychological stress and to examine their associations with QoL. Ethical approval was obtained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University) before the commencement of the study (approval no. 448/2025-2026).

The sample size was calculated using the standard formula $n = \frac{Z^2pq}{L^2}$, where Z represents the standard normal deviate at a 95% confidence level (1.96), p represents the expected prevalence (36%), q represents the complementary proportion (64%), and L represents the allowable error (10%). Using these values, the calculated minimum sample size was approximately 89 participants. A total of 140 app-based drivers were included in the study using convenience sampling. The final sample exceeded the calculated minimum sample size.

Inclusion and exclusion criteria

The study included male app-based drivers and delivery riders aged 25 to 55 years who had a minimum of six months of experience working with app-based transport or delivery platforms and used mobile phones for navigation and location purposes while on duty. Participants were recruited from ride-hailing and food-delivery platforms, including services such as Ola, Uber, Swiggy, and Zomato. Written informed consent was obtained from all participants before their inclusion in the study. The driving experience recorded in the questionnaire referred to the total duration of driving experience, irrespective of the platform used.

Female drivers and part-time app-based drivers were excluded from the study. These criteria were established to focus the assessment on full-time male app-based drivers with sufficient occupational experience. However, the restriction of the study population to male, full-time drivers may limit the generalizability of the findings to female and part-time drivers.

Data source and tools

Data were collected using a structured questionnaire (see Appendices) administered through Google Forms (Google LLC, Mountain View, CA, USA). The questionnaire consisted of four sections. Section I collected demographic and occupational information, including age, gender, type of app-based driving, and years of driving experience. Section II assessed occupational risk factors using a researcher-developed occupational risk factors questionnaire. Section III assessed perceived psychological stress using the 10-item Perceived Stress Scale (PSS-10) [19]. Section IV assessed QoL via the World Health Organization Quality of Life-Brief Version (WHOQOL-BREF) questionnaire [20]. Participation was voluntary, and informed consent was obtained before participants completed the questionnaire. The collected responses were exported to Microsoft Excel (Microsoft Corp., Redmond, WA, USA) for data management and subsequently analyzed using SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA).

Outcome measures

A researcher-developed demographic proforma was used to collect baseline information, including age, gender, type of app-based driving, and total years of driving experience. The researcher-developed structured questionnaire was used to assess occupational risk factors among app-based drivers. The questionnaire consisted of 10 items addressing working hours, prolonged sitting/forward-bending posture, work breaks, repetitive movements, load carrying, vehicle vibration, seat and driving posture comfort, traffic-related stress, time pressure, and work-related injury, accident, or near miss. The questionnaire was reviewed by five faculty/staff members from the institution for content validity, and their signatures were obtained following the review. No formal statistical reliability testing was performed, and no separate pilot testing was conducted before the main study.

Questions 1-9 were used to calculate the occupational risk score. Each response option was assigned a score from 1 to 4 according to the level of occupational risk, with higher scores indicating greater occupational risk. For items assessing favorable or protective conditions, the response options were scored in the direction of occupational risk, such that the lowest-risk response received 1 and the highest-risk response received 4. The scores of questions 1-9 were summed to obtain a total occupational risk score ranging from 9 to 36. Question 10 was not included in the total occupational risk score and was analyzed separately as a descriptive item. The total score range of 9-36 was divided into four equal intervals of 7 points: 9-15, low risk; 16-22, mild risk; 23-29, moderate risk; and 30-36, high risk.

The Perceived Stress Scale (PSS-10) developed by Cohen et al. (1983) was used to find the level of psychological stress experienced by app-based drivers. It consists of 10 items scored on a 5-point Likert scale (0-4). Higher scores indicate greater perceived stress [19].

Quality of life was assessed using a modified questionnaire based on the WHOQOL-BREF [20]. This

questionnaire included items addressing physical health, psychological health, social relationships, and environmental health. The item concerning acceptance of bodily appearance was omitted, and an additional work-related quality-of-life item was included. The psychological health domain comprised five items (questions 10-14), as the item concerning acceptance of bodily appearance was omitted. Responses were recorded on a five-point Likert scale, with scores ranging from 1 to 5. Negatively worded items were reverse-scored so that higher scores consistently represented more favorable responses. Domain scores were calculated as the mean of the corresponding items administered within each domain. The additional work-related quality-of-life item was analyzed separately as a descriptive measure and was not included in the standard WHOQOL-BREF domain scores. Because the questionnaire was modified, the resulting scores are not directly equivalent to standard WHOQOL-BREF scores.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Descriptive statistics were used to summarize participant characteristics and study variables. Categorical variables were summarized using frequencies and percentages, while continuous variables were described using means and standard deviations, as appropriate. Spearman's rank correlation coefficient was used to assess the associations between occupational risk factors, psychological stress, and QoL. For the correlation analysis, QoL was represented by the participant-level mean score across the 25 WHOQOL-BREF items (questions 1-25), with negatively worded items reverse-scored as appropriate. The participant-level mean quality-of-life score across the 25 WHOQOL-BREF items was 3.354 (SD = 0.557). Spearman's rank correlation analysis was performed using the individual scores of all 140 participants. The additional work-related quality-of-life item (question 26) was analyzed separately. Statistical significance was set at a two-tailed p-value of less than 0.05.

Results

Table *1* shows the age distribution of the 140 app-based drivers. It was observed that the majority of participants belonged to the 31 to 35 years age group (49, 35.0%), followed by the 36 to 40 years age group (39, 27.9%) and the 25 to 30 years age group (33, 23.6%). Participants aged 41 to 45 years accounted for 15 (10.7%) of the participants, while the 46 to 50 years age group represented the smallest proportion with four (2.9%). These findings indicate that most app-based drivers were young to middle-aged adults.

Age group (years)	Frequency, n (%)
25 to 30	33 (23.6%)
31 to 35	49 (35.0%)
36 to 40	39 (27.9%)
41 to 45	15 (10.7%)
46 to 50	4 (2.9%)

TABLE 1: Age distribution of subjects (total n = 140)

Table *2* presents the distribution of participants according to their total driving experience. The largest proportion of participants, 61 (43.6%), had six to 10 years of driving experience, followed by 52 participants (37.1%) with one to five years of experience. Additionally, 21 participants (15.0%) had 11 to 15 years of experience, while five participants (3.6%) reported 16 to 20 years of experience. One participant (0.7%) reported 26 to 30 years of driving experience. These findings describe the participants' overall driving experience and do not specifically indicate the duration of their work on app-based platforms.

Total driving experience (years)	Frequency, n (%)
One to five	52 (37.1%)
Six to 10	61 (43.6%)
11 to 15	21 (15.0%)
16 to 20	5 (3.6%)
21 to 25	0 (0.0%)
26 to 30	1 (0.7%)

TABLE 2: Distribution of participants according to total driving experience (total n = 140)

Table 3 shows the type of vehicle among the 140 participants. The majority used two-wheelers for app-based driving (123, 87.9%), whereas 17 (12.1%) participants used four-wheelers. This demonstrates that two-wheelers were the predominant mode of transportation among app-based drivers included in the study.

Type of vehicle	Frequency, n (%)
Two wheeler	123 (87.9%)
Four wheeler	17 (12.1%)

TABLE 3: Type of vehicle (total n = 140)

Table 4 illustrates the distribution of occupational risk levels among the 140 app-based drivers included in the study. The majority of participants, 94 (67.1%), had a moderate occupational risk level. A total of 30 (21.4%) participants had a mild occupational risk level, while 16 (11.4%) participants had a high occupational risk level. None of the participants were classified as having a low occupational risk.

Total score range	Risk level	Frequency, n (%)
9-15	Low occupational risk	0 (0.0%)
16-22	Mild occupational risk	30 (21.4%)
23-29	Moderate occupational risk	94 (67.1%)
30-36	High occupational risk	16 (11.4%)

TABLE 4: Distribution of occupational risk levels among app-based drivers (total n = 140)

Table 5 illustrates the distribution of stress levels among the 140 app-based drivers sampled in the study. The majority of participants, 92 (65.71%), were classified as having moderate stress, indicating that most drivers experienced a moderate level of psychological stress. Thirty-four (24.29%) participants had low stress, while 14 (10.00%) participants were categorized as having high stress. These findings suggest that psychological stress is common among app-based drivers, with nearly two-thirds of the participants experiencing moderate stress levels.

Stress level	Frequency, n (%)
Low (0-13)	34 (24.29%)
Moderate (14-26)	92 (65.71%)
High (27-40)	14 (10.00%)

TABLE 5: Distribution of stress levels among app-based drivers (total n = 140)

Table 6 presents the mean scores and standard deviations for the quality-of-life measures among the 140 app-based drivers. The mean scores were 3.48 for general QoL, 3.23 for physical health, 3.24 for psychological health, 3.41 for social relationships, 3.48 for environmental health, and 3.36 for the additional work-related overall quality-of-life item. The standard deviations are reported in Table 6. These results describe the participants' responses across the assessed quality-of-life domains. Note: The minimum and maximum values represent the possible scale range (1-5) for each domain.

Domain	Items	Mean	SD	Minimum	Maximum	Interpretation
General QoL	Q1-Q2	3.48	0.81	1.00	5.00	Good
Physical health	Q3-Q9	3.23	0.39	1.00	5.00	Moderate
Psychological health	Q10-Q14	3.24	0.56	1.00	5.00	Moderate
Social relationships	Q15-Q17	3.41	0.85	1.00	5.00	Good
Environmental health	Q18-Q25	3.48	0.73	1.00	5.00	Good
Additional work-related overall QoL item	Q26	3.36	1.01	1.00	5.00	Moderate

TABLE 6: Distribution of the mean scores of the WHOQOL-BREF domains among app-based drivers

WHOQOL-BREF: World Health Organization Quality of Life-Brief Version, QoL: Quality of life

Association between psychological stress and QoL

Spearman's rank correlation analysis demonstrated a moderate, statistically significant negative correlation between psychological stress and quality of life among app-based drivers ($\rho = -0.403$, $p < 0.001$). This finding indicates that higher levels of psychological stress were associated with poorer quality of life among the participants.

Association between occupational risk factors and QoL

Spearman's rank correlation analysis revealed a weak, statistically significant negative correlation between occupational risk factors and quality of life among app-based drivers ($\rho = -0.249$, $p = 0.003$). This finding suggests that higher occupational risk scores were associated with poorer quality of life among the participants.

Discussion

In the current study, 140 drivers using apps were sampled, where most of them (35.0%) fell in the 31 to 35-year-old age range, then 36 to 40 years (27.9%) and 25 to 30 years (23.6%). Such results demonstrate that the usage of app-based driving is practiced mostly by young and middle-aged people. It is due to this fact that these individuals are more physically active, better versed in mobile technology, and prefer app-based driving as a job. Such results can be found in van Vreden et al. [14], who observed that most professional drivers belonged to the economically active age group. Likewise, Wood et al. [17] and Apouey et al. [18] reported that the rapid expansion of the gig economy has attracted a younger workforce seeking flexible employment opportunities.

Regarding driving experience, the majority of participants (43.6%) had six to 10 years of experience, followed by 37.1% with one to five years of experience. This finding indicates that most participants had

moderate driving experience and were regularly exposed to occupational demands. Similar results have been reported in studies on professional drivers, where prolonged years of driving were associated with increased occupational exposure and health-related problems [14]. The current study also found that 87.9% of participants used two-wheelers, while only 12.1% used four-wheelers. The predominance of two-wheelers may be due to their affordability, better fuel efficiency, and ease of travel in congested urban areas. However, prolonged riding on two-wheelers may increase exposure to poor posture, vibration, and repetitive movements, thereby increasing occupational risk factors among app-based drivers [5,6]. Overall, the demographic findings indicate that the study population mainly consisted of young to middle-aged, moderately experienced two-wheeler drivers who may be more susceptible to occupational health problems because of the nature of their work.

The current study found that most of the app-based drivers (67.1%) had moderate occupational risk, followed by 21.4% with mild occupational risk and 11.4% with high occupational risk. These findings indicate that occupational risk factors are prevalent among app-based drivers and are associated with occupational health and work-related outcomes. The higher prevalence of medium risk could be due to the long hours of sitting, repeated driving activities, constant use of smartphones for navigating, traffic jams, insufficient breaks from work, and poor ergonomic posture. These factors may be associated with greater physical strain and musculoskeletal symptoms among app-based drivers.

The findings of the current study are in line with the systematic review by Joseph et al. [5], which identified prolonged sitting, awkward posture, whole-body vibration, and poor ergonomics as major occupational risk factors among professional drivers. Similarly, Joseph et al. [6] reported a considerable number of participants having musculoskeletal pain, particularly lower back pain, neck pain, and shoulder pain, among occupational drivers. The current findings are also supported by Magnusson et al. [7], who concluded that occupational drivers have a greater risk of developing musculoskeletal disorders than the general population because of prolonged driving and sustained static postures. Likewise, Szeto and Lam [8] and Hakim and Mohsen [10] reported that prolonged sitting, poor seat ergonomics, and repetitive driving activities significantly contribute to work-related musculoskeletal disorders among bus drivers. Although the current study did not assess specific musculoskeletal conditions, the high proportion of drivers with moderate occupational risk suggests the need for ergonomic education, regular stretching exercises, appropriate rest breaks, and physiotherapy interventions to reduce occupational hazards and promote long-term health outcomes among app-based drivers.

The current study found that 65.71% of app-based drivers experienced moderate psychological stress, while 24.29% had low stress and 10.00% had high stress. No participants were categorized as having very high stress. These findings indicate that the majority of app-based drivers experienced moderate levels of psychological stress, possibly due to long working hours, traffic congestion, financial pressure, time constraints, and continuous customer interactions.

The findings are in line with Useche et al. [1], who found that occupational stress is common among professional drivers and is related to increased mental stress and reduced work performance. Similarly, Useche et al. [2] found that prolonged job stress contributes to fatigue, which adversely affects driving performance and increases the hazard of occupational crashes. The current findings are also supported by Useche et al. [3], who found that work-related stress negatively influences both physical and psychological health among professional drivers. Likewise, Onninen et al. [4] observed that irregular work schedules, heavy workload, and insufficient recovery time are important sources of stress among tram and long-haul truck drivers. Furthermore, Hernández-Rodríguez et al. [16] mentioned that psychosocial risk factors in the workplace have been associated with high levels of stress and decreased job satisfaction in professional drivers. In the current research, the medium level of psychological stress can be linked to the demands of the job and working conditions of app-based drivers. All in all, the above findings highlight the relevance of stress-management strategies and work-life balance for psychological well-being among app-based drivers.

The current study found that the QoL of app-based drivers was moderate across the WHOQOL-BREF domains. The mean scores were 3.48 for general QoL, 3.23 for physical health, 3.24 for psychological health, 3.41 for social relationships, 3.48 for environmental health, and 3.36 for overall QoL. These findings indicate that the participants experienced a moderate level of QoL across the assessed domains. The moderate physical well-being score observed in this study may be associated with prolonged sitting, driving-related activities, and musculoskeletal pain and fatigue among app-based drivers. Musculoskeletal pain may affect daily functioning and overall quality of life [6]. Similarly, van Vreden et al. [14] reported that professional drivers often experience physical and psychological health challenges that can affect their quality of life. Their findings complement those obtained in the present study. Furthermore, Hernández-Rodríguez et al. [16] reported that psychosocial risks and occupational stressors are associated with lower job satisfaction and psychological well-being among professional drivers. This may help explain the moderate psychological health scores observed in the present study. The findings also align with Apouey et al. [18], who reported that financial insecurity and occupational stress among gig workers can negatively affect mental well-being and overall quality of life. App-based drivers may experience similar occupational challenges, including irregular income, long working hours, and work-related stress, which may contribute to a moderate quality of life.

In summary, from the current findings, the findings indicate an association between occupational hazards, psychological stress, and aspects of QoL among app-based drivers. These findings highlight the potential relevance of ergonomic measures, stress-management programs, and occupational health promotion for app-based drivers; however, the effectiveness of these interventions was not evaluated in the present study. Results from the current study show that there is a moderate negative correlation between psychological stress and QoL (Spearman's rho = -0.518, $p < 0.001$), which implies that as psychological stress increased, QoL declined. There was also a weak negative correlation between occupational risk and QoL (Spearman's rho = -0.261, $p = 0.002$), which means that as occupational risk increased, QoL deteriorated. These findings are in line with Useche et al. [1], who found that occupational stress adversely affects the health and well-being of professional drivers. Similarly, Hernández-Rodríguez et al. [16] found that psychosocial risk factors were linked to poorer mental health and reduced quality of life among drivers. The current findings also agree with Wood et al. [17], who highlighted that algorithmic control, workload, and job insecurity in the gig economy negatively influence workers' overall well-being. Likewise, Apouey et al. [18] reported that financial insecurity and occupational stress among gig workers significantly affect their mental well-being and quality of life. Overall, the findings suggest that reducing occupational risk factors and psychological stress through ergonomic modifications, stress management programs, and occupational health interventions may help enhance the QoL of app-based drivers.

Limitations

The cross-sectional design limits the ability to establish causal relationships between occupational risk factors, psychological stress, and QoL. Convenience sampling may limit the generalizability of the findings to the wider population of app-based drivers. Additionally, the study was conducted in a single city (Karad, MH, IND) and included only male, full-time app-based drivers aged 25 to 55 years; therefore, the findings may have limited generalizability to app-based drivers from other locations, female drivers, part-time drivers, and other age groups. The use of self-reported data may have introduced recall and response bias. The researcher-developed occupational risk factors questionnaire was content-validated but did not undergo formal statistical reliability testing, which may limit the robustness of its measurement properties. Recruitment through Google Forms may also have introduced selection or response bias. Potential confounding factors were not adjusted for, and no multivariable analysis was performed; therefore, the observed associations should be interpreted cautiously.

The QoL questionnaire used in this study was modified from the standard WHOQOL-BREF [20]. The item concerning acceptance of bodily appearance was omitted, and an additional item assessing overall QoL in relation to work and daily living was included. These modifications may affect the comparability of the results with studies using the standard WHOQOL-BREF and should be considered when interpreting the findings.

Conclusions

The findings of the current study indicate that occupational risk factors and psychological stress were prevalent among app-based drivers and were associated with quality of life. Most app-based drivers experienced moderate occupational risk, followed by mild and high occupational risk. Regarding psychological stress, the majority of participants experienced moderate stress, followed by low and high stress. Higher levels of psychological stress showed a moderate negative correlation with QoL, whereas higher occupational risk factors showed a weak negative correlation with quality of life. Overall, the findings suggest that greater occupational risk factors and psychological stress are associated with lower quality of life among app-based drivers.

These findings highlight the importance of occupational health promotion, ergonomic education, stress management strategies, regular health check-ups, and awareness programs for app-based drivers. However, these interventions were not evaluated in the present study, and therefore their effectiveness cannot be established from these findings. Future interventional studies are recommended to evaluate the effectiveness of such strategies, while studies involving larger and more diverse populations may help determine whether these associations are consistent across different locations, sexes, age groups, and employment patterns.

Appendices

Questionnaire

1. Demographic Information

1) Name:

2) Age:

3) Years of experience:

4) Type of vehicle used:

2. Occupational Risk Factors Questionnaire

Interpretation:

9-15 - low risk

16-22 - mild risk

23-29 - moderate risk

30-36 - high risk

Q1. On average, how many hours do you work per day as an app-based driver?

☒ Less than 6 hours

☒ 6-8 hours

☒ 8-10 hours

☒ More than 10 hours

Q2. Do you maintain a prolonged sitting or forward-bending posture while driving?

☒ Never

☒ Sometimes

☒ Often

☒ Always

Q3. How often do you take rest breaks during your working hours?

☒ Every 2 hours

☒ Once in 3-4 hours

☒ Rarely

☒ Never

Q4. Do you perform repetitive movements such as frequent accelerator/brake use, clutch use, or mobile phone handling during work?

☒ Never

☒ Sometimes

☒ Often

☒ Always

Q5. Do you carry heavy delivery bags or loads during your work?

☒ No load

☒ Light load

☒ Moderate load

☒ Heavy load

Q6. Are you exposed to continuous vehicle vibration while driving?

☒ Never

☒ Sometimes

☒ Often

☒ Always

Q7. How comfortable is your vehicle seat and driving posture?

☒ Very comfortable

☒ Comfortable

☒ Uncomfortable

☒ Very uncomfortable

Q8. How stressful is traffic exposure during your work?

☒ Not stressful

☒ Mildly stressful

☒ Moderately stressful

☒ Highly stressful

Q9. Do you feel time pressure to complete trips/deliveries quickly?

☒ Never

☒ Sometimes

☒ Often

☒ Always

Q10. Have you experienced any work-related injury, accident, or near-miss while driving?

☒ No

☒ Yes

If yes, specify: _____

3. Psychological Stress Questionnaire (Standardized Perceived Stress Scale)

Responses:

0 = Never

1 = Almost never

2 = Sometimes

3 = Fairly often

4 = Very often

Interpretation

0-13 - Low stress

14-26 - Moderate stress

27-40 - High perceived stress

1) In the last month, how often have you been upset because of something that happened unexpectedly?

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

2) In the last month, how often have you felt that you were unable to control the important things in your life?

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

3) In the last month, how often have you felt nervous and stressed?

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

4) In the last month, how often have you felt confident about your ability to handle your personal problems? (Reverse scored)

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

5) In the last month, how often have you felt that things were going your way? (Reverse scored)

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

6) In the last month, how often have you found that you could not cope with all the things that you had to do?

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

7) In the last month, how often have you been able to control irritations in your life? (Reverse scored)

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

8) In the last month, how often have you felt that you were on top of things? (Reverse scored)

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

9) In the last month, how often have you been angered because of things that were outside of your control?

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

10) In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒

4. Modified Quality of Life Questionnaire Based on WHOQOL-BREF

1 ☒ Very poor / Very dissatisfied / Not at all

2 ☒ Poor / Dissatisfied / A little

3 ☒ Neither poor nor good / Neither satisfied nor dissatisfied / Moderately

4 ☒ Good / Satisfied / Mostly

5 ☒ Very good / Very satisfied / Completely

A) General Quality of Life

1) How would you rate your quality of life?

☒1 ☒2 ☒3 ☒4 ☒5

2) How satisfied are you with your health?

☒1 ☒2 ☒3 ☒4 ☒5

B) Physical Health Domain

3) To what extent do you feel that physical pain prevents you from doing what you need to do?

☒1 ☒2 ☒3 ☒4 ☒5

4) How much do you need medical treatment to function in your daily life?

☒1 ☒2 ☒3 ☒4 ☒5

5) Do you have enough energy for everyday life?

☒1 ☒2 ☒3 ☒4 ☒5

6) How well are you able to get around?

☒1 ☒2 ☒3 ☒4 ☒5

7) How satisfied are you with your sleep?

☒1 ☒2 ☒3 ☒4 ☒5

8) How satisfied are you with your ability to perform your daily living activities?

☒1 ☒2 ☒3 ☒4 ☒5

9) How satisfied are you with your capacity for work?

☒1 ☒2 ☒3 ☒4 ☒5

C) Psychological Health Domain

10) How much do you enjoy life?

☒1 ☒2 ☒3 ☒4 ☒5

11) To what extent do you feel your life to be meaningful?

☒1 ☒2 ☒3 ☒4 ☒5

12) How well are you able to concentrate?

☒1 ☒2 ☒3 ☒4 ☒5

13) How satisfied are you with yourself?

☒1 ☒2 ☒3 ☒4 ☒5

14) How often do you have negative feelings such as anxiety, depression, or despair?

☒1 ☒2 ☒3 ☒4 ☒5

D) Social Relationships Domain

15) How satisfied are you with your personal relationships?

☒1 ☒2 ☒3 ☒4 ☒5

16) How satisfied are you with your sex life?

☒1 ☒2 ☒3 ☒4 ☒5

17) How satisfied are you with the support you get from your friends?

☒1 ☒2 ☒3 ☒4 ☒5

E) Environmental Domain

18) How safe do you feel in your daily life?

☒1 ☒2 ☒3 ☒4 ☒5

19) How healthy is your physical environment?

☒1 ☒2 ☒3 ☒4 ☒5

20) Do you have enough money to meet your needs?

☒1 ☒2 ☒3 ☒4 ☒5

21) How available is the information you need in your daily life?

☒1 ☒2 ☒3 ☒4 ☒5

22) How much opportunity do you have for leisure activities?

☒1 ☒2 ☒3 ☒4 ☒5

23) How satisfied are you with the conditions of your living place?

☒1 ☒2 ☒3 ☒4 ☒5

24) How satisfied are you with your access to health services?

☒1 ☒2 ☒3 ☒4 ☒5

25) How satisfied are you with your transport facilities?

☒1 ☒2 ☒3 ☒4 ☒5

F) Overall Quality of Life

26) How would you rate your overall quality of life in relation to your work and daily living?

☒1 ☒2 ☒3 ☒4 ☒5

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Sakshi S. Chalke, Rutuja Bhawad, Anandh S.

Acquisition, analysis, or interpretation of data: Sakshi S. Chalke, Rutuja Bhawad, Anandh S.

Drafting of the manuscript: Sakshi S. Chalke, Rutuja Bhawad

Critical review of the manuscript for important intellectual content: Sakshi S. Chalke, Rutuja Bhawad, Anandh S.

Supervision: Rutuja Bhawad, Anandh S.

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Ethics Committee, Krishna Vishwa Vidyapeeth (Deemed to be University) issued approval 448/2025-2026. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Useche SA, Ortiz VG, Cendales BE: Stress-related psychosocial factors at work, fatigue, and risky driving behavior in bus rapid transport (BRT) drivers. Accid Anal Prev. 2017, 104:106-114. 10.1016/j.aap.2017.04.023
2. Useche SA, Alonso F, Cendales B, Llamazares J: More than just "stressful"? Testing the mediating role of fatigue on the relationship between job stress and occupational crashes of long-haul truck drivers. Psychol Res Behav Manag. 2021, 14:1211-1221. 10.2147/PRBM.S305687
3. Useche SA, Cendales B, Montoro L, Esteban C: Work stress and health problems of professional drivers: a hazardous formula for their safety outcomes. PeerJ. 2018, 6:e6249. 10.7717/peerj.6249
4. Onninen J, Pylkkönen M, Hakola T, Puttonen S, Virkkala J, Tolvanen A, Sallinen M: The self-reported stress and stressors in tram and long-haul truck drivers. Appl Ergon. 2022, 102:103761. 10.1016/j.apergo.2022.103761
5. Joseph L, Vasanthan L, Standen M, Kuisma R, Paungmali A, Pirunsan U, Sitilertpisan P: Causal relationship between the risk factors and work-related musculoskeletal disorders among professional drivers: a systematic review. Hum Factors. 2023, 65:62-85. 10.1177/00187208211006500
6. Joseph L, Standen M, Paungmali A, Kuisma R, Sitilertpisan P, Pirunsan U: Prevalence of musculoskeletal pain among professional drivers: a systematic review. J Occup Health. 2020, 62:e12150. 10.1002/1348-9585.12150
7. Magnusson ML, Pope MH, Wilder DG, Areskoug B: Are occupational drivers at an increased risk for developing musculoskeletal disorders?. Spine (Phila Pa 1976). 1996, 21:710-717. 10.1097/00007632-199603150-00010
8. Szeto GP, Lam P: Work-related musculoskeletal disorders in urban bus drivers of Hong Kong . J Occup Rehabil. 2007, 17:181-198. 10.1007/s10926-007-9070-7
9. Lee JW, Lim YH, Won YH, Kim DH: Effect of gel seat cushion on chronic low back pain in occupational drivers: a double-blind randomized controlled trial. Medicine. 2018, 97:e12598. 10.1097/MD.0000000000012598
10. Sheth A, Pagdhune A, Viramgami A: Prevalence of work-related musculoskeletal disorders (WRMSDs) and its association with modifiable risk factors in metropolitan bus transit drivers: a cross-sectional comparison. J Family Med Prim Care. 2023, 12:1673-1678. 10.4103/jfmpc.jfmpc_532_23
11. Alperovitch-Najenson D, Katz-Leurer M, Santo Y, Golman D, Kalichman L: Upper body quadrant pain in bus drivers. Arch Environ Occup Health. 2010, 65:218-223. 10.1080/19338244.2010.486422
12. Davidson S, Fletcher S, Wadley G, Reavley N, Gunn J, Wade D: A mobile phone app to improve the mental health of taxi drivers: single-arm feasibility trial. JMIR Mhealth Uhealth. 2020, 8:e13133. 10.2196/13133
13. Beckman KL, Monsey LM, Archer MM, Errett NA, Bostrom A, Baker MG: Health and safety risk perceptions and needs of app-based drivers during COVID-19. Am J Ind Med. 2021, 64:941-951. 10.1002/ajim.23295
14. van Vreden C, Xia T, Collie A, et al.: The physical and mental health of Australian truck drivers: a national cross-sectional study. BMC Public Health. 2022, 22:464. 10.1186/s12889-022-12850-5
15. Sluiter JK, van der Beek AJ, Frings-Dresen MH: Work stress and recovery measured by urinary catecholamines and cortisol excretion in long distance coach drivers. Occup Environ Med. 1998, 55:407-413. 10.1136/oem.55.6.407
16. Hernández-Rodríguez V, Maeso-González E, Gutiérrez-Bedmar M, García-Rodríguez A: Psychosocial risk and job satisfaction in professional drivers. Front Psychol. 2022, 13:994358. 10.3389/fpsyg.2022.994358
17. Wood AJ, Graham M, Lehdonvirta V, Hjorth I: Good gig, bad gig: autonomy and algorithmic control in the global gig economy. Work Employ Soc. 2019, 33:56-75. 10.1177/0950017018785616
18. Apouey B, Roulet A, Solal I, Stabile M: Gig workers during the COVID-19 crisis in France: financial precarity and mental well-being. J Urban Health. 2020, 97:776-795. 10.1007/s11524-020-00480-4
19. Cohen S, Kamarck T, Mermelstein R: A global measure of perceived stress . J Health Soc Behav. 1983, 1:385-396.
20. The WHOQOL Group: Development of the World Health Organization WHOQOL-BREF quality of life assessment. Psychol Med. 1998, 28:551-558. 10.1017/s0033291798006667