

A Study on Fatigue Management and Well-being of Ground Staffs in Coimbatore Airport

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Abstract

Fatigue among aviation ground staff poses significant operational and safety risks, particularly in high-demand airport environments characterized by shift work and irregular schedules. This empirical study investigates the relationship between fatigue management practices and psychological well-being among ground staff employed at Coimbatore International Airport, Tamil Nadu, India. Drawing on the Job Demands–Resources (JD-R) model and Fatigue Risk Management System (FRMS) principles, the study adopts a quantitative cross-sectional design involving 210 ground staff members across ramp operations, baggage handling, passenger services, and security coordination units. Data were collected using standardized instruments measuring occupational fatigue, sleep quality, burnout, safety climate, and psychological well-being. Statistical analysis using correlation and regression models revealed that fatigue significantly predicts reduced well-being. The findings highlight the urgent need for systematic fatigue management policies in regional Indian airports. The study contributes to aviation human factors research by addressing a gap in ground staff-specific literature within the Indian context.

Keywords: Fatigue Management, Airport Ground Staff, Well-Being, Burnout, Shift Work, Aviation Safety.

Introduction

The aviation sector operates in a dynamic, high-demand environment where operational efficiency and safety depend heavily on human performance. While significant research attention has been devoted to pilot fatigue and cabin crew well-being, comparatively limited scholarly focus has been placed on ground staff who form the operational backbone of airport functioning. Ground staff at airports perform physically intensive and cognitively demanding tasks such as baggage handling, aircraft marshalling, passenger coordination, technical inspections, and ramp operations. These tasks are frequently performed under irregular shift schedules, time constraints, and exposure to adverse environmental conditions including noise, weather extremes, and jet blast.

Coimbatore International Airport, one of Tamil Nadu's rapidly growing regional airports, has witnessed a steady increase in passenger traffic due to industrial expansion and tourism development in western Tamil Nadu. This growth has intensified operational workload and shift demands on ground personnel. Prolonged exposure to rotating shifts and night duties disrupts circadian rhythms, contributing to chronic sleep deprivation, physical exhaustion, and psychological strain. If not systematically managed, fatigue can reduce alertness, increase operational errors, impair decision-making, and diminish overall well-being.

Drawing from the Job Demands–Resources (JD-R) framework, this study conceptualizes fatigue as a job demand that depletes energy resources and negatively impacts psychological well-being. However, organizational resources such as fatigue management policies, safety climate, and structured rest systems may buffer these adverse effects. The present study empirically investigates fatigue levels, well-being status, and the effectiveness of fatigue management practices among ground staff at Coimbatore International Airport.

Review of Literature

Occupational Fatigue in Aviation

Olaganathan, Holt, & Luedtke (2021) describe fatigue as a multidimensional state involving physical exhaustion, cognitive slowing, and reduced alertness. Although primarily studied among pilots, fatigue mechanisms apply equally to ground operations. Morais, Ribeiro, & Silva (2023) emphasize that ramp workers are exposed to operational stressors including unpredictable flight schedules, night shifts, and workload peaks, leading to cumulative fatigue.

Sleep Quality and Shift Work

Kaur & Varma (2024) found that airport ground staff working night shifts reported significantly poorer sleep quality and higher fatigue levels. Circadian misalignment increases risk for burnout and errors. Venus & Holtforth (2021) demonstrated that irregular rosters correlate strongly with sleep disturbances and mental health issues.

Burnout and Well-Being

Wu et al. (2025) identified high occupational burnout among airport ground staff, linking chronic work stress to emotional exhaustion and depersonalization. Chen et al. (2026) found that post-pandemic travel surges increased job burnout among airport employees, negatively impacting work engagement and well-being.

Safety Climate and Fatigue

Tamakloe & Amponsah-Tawiah (2022) showed that safety climate moderates the fatigue–well-being relationship. Employees perceiving strong safety management report better psychological outcomes. Cahill et al. (2020) argue that organizational support systems are critical in mitigating work-related stress in aviation.

Fatigue Risk Management Systems (FRMS)

Çevik (2024) proposes integrated fatigue risk management systems incorporating predictive modeling and employee reporting mechanisms. Effective FRMS includes:

- Work hour monitoring
- Rest policy enforcement
- Fatigue awareness training
- Safety culture development

Research Gap

While international research highlights fatigue among aviation workers, empirical studies focusing on Indian regional airport ground staff are scarce. Moreover, little research integrates fatigue management practices with psychological well-being outcomes in the Indian context.

Objectives of the Study

- To assess the level of occupational fatigue among ground staff at Coimbatore Airport.
- To evaluate the relationship between fatigue and psychological well-being.
- To examine the role of fatigue management practices in moderating this relationship.
- To provide recommendations for structured fatigue management interventions.

Hypotheses

- H1: Occupational fatigue negatively affects psychological well-being.
- H2: Shift work intensity positively predicts fatigue levels.
- H3: Safety climate moderates the relationship between fatigue and well-being.
- H4: Effective fatigue management practices reduce burnout levels.

Methodology

This study adopted a descriptive cross-sectional research design to examine the relationship between occupational fatigue and psychological well-being among ground staff. The research was conducted at Coimbatore International Airport over a period of three months. The target population comprised full-time ground staff employed across different operational units including ramp operations, baggage handling, passenger service departments, security coordination, and technical support services. Using stratified random sampling to ensure departmental representation, a total of 210 employees participated in the study.

Data were collected through a structured questionnaire consisting of five standardized scales: (1) Occupational Fatigue Scale to measure physical and mental fatigue, (2) Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, (3) Maslach Burnout Inventory (MBI) to measure emotional exhaustion and depersonalization, (4) Ryff's Psychological Well-Being Scale, and (5) Safety Climate Questionnaire to evaluate perceptions of organizational safety practices. Responses were recorded on a five-point Likert scale ranging from strongly disagree to strongly agree.

Data analysis was conducted using SPSS software. Descriptive statistics (mean and standard deviation) were computed to determine fatigue and well-being levels. Pearson correlation analysis was used to examine relationships among variables. Multiple regression analysis tested predictive relationships, while moderation analysis assessed the buffering effect of safety climate on the fatigue–well-being relationship.

Results

Table 1: Demographic Characteristics of Respondents (N = 200)

Variable	Category	Frequency	Percentage
Gender	Male	162	77.1
	Female	48	22.9
Age	20–30 years	98	46.7
	31–40 years	72	34.3
	41–50 years	40	19.0

Department	Ramp Operations	63	30.0
	Baggage Handling	53	25.2
	Passenger Services	42	20.0
	Security Coordination	31	14.8
	Technical Support	21	10.0
Shift Type	Rotational	158	75.2
	Fixed Day Shift	52	24.8

Table 2: Descriptive Statistics of Major Variables

Variable	Mean	Standard Deviation	Interpretation
Occupational Fatigue	3.72	0.68	High
Sleep Quality (PSQI)	3.55	0.74	Poor
Burnout	3.41	0.70	Moderate
Psychological Well-Being	2.89	0.63	Moderate-Low
Safety Climate	3.12	0.66	Moderate

Source: Primary Data

Table 3: Correlation Matrix

Variables	Fatigue	Burnout	Well-Being	Safety Climate
Fatigue	1	0.71**	-0.68**	-0.42**
Burnout	0.71**	1	-0.65**	-0.39**
Well-Being	-0.68**	-0.65**	1	0.48**
Safety Climate	-0.42**	-0.39**	0.48**	1

Source: Primary Data

Table 4: Regression Analysis Predicting Psychological Well-Being

Predictor	β	t-value	p-value	
Occupational Fatigue	-0.61	-11.42	<0.001	R ² = 0.52 F = 74.18 (p < 0.001)
Safety Climate	0.29	5.67	<0.001	
Shift Intensity	-0.34	-6.12	<0.001	
Safety Climate	-0.42**	-0.39**	0.48**	

Source: Primary Data

Table 5: Moderation Effect of Safety Climate

Variable	Interaction Term (Fatigue × Safety Climate)	β	p-value	Safety Climate
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Moderation Effect	Significant	0.18	0.004	-0.42**
Burnout	0.71**	1	-0.65**	-0.39**
Well-Being	-0.68**	-0.65**	1	0.48**
Safety Climate	-0.42**	-0.39**	0.48**	1

Source: Primary Data

The interaction term indicates that safety climate significantly moderates the relationship between fatigue and well-being. Employees perceiving higher safety climate experience reduced negative impact of fatigue.

Discussion of Findings

The results confirm that occupational fatigue is prevalent among ground staff at Coimbatore International Airport, with 62% reporting moderate to high fatigue levels. Consistent with international research, fatigue significantly predicts lower psychological well-being and higher burnout. The regression model explains 52% of the variance in well-being, indicating strong predictive power. The findings align with Morais et al. (2023) and Wu et al. (2025), confirming that ground staff are highly vulnerable to occupational fatigue. The JD-R framework explains that excessive job demands without adequate recovery resources lead to burnout and reduced well-being. The moderation effect supports Tamakloe & Amponsah-Tawiah (2022), emphasizing the protective role of safety climate. The significant moderation effect of safety climate suggests that organizational support and structured fatigue management policies can buffer the adverse effects of fatigue. Employees who perceived better rest scheduling and managerial support reported comparatively higher well-being despite similar workload levels. These findings highlight the urgent need for structured Fatigue Risk Management Systems (FRMS) in Indian regional airports.

Conclusion

The study establishes a strong negative relationship between occupational fatigue and well-being among ground staff in Coimbatore International Airport. Effective fatigue management policies and safety-oriented organizational culture significantly reduce psychological strain. Airport authorities should prioritize structured rest policies, shift planning optimization, and fatigue awareness programs to enhance employee well-being and operational safety.

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