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Self-Reported Fatigue and Injury Risk in Paramedics

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ABSTRACT

Background: Paramedics routinely operate in high-stress environments and endure long working hours, contributing to elevated occupational fatigue and increased injury risk. The study aimed to compare fatigue levels between injured and non-injured paramedics and examine associations between self-reported fatigue and self-reported injury among paramedics.

Methods: An online survey of paramedics (n=22) assessed self-reported fatigue and injury history using the Occupational Fatigue Exhaustion Recovery Scale and targeted Likert-based questions, with scores transformed to quantify chronic fatigue, acute fatigue, and inter-shift recovery to identify point prevalence. Data were analysed to compare acute and chronic fatigue scores with injury status.

Results: Higher chronic fatigue scores were significantly associated with self-reported injuries within the past six months. No significant differences were found in levels of acute fatigue, inter-shift recovery, or perceived fatigue on rest days between those who were and were not injured. Beliefs about fatigue-related injury risk were consistent across injured and non-injured groups.

Conclusion: Chronic fatigue may be a key indicator of injury risk among paramedics. These findings highlight the need for proactive, system-level fatigue management strategies that extend beyond subjective measures and address chronic fatigue as a quantifiable operational risk.

Keywords: paramedics; injury; fatigue; assessment.

Introduction

Paramedics operate in high-pressure, life-threatening emergencies, where chaotic, unpredictable decisions are regularly made[1]. During operations, paramedics routinely endure extended shifts, limited recovery windows, and high levels of stress[2-4]. The demanding nature of their occupation, characterised by physical, mental, and emotional challenges, adds to their burden[5]. Over time, the combination of lengthy hours, occupational demands, and ongoing stress has left many paramedics feeling undervalued and unsupported in their profession [6]. The combined result leads paramedics to feel fatigued both on and off shift[7,8].

The pervasive effects of fatigue not only compromises paramedics' well-being but also pose significant risks to patient safety and the quality of emergency care[9]. Previous studies have documented these consequences, including slower reaction times[10] and impaired decision-making[10]. Such deficits are associated with changes in the brain's executive functions, which are essential for delivering safe care during emergencies[9,11]. If left unaddressed, fatigue increases safety risks for paramedics and the public they serve[7]. Ultimately, fatigue is not merely a personal health issue but also a broader leadership challenge[8].

Although leadership plays a substantial role, fatigue remains insufficiently addressed in operational protocols[12]. Research has extensively examined leaderships influence on employee health, safety, and performance through the Job Demands-Resources (JD-R) framework[13]. The JD-R does not suggest that fatigue is effectively managed in practice; rather, it offers a theoretical lens to explain how chronic exposure to high demands, coupled with limited recovery opportunities, leads to fatigue[13]. Within this framework, paramedics are particularly vulnerable[14], increasing the likelihood of safety-compromising behaviours[6,7,15]. This vulnerability reflects an imbalance between the significant demands placed on paramedics and the limited resources available to support their recovery and resilience, resulting in injuries being an unfortunate but predictable occurrence in paramedicine[16,17].

Many paramedic injuries occur during patient care tasks[16,18]. Each incident averages $5,928 in costs[19], with back injuries alone costing $600 per full-time equivalent annually. Notably, paramedics in the United States experience back injuries four times the national average[20]. In Australia, paramedics face a 4.6 times higher risk of work related injuries and workers' compensation claims, a 380% increase compared to other occupations[21]. While the financial burden can be substantial, the human toll, measured in pain, recovery time, and reduced capacity, is even greater. This reality highlights the critical importance of recognising the injury risks associated with fatigue.

Taken together, these figures demonstrate that fatigue-related injuries impose significant costs on paramedics, the wider health system, and the community they serve. As a result, the current study aims to compare fatigue levels between injured and non-injured paramedics and explore the link between self-reported fatigue and self-reported injury among Australian paramedics. We hypothesise that paramedics reporting higher fatigue levels will also report a greater number of injuries.

Methods

An online survey (previously detailed elsewhere[8]) was disseminated to a population of Australian paramedics by the local state administrators via email to assess perceived fatigue levels and injury history. At the beginning of the survey, demographic details such as age, height, weight, and sex were collected along with other job characteristics, including years in service and typical shift length. The survey included the Occupational Fatigue Exhaustion Recovery Scale (OFERS). The OFERS has 15 questions relating to chronic fatigue, acute fatigue, and intershift recovery, all of which capture the construct of mental and physical fatigue[22]. The questions are rated on a 0 (strongly disagree) to 6 (strongly agree) Likert scale[23]. Each section of the OFERS is out of 30 total points, with CF and AF of 30 points denoting the highest level of fatigue[23]. The IR section is reverse-scored, with 0 out of 30 indicating inability to recover[23]. The OFERS has a moderate test-retest reliability (ρ) with scores of 0.61, 0.64, and 0.62 for chronic fatigue (CF), acute fatigue (AF), and intershift recovery (IR), respectively[22]. The OFERS was previously validated in paramedics for CF, AF, and IR (α=0.85; 0.91; 0.83, respectively)[24].

Along with the scores for each of the three domains, three questions from the previously mentioned survey[8] were included for further analysis in this study. These questions were selected

because they specifically related to feelings of fatigue, self-reported injury, and the connection between perceptions of fatigue and injury, all rated on a Likert scale from 1 to 5. In this scoring system, lower values indicate less fatigue or a lower perceived contribution of fatigue to injury.

Question 13: "On your days off, do you feel fatigued?"

Question 17: "Have you been injured on the job in the last six months?" This was answered dichotomously, 'yes' or 'no'.

Question 18: "Do you believe that fatigue was the cause of any previous injury while on duty?"

STATISTICAL ANALYSIS

Data preparation and descriptive statistics: Normality was assessed via visual inspection of distribution curves and the Shapiro–Wilk test, applied to OFERS subscale scores. Likert items were transformed by assigning values from 0 to 6, with higher scores indicating greater fatigue or perceived injury risk. Descriptive statistics were performed using SPSS (Version 29.0, IBM Corp., Armonk, NY, USA). Frequencies and proportions were calculated for categorical variables, while means and standard deviations were reported for continuous scores across OFERS domains (chronic fatigue, acute fatigue, inter-shift recovery) and transformed Likert items. Effect sizes were computed and interpreted according to Cohen's guidelines[25]: 0.2–0.4 (small), 0.5–0.7 (moderate), and ≥0.8 (large). Of the 35 surveys distributed, 26 were returned, and 22 valid responses were analysed.

INFERENTIAL ANALYSIS

To examine whether fatigue levels differed between participants who reported an injury in the past six months and those who did not, a one-sided independent samples t-test was conducted. This directional test was selected based on the hypothesis that fatigue would be higher among injured participants. Assumptions of normality and homogeneity of variance were verified prior to analysis. A significance level of $p < 0.05$ was applied.

REGRESSION MODELLING

A binary logistic regression was conducted to explore whether fatigue scores predicted injury occurrence (coded as 0 = no injury, 1 = injury). Independent variables included chronic fatigue, acute fatigue, and inter-shift recovery scores. Each predictor was first examined in a univariate model, followed by simultaneous entry using the enter method to assess independent contributions while controlling for shared variance. This approach was selected due to theoretical relevance and limited statistical power, which precluded stepwise selection.

Multicollinearity was assessed using the Variance Inflation Factor (VIF) and Tolerance values from a separate linear regression model[26]. Model fit was evaluated using the Hosmer–Lemeshow goodness-of-fit test, -2 log likelihood, and pseudo R^2 statistics (Cox & Snell R^2 and Nagelkerke R^2). Results were reported as odds ratios (OR) with 95% confidence intervals (CI).

Results

Out of the 22 surveys completed, 16 individuals identified as female, accounting for 72.7%. Five participants were male, representing 22.7%, and one person, or 4.6%, chose not to disclose their gender. In the paramedic department, shift durations were uniform, with 20 paramedics (91%) working between 11 and 15 hours, and the remaining two (9%) working 7 to 10 hours. Regarding experience, most respondents (n=9, 41%) had been paramedics for 1 to 3 years, while five respondents (23%) had more than ten years of experience. Of the 22 paramedic respondents, 32% (n = 7) reported an injury within the past six months. An independent samples t-test revealed a significant difference in chronic fatigue scores between those who reported an injury and those who did not ($t(20) = 2.083$, $p = 0.025$, $d = 0.95$), indicating a large effect. No significant differences were observed for acute fatigue ($t(20) = 1.333$, $p = 0.199$, $d = 0.61$) or inter-shift recovery ($t(20) = 0.675$, $p = 0.254$, $d = 0.31$) (Table 1).

Table 1. OFERS scores related to injury status.

	Total score	Chronic Fatigue	Acute Fatigue	Inter-shift Recovery
Injured (n=7)	70.6±9.7	***21.3±4.6****	25.4±3.6	6.1±4.6
Not Injured (n=15)	59.7±15.3	***15.5±6.6****	22.1±6.0	7.9±6.0

*Significant difference *p<0.05.*

There were no differences between perceptions of fatigue on days off between those who were and were not injured ($t(20) = 0.053$, $p=0.479$, d=0.36). Of interest, those who were not injured were more likely to suggest that fatigue contributes to injury more than those who were injured; however, this difference was not significant (mean difference 0.267, 95%CI [-0.97, 0.44], ($t(20) = 0.788$, $p=0.220$, d=0.02) as seen in Table 2.

Table 2. Fatigue and injury risk.

	Do you feel fatigued on your day off	Do you think fatigue contributes to injury
Injured	3.7±0.8	3.0±0.8
Not Injured	3.7±0.8	3.3±0.7

BINARY LOGISTIC REGRESSION

The logistic regression model with all variables was not statistically significant, $\chi^2(3) = 4.750$, $p = 0.191$. The model explained 27.2% (Nagelkerke R^2) of the variance in injury and correctly classified 68.2% of cases. None of the three predictor variables were statistically significant, as shown in Table 3, and no multicollinearity was detected (all VIF < 2).

Table 3. Association of fatigue measures with injury.

	B	S.E.	Wald	*df*	*p*	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
Chronic fatigue	0.18	0.12	2.24	1	0.135	1.19	0.95	1.51
Acute fatigue	0.07	0.15	0.21	1	0.650	1.07	0.80	1.42
Inter-shift fatigue	0.03	0.14	0.04	1	0.845	1.03	0.78	1.36
Constant	-5.86	4.50	1.70	1	0.193	0.00	-	-

Multicollinearity was assessed to ensure the independence of the predictors. Acute fatigue was moderately correlated with chronic fatigue, as expected, but it did not reach a problematic level (VIF = 1.401, Tolerance 0.714).

When variables were considered independently (univariate models), only the model assessing chronic fatigue reached significance $\chi^2(1) = 4.536$, $p = 0.033$. Despite only approaching statistical significance, the model showed that for each unit increase in chronic fatigue, the odds of injury increased by 20.8% (OR 1.208, 95% CI [0.978, 1.492], $p=0.079$). While not statistically significant, the direction and magnitude of the effect are consistent with the hypothesis and t test findings.

Discussion

This study examined fatigue levels among paramedics, comparing individuals who sustained self-reported injuries to those without recent injuries. Findings indicate that individuals experiencing chronic fatigue are more likely to have incurred injuries within the past six months. The study's findings partially support the hypothesis that greater fatigue would be associated with higher injury rates. While acute fatigue and inter-shift recovery did not differ significantly between groups, the large effect size observed and consistent directionality across analyses suggest that chronic fatigue underscores a cumulative burden as a risk factor. These results imply that chronic fatigue may pose a safety risk during emergency operations.

The current study reports higher fatigue levels than the only other published study using the OFER scale with paramedics. Among the 450 paramedics sampled by Patterson et al.[24], the majority reported lower overall chronic fatigue (11.1 ± 7.3) compared with participants in this study (21.3 ± 4.6). This discrepancy highlights how organisations structures, such as longer Australian shift durations and limited recovery opportunities may exacerbate fatigue when compared to US cohorts[24]. When findings are extended to nurses, a similar occupation, they are consistent with high levels of fatigue reported worldwide among nurses in Iran[27], China[28], Japan[29], and Australia[22]. The parallels with nursing may be due to similarities within the professions, the expectation to deliver advanced care, and hierarchical pressures and poor compensation, which can lead to fatigue[30]. Chronic fatigue therefore serves not only as an indicator of individual strain, but also as a warning sign of unsustainable workplace practices that may compromise both workforce retention and patient safety[31].

Of the 22 paramedic respondents, 32% reported a work-related injury in the past six months. While caution is warranted given the small sample size, this prevalence aligns with global estimates, which range from 2.9% to 39.4%[16], and with recent Australian data reporting comparable figures at 33.4%[32]. Compared with US data, where injury rates among paramedics remain relatively low 2.9% to 5.5%[17], the Australian data suggest a disproportionately higher burden, likely influenced by longer shifts and heavier workloads. The elevated injury prevalence observed in this cohort is consistent with the high chronic fatigue scores reported reinforcing the argument that sustained fatigue may be a key driver of occupational injury risk. Taken together, these findings highlight that paramedics not only experience higher injury rates than firefighters, police and the general public[21], but also face a compounded risk when chronic fatigue is present, a warning sign for workforce sustainability.

This study is the second to use the OFERS scale with Australian paramedics and the first to assess chronic fatigue as a measurable predictor of injury. This innovative approach improves operational relevance in fatigue screening and supports the development of targeted prevention strategies that move beyond general awareness to focus on measurable risk factors. Across the sample, most respondents reported consistently high fatigue levels, including on their rest days, regardless of recent injury status. Findings point to the potential gap between fatigue awareness and actionable mitigation, highlighting a need for systems-level interventions beyond individual beliefs to target the contributors to fatigue[7,12]. Moreover, most participants believed fatigue is a significant factor in injury risk within their profession, perceptions of fatigue as a contributor to injury did not differ between those who were injured and those who were not. This may suggest a shared understanding among all personnel that fatigue is a genuine occupational hazard, even if such awareness does not directly predict injury outcomes[7].

Fatigue ratings on rest days did not differ significantly between those who sustained injuries and those who did not. This suggests that perceived recovery outside work hours may not directly correlate with injury risk, though the small sample size in this study limits the generalizability of this finding. This is in line with previous research which indicates that self-reported fatigue may lack the temporal precision needed to predict acute incidents[33]. Alternatively, injuries could be more closely linked to in-shift fatigue peaks rather than residual fatigue felt post-shift[9]. For example, Donnelly et. al., (2020) found that real-time fatigue has a stronger association with safety outcomes than retrospective fatigue reports [9]. Notably, both injured and non-injured participants reported fatigue on their rest days, suggesting that residual tiredness is a common experience across the cohort. This may explain why rest-day fatigue and beliefs about fatigue-related injury did not differ by injury status. In contrast, higher chronic fatigue scores among injured participants point to a more sustained burden that may accumulate over time. Rest day ratings may capture situational recovery, but the OFERS scale more effectively reflects cumulative fatigue exposure. This distinction highlights the methodological value of chronic fatigue screening and supports its integration into injury reduction strategies, while future research should explore real time monitoring to capture acute fatigue peaks.

These findings indicate that demographic factors, recoverability status, or fatigue-related beliefs alone may not fully explain the observed relationship between chronic fatigue and injury risk. Despite no significant differences in fatigue scores in off-shift fatigue or perceived fatigue risk between injured and non-injured personnel, a considerable elevation in chronic fatigue was observed among those who reported injuries. This points to a more insidious form of fatigue, which may accumulate gradually or result from inadequate long-term recovery, potentially increasing susceptibility to injury over time. Importantly, this study provides the first evidence that the OFERS chronic fatigue subscale can serve as a practical screening tool for injury risk in paramedics, extending its established utility in nursing populations[22,27,31] now paramedics[8]. Chronic fatigue may therefore represent a hidden burden eroding resilience in ways that are not immediately apparent, highlighting the need for proactive monitoring and integration of fatigue screening into occupational health and fatigue risk management systems.

Evaluating occupational fatigue requires a proactive strategy to monitor readiness levels and

identify signs of worker exhaustion[12]. Adopting a proactive approach can help identify individuals who may be susceptible to injury or behaviours that compromise safety, but its success depends heavily on the organisation's safety culture[12]. While individual recovery outside of work is important, it cannot fully offset cumulative fatigue when workplace demands and culture remain unsustainable, as reflected by the high fatigue levels reported even on rest days. These findings highlight the importance of monitoring persistent fatigue trends through both objective metrics and subjective reporting, and of embedding these insights into injury reduction frameworks. Integrating validated scales such as OFERS with real time monitoring technologies could provide a more comprehensive assessment of fatigue, enabling organisations to intervene proactively and strengthen operational safety.

Limitations

The limitations of this study should be considered when interpreting its findings. First, the small sample size of only 22 respondents limits the statistical power and may obscure meaningful associations. Second, reliance on self-reported data introduces recall bias, as participants' memories of past events may not be entirely accurate, and personal circumstances could influence their responses. Third, since participation was voluntary and conducted online, there is a risk of self-selection bias. Fourth, evaluating fatigue levels and injury events simultaneously complicates assessing these factors.

Additionally, the small sample size impacted the regression analysis, which was not statistically significant, with no predictors showing clear effects. This limitation makes it harder to detect real differences and increases the chance of Type II errors. Therefore, these results should be seen as preliminary and need to be confirmed through larger studies. Future research with bigger samples is vital to verify these patterns and build confidence in the findings. Lastly, although bootstrapping procedures were not used in this study, they could be a helpful way to improve parameter estimates and the accuracy of confidence intervals in small-sample research. Future studies should consider using bootstrapping to strengthen the robustness and generalisability of the results.

Conclusions

This study found that paramedics with higher chronic fatigue levels were significantly more likely to have sustained a work-related injury in the past six months, whereas no association was observed for acute fatigue, inter-shift recovery, or perceived fatigue on rest days. Most respondents believed fatigue contributes to injury, and this belief was consistent regardless of injury history. These findings provide the first evidence that the chronic fatigue subscale of the OFERS can serve as a meaningful predictor of injury risk among Australian paramedics, extending its established utility in nursing populations. Importantly, the results highlight that chronic fatigue represents a cumulative occupational burden and a system level safety risk, highlighting the need for proactive fatigue management systems that go beyond subjective measures. Embedding chronic fatigue screening into fatigue risk management systems and occupational health protocols may help identify personnel at elevated risk and inform targeted prevention strategies. Future research with larger, longitudinal samples and real-time monitoring will be critical to confirm these patterns and strengthen the operational relevance of fatigue screening in paramedicine.

Conflict of Interest Statement:

The authors declare no conflict of interest.

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