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Sustainable Working Conditions in Healthcare: Psychosocial Risks and Work-Related Musculoskeletal Disorders

Pilar Baylina [1,*], Paula Machado Santos [2] and Carla Barros [3,*]

[1] ESS, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida, 400, 4200-072 Porto, Portugal

[3] Unidade Local de Saúde de Matosinhos, Rua Dr. Eduardo Torres, 4464-513 Senhora da Hora, Portugal

[2] Faculty of Human and Social Sciences, University Fernando Pessoa, Praça de 9 de Abril 349, 4249-004 Porto, Portugal

* Correspondence: pilarbaylina@ess.ipp.pt (P.B.); cbarros@ufp.edu.pt (C.B.)

Abstract

Healthcare organizations face emerging challenges that threaten the safety of professionals and patients, as well as the performance and long-term sustainability of healthcare systems. Health problems such as work-related musculoskeletal disorders (WRMSD) are highly prevalent among nurses, not only due to the physical demands but also because of significant psychosocial stressors and mental health challenges inherent in healthcare environments. This study investigates the impact of psychosocial risks at work on the occurrence of WRMSD in nurses. A cross-sectional study was conducted, using a snowball recruitment method, from Octobre 2025 to March 2026, among 266 nurses. Data were collected using the Psychosocial Risk Factors scale (INSAT_ERPS) and The Depression, Anxiety and Stress Scale - 21 Items (DASS-21), and analyzed with descriptive and inferential statistics to analyze the predictive role of the psychosocial risk on burnout dimensions. This study analyzed the relationships between PSR, mental health and WRMSD. Key psychosocial determinants of WRMSDs include high psychological strain—manifesting as anxiety—compounded by psychosocial stressors such as low job control, role ambiguity, and barriers to professional development. The results highlight the importance of addressing PSR and mental health, to reduce the incidence of WRMSD among nurses. Interventions focused on improving working conditions and promoting mental health may be effective in preventing WRMSD.

Keywords: work-related musculoskeletal disorders; psychosocial risk factors; mental health; anxiety; nurses

1. Introduction

Today, healthcare organizations operate in increasingly complex contexts, facing staff shortages, high cognitive and emotional demands, and persistent exposure to psychosocial risks. These healthcare crisis exert significant and constant pressure on human resources and raise serious concerns regarding the health and well-being of healthcare professionals, with direct implications for organizational sustainability and the achievement of Sustainable Development Goals 3 (Good Health and Well-being) and 8 (Decent Work and Economic Growth) [1–3].

In this context, safety culture—which includes common beliefs, values, and behaviors that put safety, education, and open communication first—has become a key organizational concept [4]. Various studies demonstrate that poor safety cultures in the healthcare sector are linked to increased psychosocial risks, anxiety, burnout, and negative effects on workers' physical health, including work-related musculoskeletal disorders (WRMSD) [5,6].

The global burden of WRMSD remains the leading cause of lost work-days and disability worldwide, with substantial health and economic costs for workers and their employers [7]. In the

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healthcare sector significant challenges impose both physical and emotional strains on workers, namely nurses [8]. Due to the inherent demands of their profession, nurses are particularly susceptible to various health risks, including WRMSD [9]. The specific nature of nursing responsibilities, combined with organizational culture and environmental factors within healthcare settings, exacerbates nurses' vulnerability to physical and psychological ailments. These health issues strongly influence their performance and have a significant impact on both the quality of care provided and patient safety [10–12].

The analysis of the psychosocial risk factors represents an important step in assessing workplace risks associated with mental and physical well-being. The relevance of addressing psychosocial factors in occupational health, aligning with contemporary frameworks such as the Job Demand-Control-Support (JDCS) model [13–15], Effort-Reward Imbalance (ERI) model [16,17], and Job Demands-Resources (JD-R) model [18] shows that high job demands and low social support—two key psychosocial risk factors - contribute directly to emotional distress and psychological strain. When combined with other psychosocial risks, such as working hours (extensive workload), limited autonomy and decision-making capacity, and emotional demands, these conditions can contribute to chronic stress, anxiety and a decline in overall mental well-being.

Psychosocial risks in the healthcare environment stem from increased workloads, time pressure, emotional demands, and insufficient support from management and colleagues. These factors create a stressful work atmosphere that negatively impacts nurses' physical and mental health, contributing to a higher incidence of WRMSD [7].

Previous studies have established a strong link between the intense pace work, exposure to suffering and death, emotional overload, and the development of musculoskeletal disorders among nursing professionals [19–21]. In addition to psychosocial risks, mental health concerns, including depression, anxiety, and stress, are prevalent among nurses and significantly affect their susceptibility to WRMSD [22]. High job demands, emotional labor, and the burden of caregiving contribute to psychological distress, which in turn exacerbates physical health problems [23,24].

This study seeks to elucidate the multifaceted influences on the occurrence of WRMSD in nurses, providing a foundation for targeted interventions and preventive measures to improve the health and well-being of healthcare workers.

2. Materials and Methods

A cross-sectional study was conducted in Portuguese nurses from public and private hospitals, between Octobre 2025 and March 2026. All participants provided informed consent to participate in this study, and issues associated with confidentiality and anonymity were ensured, by Data Protection Law Regulation (EU) 2016/679 (General Data Protection Regulation). The Ethics Committee of Fernando Pessoa University approved the study, with the reference FCHS/PI 219/21-2. The study promotion and recruitment were done by social platforms (e.g. Instagram, Facebook, WhatsApp), and data collection was conducted online using the Google Forms platform.

The sample consisted of 266 nurses working in hospitals and primary healthcare centers in Portugal, both public (53.4%) and private (46.6%). It was composed of 83.3% females and 16.7% males, aged between 20 and 67 years (M = 36.67; SD = 10.992). Most nurses (61.7%) have been working for less than 16 years. Most of the participants (79.3%) work under permanent contracts.

In this study, two different scales were used: INSAT - Health and Work Survey, a self-reported questionnaire that measures working conditions, risk factors, and health problems. Concerning the main goal of the present study, only the psychosocial risk factors and musculoskeletal disorders items were used. The psychosocial risk factors were grouped in categories: work intensity (10 items, α = 0.918); lack of autonomy and initiative (4 items, α = 0.857); work relations with coworkers and managers (8 items, α = 0.908); employment relations with the organization (13 items, α = 0.909); working hours (8 items, α = 0.848); emotional demands (8 items, α = 0.919), and work values (4 items, α = 0.901). Psychosocial-risk items originally measured on a 6-point Likert scale (0 = "not exposed"; 1–5 = "exposed" with increasing discomfort) were dichotomized for analysis: 0 = no exposure and

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1 = yes (combining responses 1 through 5). In terms of psychometric properties, the INSAT has good internal consistency obtained by the Rasch Partial Credit Model analysis, with Person Separation Reliability coefficient of 0.8761, and has been used in several health-related studies before [10,19,25]. To measure WRMSD a four ordered categories item from INSAT was used (0 = no disorder; 1 = disorder not work-related; 2 = disorder present and work aggravate it; 3 = disorder present and work is the primary cause). For this study's purposes, this variable was transformed into a dichotomous outcome: 0 = no work-related disorder (levels 0 and 1) and 1 = work-related disorder (levels 2 and 3). This collapses non-occupational conditions into the reference category and isolates cases in which work exposure either precipitates or exacerbates the disorder, thereby aligning the dependent variable with the study's focus on work-related risk; ii) The Depression, Anxiety and Stress Scale - 21 Items (DASS-21) [26,27] is a set of three self-report scales designed to measure the emotional states of depression (7 items, $\alpha = 0.914$), anxiety (9 items, $\alpha = 0.937$) and stress (5 items, $\alpha = 0.910$). These categories have different items measured on a 4-point Likert scale ranging from 0 (not applied to me) to 3 (applied to me most of the time).

A descriptive statistical analysis of all variables assessed was performed. Frequency and percentage analyses were performed on the sociodemographic characteristics of the participants. Afterwards, a descriptive analysis of all variables from the two questionnaires was performed using frequency measures, central tendency (mean) and dispersion measures (standard deviation, range, minimum and maximum). Then, a Bivariate analysis was performed using point-biserial correlation to identify the psychosocial risk factors and mental health factors that could be related to WRMSD. Subsequently, a multivariable binary-logistic regression was performed using the ENTER method, entering predictors in three sequential blocks (block 1: psychosocial risk items, block 2: DASS-21 anxiety score) to estimate their adjusted associations with the presence of WRMSD. The threshold for statistical significance was $p < 0.05$. The regression equations satisfied all assumptions, and the results of the logistic regression analyses were considered reliable. Data were analyzed with the support of the IBM SPSS statistical program for Windows, version 29.0 (SPSS Inc.: Chicago, IL, USA).

3. Results

The study was performed with 266 nurses from the public (53.4%) and private (46.6%) sectors. Participants' ages ranged between 20 and 67 years (Mean (M) = 36.67 years; Standard Deviation (SD) = 10.992 years). All the sociodemographic characteristics are presented in Table 1.

Table 1. Sociodemographic characteristics of the sample.

	M	**SD**
Age(years)	M=36.67	SD=10.992
Gender	**N**	**%**
Male	46	17.2
Female	218	82,0
Other	2	.8
Relationship status		
Married	136	51.1
Divorced	12	4.5
Single	116	43.6
Widow	2	.8
Education level		
Bachelor	188	70,68
Master	74	27,82

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PhD	4	1,50
Working situation		
Fixed-term contract	26	9,77
Permanent contract	188	70,68
Temporary contract	42	15,79
Self-employed, own account, without employees	10	3,76

Legend: M – Mean; SD – Standard Deviation.

The descriptive analysis of the WRMSD item from INSAT showed that 86% of the participants suffered from musculoskeletal disorders.

Table 2 summarizes the descriptive analysis of the INSAT Psychosocial Risk Factors Scale, reporting the proportion of nurses who answered "yes" to each workplace stressor. To highlight the most prevalent issues affecting practice, only items endorsed by ≥ 20 % of respondents are shown.

Table 2. Descriptive analysis of psychosocial risk factors.

Category		Psychosocial Risk Factors	% Yes
Work Intensity	WI1	Intense work pace	90.6
	WI2	Depending on colleagues to carry out my work	70.2
	WI3	Depending on direct customer requests	80.0
	WI4	Working to tight deadlines and/or strict standards	80.8
	WI5	Having to constantly adapt to changes in work methods or tools	75.5
	WI6	Lack of clear guidance on my tasks	47.5
	WI7	Have to deal with contradictory instructions	67.2
	WI8	Frequent disturbing interruptions	72.5
	WI9	Constantly changing roles, tasks depending on the needs of the company/organization	49.4
	WI10	Hyper-solicitation	74.7
Working Hours	WT1	Having to take work home beyond my working hours	56.6
	WT2	Having to work beyond normal working hours	85.3
	WT3	Having to sleep at unusual hours because of work demands	61.1
	WT4	Having to skip or shorten a meal or reduce break times due to work demands	86.0
	WT5	Not knowing my work schedule in advance	52.8
	WT6	Conflict in balancing work and personal life	76.2
	WT7	Having to be permanently available at any time of day	62.6
	WT8	Having to travel frequently for work (resulting in absence or significant distance that disrupts family or social routines)	43.8
Lack of Autonomy and Initiative	AI1	Having to complete the work exactly as defined, with no possibility of making changes	39.2
	AI2	Having to respect strictly defined break periods, with no option to adjust them	27.9

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	AI3	Having to follow a strict work schedule, with no possibility of small adjustments	34.7
	AI4	Having no opportunity to participate in decisions about my work	43.8
Social Work Relations	WR1	Spending many hours in a workspace where I feel uncomfortable	30.2
	WR2	Frequently needing help from colleagues but not getting it	30.9
	WR3	It's rare to exchange experiences with colleagues to improve the work	21.9
	WR4	My opinion about the functioning of the department/section is disregarded	29.4
	WR6	At work, I am not well recognized by my colleagues	29.4
	WR7	I have no one I can trust	21.1
	WR8	I am not treated fairly and with respect by management	34.7
Employment Relations	ER2	Career progression is almost impossible	69.8
	ER3	My salary does not allow me to maintain a satisfactory standard of living	70.2
	ER4	Lack of resources to carry out my work	60.4
	ER5	There are conditions that undermine my dignity	37.7
	ER6	Lack of opportunities to develop my professional skills	51.3
	ER7	Lack of recognition and/or appreciation	66.4
	ER8	Lacks the feeling of "useful contribution to society"	40.0
	ER9	At work, I feel exploited most of the time	55.1
	ER10	I am afraid of suffering an injury caused by the nature of my job.	60.4
	ER11	My company shows no concern for my well-being	55.8
	ER12	It will be very difficult for me to do my job when I am 60 years old	74.0
Emotional Demands	ED1	Have to deal with direct contact with external public	94.0
	ED3	I have to handle tense situations in relationships with the public	85.3
	ED4	I fear the possibility of verbal aggression from the public	65.7
	ED5	I fear the possibility of physical aggression from the public	61.1
	ED6	I have to deal with other people's difficulties and/or suffering	89.4
	ED7	I have to simulate good mood and/or empathy	70.9
	ED8	I have to hide my emotions at workplace	67.9
Work Values	WV1	I have to do things that I disapprove of	45.3
	WV2	My professional conscience is shaken	37.7
	WV3	The things I do are seen as underrated	43.0
	WV4	Lack of necessary resources to perform a well-done job	50.6

Within Work Intensity, over 90% of participants reported an intense work pace, and more than 70% indicated dependencies on colleagues or customer demands, strict standards, and frequent interruptions, indicating sustained operational pressure. Working-hours strain is reinforced by unpredictable schedules (53 %) and permanent availability (63 %). Autonomy is limited for roughly four in ten workers, who lack decision latitude or flexible breaks. In contrast, Social Work Relations show notably lower exposure levels, with fewer than one-third reporting discomfort related to

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recognition, fairness, or trust among colleagues, suggesting relatively stable interpersonal dynamics. However, Employment Relations highlight substantial concerns, with around 70% mentioning stagnant career progression, inadequate salary, and lack of recognition, signaling structural dissatisfaction. The Emotional Demands dimension stands out, with nearly all respondents reporting regular public contact (94%) and handling others' suffering (89.4%), underscoring the emotional burden intrinsic to their roles. Finally, Work Values reflect moderate concern, with around 45% expressing dissonance between their actions and values or professional identity. Collectively, these findings point to high emotional strain in the work environment, with key risk zones in work intensity, emotional exposure, and organizational recognition.

The descriptive analysis for the three dimensions of mental health (DASS-21) is presented in **Table 3**.

Table 3. Descriptive analysis of Mental Health dimensions for the sample (N=266).

	M (SD)	Min.-Max.
Mental Health		
Anxiety	0.58 (0.665)	0-3
Depression	0.58 (0.722)	0-3
Stress	0.76 (0.731)	0-3

Complementary continuous measures (Table 2) reinforce these results. Mental-health scores were moderate: stress averaged 0.76 (SD = 0.731), slightly exceeding anxiety and depression (both M = 0.58). The co-occurrence of elevated emotional demands and measurable mental health symptomatology underscores a multifaceted psychosocial burden likely to influence musculoskeletal health outcomes examined in subsequent analyses.

The results of the point-biserial analysis are presented in Table 4, with the statistically significant correlations observed between psychosocial risk factors, mental health factors, and WRMSD.

Table 4. Point-Biserial analysis: correlations between psychosocial risk factors, mental health factors, and WRMSD.

Category		Psychosocial risk Factors	*r*	*p*
Working Intensity	WI2	Depending on colleagues to carry out my work	0.131	0.033
	WI6	Lack of clear guidance on my tasks	0.218	<.001
	WI7	Have to deal with contradictory instructions	0.284	<.001
	WI9	Constantly changing roles and tasks depending on the needs of the company/organization	0.166	0.007
	WI10	Hyper-solicitation	0.251	<.001
Working Hours	WH3	Having to sleep at unusual hours because of work demands	0.199	0.001
	WH4	Having to skip or shorten a meal or reduce break times due to work demands	0.141	0.022
	WH5	Not knowing my work schedule in advance	0.200	0.001
	WH6	Conflict in balancing work and personal life	0.151	0.014
	WH8	Having to travel frequently for work	0.132	0.032
Lack of Autonomy and	AI1	Having to complete the work exactly as defined, with no possibility of making changes	0.197	0.001

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Initiative	AI2	Having to respect strictly defined break periods, with no option to adjust them	0.277	<.001
	AI3	Having to follow a strict work schedule, with no possibility of small adjustments	0.265	<.001
	AI4	Having no opportunity to participate in decisions about my work	0.292	<.001
Social Work Relations	WR1	Spending many hours in a workspace where I feel uncomfortable	0.203	0.001
	WR2	Frequently needing help from colleagues but not getting it	0.282	<.001
	WR3	It's rare to exchange experiences with colleagues to improve the work	0.194	0.001
	WR4	My opinion about the functioning of the department/section is disregarded	0.262	<.001
	WR6	At work, I am not well recognized by my colleagues	0.262	<.001
	WR7	I have no one I can trust	0.222	<.001
	WR8	I am not treated fairly and with respect by management	0.182	0.003
Employment Relations	ER2	Career progression is almost impossible	0.177	0.004
	ER3	My salary does not allow me to maintain a satisfactory standard of living	0.270	<.001
	ER4	Lack of resources to carry out my work	0.236	<.001
	ER5	There are conditions that undermine my dignity	0.143	0.02
	ER6	Lack of opportunities to develop my professional skills	0.289	<.001
	ER7	Lack of recognition and/or appreciation	0.203	0.001
	ER8	Lacks the feeling of "useful contribution to society"	0.142	0.02
	ER9	At work, I feel exploited most of the time	0.186	0.002
	ER10	I am afraid of suffering an injury caused by the nature of my job.	0.365	<.001
	ER11	My company shows no concern for my well-being	0.230	<.001
	ER12	It will be very difficult for me to do my job when I am 60 years old	0.236	<.001
Emotional Demands	ED1	I have to handle tense situations in relationships with the public	0.167	0.016
	ED3	Have to deal with direct contact with external public	0.148	0.006
	ED4	I fear the possibility of verbal aggression from the public	0.357	<.001
	ED5	I fear the possibility of physical aggression from the public	0.345	<.001
	ED6	I have to deal with other people's difficulties and/or suffering	0.162	0.008
	ED7	I have to simulate good mood and/or empathy	0.197	0.001
	ED8	I have to hide my emotions at workplace (e.g. fear, frustration, anger, sadness, disappointment)	0.246	<.001
Work Values	WV1	I have to do things that I disapprove of	0.202	0.001
	WV2	My professional conscience is shaken	0.143	0.02
	WV3	The things I do are seen as underrated	0.185	0.002
	WV4	Lack of necessary resources to perform a well-done job	0.214	<.001
Mental Health		Anxiety	0.336	<.001
		Depression	0.280	<.001
		Stress	0.337	<.001

Point-biserial correlations show a positive and statistically robust link between musculoskeletal disorders and a set of psychosocial stressors. The strongest associations ($r \approx 0.34 - 0.37$, $p < 0.001$)

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appear for specific employment and emotional-threat items: afraid of suffering an injury (r = 0.365), and fear of verbal aggression from the public (r = 0.357). Moderate correlations (r ≈ 0.25 – 0.30) cluster around lack of autonomy with "Having no opportunity to participate in decisions" (r = 0.292), "deal with contradictory instructions"/" hyper-solicitation" (r = 0.284–0.251), and employment relations (e.g., low salary, r = 0.270). Although somewhat smaller, consistently significant (r ≈ 0.13 – 0.22) links emerge for work-intensity factors (e.g., "Depending on colleagues", "Lack of clear guidance") and work values ("things I do are seen as underrated" or "professional conscience is shaken"). Collectively, these coefficients—ranging from small to moderate—indicate that musculoskeletal complaints are most closely tied to perceived threat and insecurity at work, but they are also sensitively modulated by autonomy, workload clarity, and overall psychosocial climate.

Focusing specifically on DASS-21 mental-health scores, the point-biserial analysis confirms a psychological pathway to WRMSD. Anxiety and stress are the mental health dimensions with the highest correlations (respectively, r =0.336 and r =0.337). All dimensions contribute significantly (all p <0.001). These results highlight the need for integrated interventions that address emotional well-being, as they suggest that increased affective distress and adverse psychosocial work experiences are cumulatively related to higher odds of WRMSD.

After this, a multivariable binary-logistic regression was performed using the ENTER method only with the items considered statistically significant from the previous analysis (Table 5). The method option was Enter because a model with only significant predictors was the main objective for this work. Before this, the assumptions to use this statistical tool were verified and validated. Due to the possibility of multicollinearity between all independent variables, the Variance Inflation Factor (VIF) was calculated and all VIF > 10.0 were removed from the model to ensure the reliability of the logistic regression model. [28].

Table 5. Logistic regression analysis to identify psychosocial risk factors and Mental Health factors that are predictors of WRMSD.

	Items	*p*	OR (95% C.I.)
Psychosocial risk factors			
WI2	Depending on colleagues to carry out my work	0.038	0.228 (0.057 - 0.922)
WI6	Lack of clear guidance on my tasks	0.028	4.808 (1.189 - 19.444)
WH6	Conflict in balancing work and personal life	0.014	0.109 (0.019 - 0.635)
AI4	Having no opportunity to participate in decisions about my work	0.009	8.940 (1.717 - 46.562)
WR2	Frequently needing help from colleagues but not getting it	0.003	11.753 (2.305 - 59.939)
ER5	There are conditions that undermine my dignity	0.006	2.073 (1.711 - 2.770)
ER6	Lack of opportunities to develop my professional skills	<0.001	33.532 (6.346 - 177.178)
ER9	At work, I feel exploited most of the time	0.016	2.068 (1.610 - 2.623)
WV8	I have to hide my emotions at workplace	0.045	5.958 (0.962 - 36.912)
Mental Health			
	Anxiety	0.005	19.075 (2.434 - 149.468)

The multivariable logistic-regression results show that both work-related stressors and emotional burdens independently shape the odds of reporting WRMSD. The analysis of psychosocial risk factors shows that four items markedly raise risk: "There are conditions that undermine my dignity" (ER5, OR = 2.073), "feel exploited most of the time " (ER9, OR = 2.068), "Lack of clear guidance" (WI6, OR = 4.808), "no opportunity to participate in decisions " (AI4, OR = 8.940), "needing help from colleagues.." (WR2, OR = 11.753), and "Lack of opportunities to develop professional skills" (ER6, OR = 33.532). Conversely, several conditions appear protective: "Depending on colleagues" (WI2, OR = 0.228) and "Conflict in balancing work and personal life" (WH6, OR = 0.109) show ORs

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significantly below 1, suggesting lower WRMSD odds when these issues are present. The anxiety dimension from mental health is a dominant predictor: each one-unit increase in anxiety multiplies WRMSD odds nearly twenty-fold (OR = 19.08).

To resume, inadequate guidance, low decision latitude, skill-development barriers, and anxiety form the principal drivers of WRMSD in this workforce. In contrast, several seemingly adverse conditions display inverse associations that warrant further qualitative exploration. This model shows that both psychosocial risks and mental health dimensions impact the presence of WRMSD. The direction and magnitude of these effects provide insights into which factors most strongly influence WRMSD.

presents an explanatory model structure to visualize the relationship between predictors and WRMSDs.

4. Discussion

This study analyzed the complex relationships that exist between psychosocial risk factors, mental health, particularly anxiety, and WRMSD in Portuguese nurses. This discussion summarizes the findings in the context of previous research, focusing on three main findings: 1) between psychosocial risk factors and WRMSD; 2) between WRMSDs and mental health, especially anxiety; and 3) a suggested model is presented in Figure 1 to explain the interrelations among psychosocial risk factors, mental health, and WRMSD.

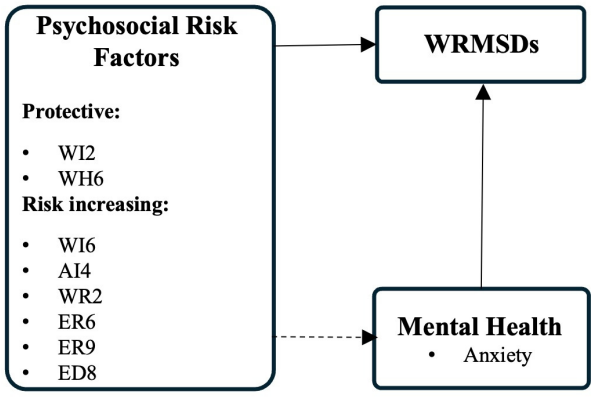

Figure 1. Explanatory Model Diagram.

4.1. WRMSDs and Psychosocial Risk Factors

The bivariate and multivariable analyses identified multiple psychosocial risk factors as significant correlates—or predictors—of WRMSD. Notably, fear of job-related injury (ER10; $r = 0.365$, $p < 0.001$) and fear of verbal aggression (ED4; $r = 0.357$, $p < 0.001$) exhibited the strongest point-biserial correlations with WRMSD, suggesting that perceived threat and insecurity at work substantially heighten musculoskeletal complaints. This finding aligns with literature which indicates that exposure to threatening work environments amplifies physical tension and muscular strain, thereby exacerbating WRMSD [7,19]. This result is consistent with research from the reliability organizations and psychosocial safety climate literature, which shows that workplaces with high levels of perceived threat and insecurity lead to long-lasting physiological stress reactions, such as tense muscles and a decreased ability to recover. These processes may exacerbate musculoskeletal strain and increase susceptibility to WRMSD in the absence of strong, safety-oriented, and sustainable organizational policies [6,29,30].

Beyond threat perception, lack of autonomy emerged as a robust predictor. Participants reporting "no opportunity to participate in decisions about my work" (AI4) had higher odds of WRMSD (OR = 8.94, 95% CI = 1.717–46.562; $p = 0.009$), and "following a strict work schedule with no adjustments" (AI3; $r = 0.265$, $p < .001$) correlated positively with WRMSD. Such associations mirror

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prior evidence that limited decision latitude fosters muscle tension and reduces opportunities for micro-breaks, both of which are known risk factors for musculoskeletal injury. From the standpoint of a high reliability organization and sustainable work, inadequate autonomy compromises safe work practices and adaptive capability, increasing susceptibility to WRMSD, especially in complex and high-demand work contexts [19,23,31,32].

On the other hand, some factors showed inverse associations. "Depending on colleagues to carry out my work" (WI2) was associated with lower odds of WRMSD (OR = 0.228, 95% CI = .057–.922; p = .038). The idea that interdependence promotes social support and shared workload, which might reduce physical strain, is one tenable explanation. However, where help from colleagues was absent (WR2), the likelihood of WRMSD significantly rose (OR = 11.753, 95% CI = 2.305–59.939; p = .003), highlighting the importance of perceived (or real) social support as a modifier: its presence reduces the risk of WRMSD, whereas its absence increases it. So, interdependence, teamwork, and mutual monitoring regularly reduce operational failure and employee stress, promoting a sustainable workplace and a safety culture [23,29,32,33].

Structural concerns regarding career progression (ER2; r = .177, p = .004), remuneration (ER3; r = .270, p < .001), and skill development (ER6) also predicted WRMSD. In particular, "lack of opportunities to develop my professional skills" (ER6) conferred dramatically increased odds (OR = 33.532, 95% CI = 6.346–177.178; p < .001). These findings suggest that organizational dissatisfaction—manifested as perceived stagnation or under-utilization—leads to psychological strain that may manifest somatically as muscle tension or other musculoskeletal symptoms [19,23,34]. Taken together, our results corroborate and extend earlier literature: high work intensity, limited autonomy, poor work relations, and structural frustrations each contribute to WRMSD via psychological and behavioral pathways, contributing to a poor safety culture and low-reliability organizations [7,19]. From an intervention standpoint, these psychosocial domains (e.g., autonomy, social support, resource adequacy) should be prioritized in efforts to reduce WRMSD incidence among nurses [23,35,36].

4.2. WRMSDs and Mental Health (Anxiety Focus)

Mental health dimensions—particularly anxiety and stress—were strongly correlated with WRMSDs and remained significant predictors in multivariable models. The point-biserial correlation between anxiety and WRMSD (r = .336, p < .001) was nearly identical to that for stress (r = .337, p < .001), while depression also showed a more moderate association (r = .280, p < .001). However, when analyzed the logistic regression only anxiety continued as an independent predictor (OR = 19.075, 95% CI = 2.434–149.468; p = .005): This indicates that anxiety may be the primary "mental health" driver of musculoskeletal complaints. This observation is consistent with some studies where were found that hospital nurses with comorbid WRMSD and depression more frequently reported elevated anxiety levels, suggesting that anxiety both co-occurs and exacerbates musculoskeletal pain [22,37]. Another study documented those psychosocial risks at work (e.g., emotional demands, pressure) heighten anxiety, which in turn exacerbates physical discomfort [23,24]. Also, evidence shows that, physiologically, anxiety provokes increased muscle tension, altered posture, and hypervigilance—factors that directly increase the mechanical load on musculoskeletal structures [10,38]. This pathway is supported by more recent reliability organizations studies on psychological safety and psychosocial safety climate. Even after adjusting for physical workload, research indicates that low psychological safety raises anxiety, which in turn predicts neck, shoulder, and back discomfort [6].

Musculoskeletal pain may also feed back into anxiety, creating a bidirectional cycle: persistent pain creates anxiety by reducing functional capacity, promotes dramatization, and increases worry about job performance, fostering anxiety [23]. Clinically, these data emphasize the importance of integrated interventions—combining cognitive-behavioral strategies to reduce anxiety with ergonomic adjustments—to break this cycle and mitigate WRMSD [22,39–43].

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4.3. Explanatory Model

In summary, Figure 1 encapsulates a multifactorial framework: psychosocial factors not only elevate WRMSD risk directly (e.g., by fostering muscle tension and poor work behaviors) but also indirectly via increased anxiety. A self-reinforcing cycle is also created when anxiety worsen WRMSD. This concept is in line with some authors who promoted integrated strategies that successfully reduce WRMSD by addressing both psychological and physical risk factors [8,44,45].

4.4. Implications for Practice and Future Research

Our findings support that ergonomic interventions alone are insufficient to minimize or/and control WRMSD prevalence; comprehensive strategies must include psychosocial risk management, mental health support, and organizational improvement. Specifically:

Psychosocial Interventions: Promoting decision autonomy (flexible scheduling, participatory decision-making) can reduce muscle tension and perceived stress [19,46]. Instituting regular team-based debriefings and peer-support programs may bolster social support, attenuating the detrimental effects of workload intensity [47–49].

Anxiety Management: Onsite encouraging services, resilience training, mentoring programs, and mindfulness-based stress reduction programs can decrease anxiety, thereby disrupting the anxiety–WRMSD cycle [50–52].

Integrated Ergonomic-Psychosocial Programs: The underlying drivers of WRMSDs can be holistically addressed by customized interventions that integrate ergonomic assessments (e.g., safe patient-handling training) with psychosocial risk audits [53–55].

Organizational improvement: Stronger safety cultures and improved organizational tactics are key factors in enhancing working conditions in healthcare settings. A strong safety culture helps lower psychological and physical risks and supports the mental and physical well-being of healthcare workers by encouraging open communication, shared accountability, learning from mistakes, and proactive risk management. Since healthier and better-supported professionals are better equipped to act safely and effectively, these gains are directly associated with improved patient safety and greater quality of care. In this regard, Improving organizational management practices, through the implementation of practices preconized by high-reliability organizations, for example, is a tangible and methodical way to operationalize a safety culture and translate common values into daily procedures that support workforce protection, patient safety, and the long-term sustainability and resilience of healthcare systems [6,32].

5. Conclusions

This study clarifies a complex network of factors that contribute to WRMSD in nurses: psychosocial risk factors (such as a lack of autonomy and inadequate resources) raise musculoskeletal complaints directly while also increasing anxiety, which raises the risk of WRMSD on their own. Figure 1 effectively integrates these pathways, illustrating that interventions must target psychosocial and mental health concurrently to reduce WRMSD burden in healthcare settings. Due to the cross-sectional design, causal inferences are limited. Future studies should be supported by longitudinal research to examine temporal dynamics among psychosocial risks, anxiety, and WRMSD. Furthermore, qualitative research examining nurses' perceptions of the relationship between physical discomfort and professional pressures may clarify complex pathways that are not represented by quantitative measures.

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Abbreviations

The following abbreviations are used in this manuscript:

PSR	Psychosocial risks
WRMSD	Work-related musculoskeletal diseases

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