PREVALENCE AND PREDICTORS OF MUSCULOSKELETAL DISORDERS AMONG HEALTHCARE WORKERS IN TERTIARY HOSPITALS OF PUNJAB: A CROSS-SECTIONAL ANALYTICAL STUDY

ORIGINAL RESEARCH

Abdul Mannan*[1], Hafsa Noreen[2], Jawad Ul Hassan[3]
[1] Lecturer, Avicenna Medical College, Lahore
[2] Assistant Professor, Riphah International University, Lahore
[3] Lecturer, Department of Physiotherapy, University of Health Sciences, Lahore

Corresponding Author: Abdul Mannan, Abdulmannan9111@gmail.com, Lecturer, Avicenna Medical College, Lahore

Conflict of Interest: None	Grant Support & Financial Support: None

ABSTRACT

BACKGROUND: Musculoskeletal disorders (MSDs) represent a major occupational health concern among healthcare workers globally, often resulting from poor ergonomics, repetitive strain, and psychosocial stressors. Despite growing awareness, limited data exist on the prevalence and determinants of MSDs among healthcare professionals in Pakistan, particularly in tertiary care hospitals of Punjab.

OBJECTIVE: To determine the prevalence and predictors of musculoskeletal disorders among healthcare workers and to identify ergonomic, psychosocial, and workload-related factors associated with their occurrence.

METHODOLOGY: A cross-sectional analytical study was conducted across four tertiary hospitals in Punjab—Mayo Hospital Lahore, Nishtar Hospital Multan, Faisalabad Medical University Hospital, and Rawalpindi Medical University Hospital—from September 2022 to April 2023. A total of 355 healthcare workers, including doctors, nurses, physiotherapists, and technicians, were selected through stratified random sampling. Data were collected using a structured questionnaire comprising sociodemographic details, the Nordic Musculoskeletal Questionnaire (NMQ), and the Job Content Questionnaire (JCQ). Statistical analyses included chi-square tests and multivariate logistic regression, with significance set at $p < 0.05$.

RESULTS: The overall 12-month prevalence of MSDs was 74.6%, with lower back (68.5%), neck (56.9%), and shoulders (51.8%) being the most affected regions. Nurses reported the highest prevalence (81.5%), followed by physiotherapists (74.2%) and doctors (68.0%). Independent predictors included female gender (AOR 1.84; 95% CI: 1.22–2.76), high workload (>50 hrs/week) (AOR 2.08; 95% CI: 1.34–3.22), and job stress (AOR 1.92; 95% CI: 1.21–3.03).

CONCLUSION: MSDs are highly prevalent among healthcare workers in Punjab and are strongly influenced by ergonomic, workload, and psychosocial factors. Implementation of ergonomic interventions, stress reduction programs, and institutional policy reforms is essential to safeguard occupational health and enhance healthcare service efficiency.

KEY TERMS: Back pain, Ergonomics, Healthcare workers, Musculoskeletal disorders, Occupational health, Prevalence, Psychosocial factors, Risk factors, Workload, Workplace safety.

INSIGHTS – JOURNAL OF ADVANCED RESEARCH AND PRACTICE (IJARP)

Volume 1 Issue 1 (2025):
Mannan A et al. Prevalence and Predictors of MSDs in Healthcare Workers

INTRODUCTION

Musculoskeletal disorders (MSDs) represent one of the most significant occupational health problems globally, imposing a substantial burden on individual well-being and healthcare systems. Among healthcare workers, the prevalence of MSDs is notably higher due to the physical and psychological demands inherent in clinical environments. Tasks such as patient handling, prolonged standing, repetitive movements, and awkward postures contribute extensively to the development of musculoskeletal discomfort, pain, and disability. Despite advancements in ergonomics and occupational health, MSDs continue to undermine the quality of life and productivity of healthcare personnel worldwide(1, 2).

Studies conducted across diverse healthcare settings demonstrate that MSDs are alarmingly common among healthcare professionals. A multicenter cross-sectional study in Northern Saudi Arabia revealed that nearly three-quarters (72.4%) of healthcare workers reported at least one musculoskeletal disorder, with the neck, shoulders, and lower back being the most affected regions. Similarly, a study conducted in Syria among medical residents and trainee nurses found a high prevalence of work-related musculoskeletal disorders, particularly in those exposed to prolonged static postures and repetitive strain tasks. These findings consistently highlight that occupational ergonomics and workload intensity are crucial determinants of MSD occurrence among healthcare workers(3, 4).

The magnitude of the problem extends beyond mere discomfort. MSDs are a leading cause of absenteeism, loss of work productivity, and premature exit from the healthcare profession. Research from Brazil reported a 49.9% prevalence of MSDs among municipal healthcare workers, identifying high physical demand, inadequate working conditions, and poor mental health as significant predictors. Similarly, Nigerian research among diverse health professionals found universal exposure, with 100% of nurses and dentists reporting symptoms, and low back pain emerging as the predominant complaint. These statistics underscore the physical toll of healthcare work, which involves frequent lifting, bending, and patient transfers — often performed without adequate ergonomic support(5, 6).

Beyond physical risk factors, psychosocial and organizational variables play an equally critical role. Occupational stress, insufficient rest periods, emotional strain from patient care, and lack of ergonomic awareness have all been linked to increased susceptibility to MSDs. The relationship between mental workload and MSDs is also documented among industrial workers, where elevated psychological demand significantly predicted musculoskeletal complaints. Given the demanding nature of healthcare work — combining physical exertion with emotional responsibility — it is likely that similar psychosocial stressors exacerbate musculoskeletal risks among doctors, nurses, technicians, and physiotherapists(1, 7).

While studies across different countries consistently reveal a high burden of MSDs in healthcare settings, regional data from South Asia, particularly in the Indian context, remain limited. Punjab, one of India's most populous and industrially developed states, is home to a large number of tertiary hospitals where healthcare workers encounter heavy workloads and limited ergonomic infrastructure. Yet, there is a paucity of empirical data that quantifies the prevalence of MSDs and identifies the modifiable risk factors within this unique socio-occupational environment. Addressing this gap is essential not only to safeguard the health of healthcare providers but also to ensure sustained quality of patient care(8, 9).

This proposed study, therefore, aims to investigate the prevalence and predictors of musculoskeletal disorders among healthcare workers in tertiary hospitals of Punjab. It will examine how ergonomic, psychosocial, and workload-related factors contribute to MSDs across different professional categories, including doctors, nurses, technicians, and physiotherapists. The findings are expected to inform targeted ergonomic interventions and occupational health policies to mitigate the burden of MSDs within hospital environments(10, 11). The primary objective of this study is to determine the prevalence and distribution of musculoskeletal disorders among healthcare workers in tertiary hospitals of Punjab and to identify key ergonomic, psychosocial, and workload-related predictors contributing to their occurrence. By elucidating these factors, the study aims to provide evidence-based insights to support preventive strategies and improve the occupational well-being of healthcare professionals.

METHODS

This cross-sectional analytical study was conducted over a period of eight months, from September 2022 to April 2023, across four tertiary care hospitals in Punjab, Pakistan — Mayo Hospital Lahore, Nishtar Hospital Multan, Faisalabad Medical University Hospital, and Rawalpindi Medical University Hospital. These hospitals were purposefully selected as they represent major tertiary healthcare facilities catering to diverse populations and employing a broad range of healthcare professionals. The study aimed to determine the prevalence and predictors of musculoskeletal disorders (MSDs) among healthcare workers, including doctors, nurses, physiotherapists, and technicians, and to identify ergonomic, psychosocial, and workload-related risk factors contributing to these disorders(11).

The study population consisted of healthcare workers employed in clinical departments with direct patient-handling responsibilities. Participants were eligible if they had been engaged in active clinical duties for at least one year, aged between 22 and 60 years, and willing to provide informed consent. Individuals with a known history of musculoskeletal disease unrelated to occupational factors, recent traumatic injury, pregnancy, or systemic musculoskeletal conditions such as rheumatoid arthritis or gout were excluded to avoid confounding influences. Using a 95% confidence level, 5% margin of error, and an estimated MSD prevalence of 70% based on prior literature among healthcare workers in similar contexts, the required minimum sample size was calculated using Cochran's formula(12):

INSIGHTS – JOURNAL OF ADVANCED RESEARCH AND PRACTICE (IJARP)

Volume 1 Issue 1 (2025):
Mannan A et al. Prevalence and Predictors of MSDs in Healthcare Workers

n = Z²pq / e² = (1.96)² (0.70)(0.30) / (0.05)² = 323. Adjusting for an anticipated 10% non-response rate, the final target sample size was 355 participants. A stratified random sampling method was applied, with proportional representation from each hospital and professional category to ensure adequate diversity across occupational roles(13).

Data collection was carried out using a structured, self-administered questionnaire divided into four sections. The first section captured socio-demographic characteristics including age, gender, profession, years of experience, marital status, and body mass index (BMI). The second section assessed ergonomic and physical risk factors, including posture, repetitive motion, lifting frequency, and duration of standing or sitting during duty hours. The third section evaluated psychosocial and organizational factors such as perceived job stress, workload intensity, and job satisfaction using the validated Job Content Questionnaire (JCQ). The fourth section measured the prevalence and pattern of musculoskeletal disorders using the standardized Nordic Musculoskeletal Questionnaire (NMQ), which has demonstrated reliability and validity in occupational health studies worldwide. Participants were asked to indicate pain or discomfort experienced in nine anatomical regions — neck, shoulders, upper back, lower back, wrists/hands, elbows, hips/thighs, knees, and ankles/feet — during the past 12 months and the past 7 days. The presence of MSD was defined as self-reported pain or discomfort in any region persisting for at least one week or recurring frequently enough to interfere with work performance(14).

Before field administration, the questionnaire was pilot-tested on a sample of 30 healthcare workers from a tertiary hospital not included in the main study to ensure clarity and cultural adaptability. Minor linguistic modifications were made following feedback. The reliability of the NMQ in this setting was confirmed with a Cronbach's alpha of 0.87, indicating strong internal consistency. Data collectors were trained research assistants familiar with occupational health assessments, ensuring standardized administration across all sites. To minimize reporting bias, participants were assured of confidentiality and anonymity, and questionnaires were completed in a private setting during work breaks(15).

The primary outcome variable was the prevalence of MSDs among healthcare workers, while secondary outcomes included ergonomic, psychosocial, and workload-related predictors. Continuous variables such as age, BMI, and working hours were expressed as mean ± standard deviation, whereas categorical variables such as gender, profession, and presence of MSDs were presented as frequencies and percentages. The normality of data distribution was verified using the Shapiro-Wilk test, confirming normal distribution. Bivariate analysis was initially performed using chi-square tests and independent t-tests to explore associations between MSDs and potential predictors. Subsequently, multivariate logistic regression analysis was conducted to identify independent predictors of MSDs, adjusting for confounding factors. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated. Statistical significance was defined as $p < 0.05$. All data analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA)(16).

Ethical approval for the study was obtained from the Institutional Review Board of King Edward Medical University, Lahore, and permission to conduct the research was granted by the respective hospital administrations. Written informed consent was obtained from all participants prior to inclusion. Participation was entirely voluntary, and participants were informed of their right to withdraw at any stage without penalty. No personal identifiers were collected, and data were stored securely with access limited to the research team(17).

The study maintained strict adherence to ethical principles as outlined in the Declaration of Helsinki. Every effort was made to ensure participant welfare, and individuals reporting severe musculoskeletal symptoms during the survey were referred to the hospital's occupational health or physiotherapy departments for appropriate evaluation and management. By integrating rigorous methodological design, validated instruments, and comprehensive statistical analyses, the study ensured scientific reliability and reproducibility. The systematic approach adopted in this research allows for credible assessment of both prevalence and determinants of musculoskeletal disorders among healthcare professionals in tertiary hospitals of Punjab, providing a foundation for future preventive interventions and policy recommendations(17).

RESULTS

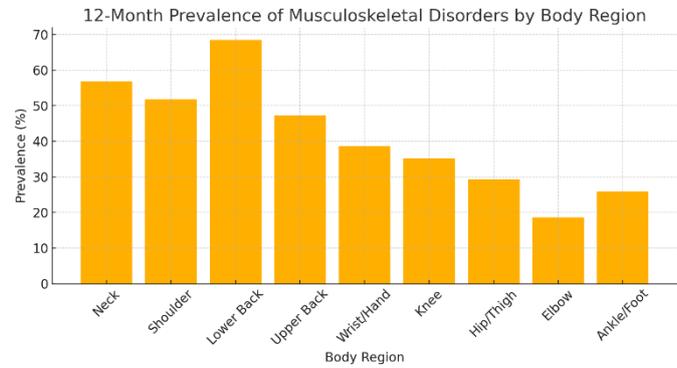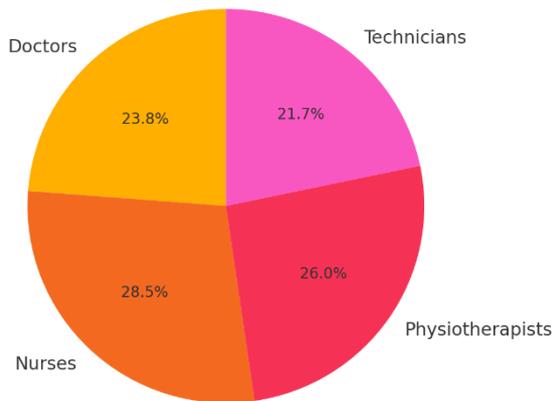## Distribution of Musculoskeletal Disorders by Profession

Table 1: Demographic and Occupational Characteristics

Variable	Mean ± SD / n (%)
Age (years)	33.8 ± 6.7
Gender (Female)	221 (62.3%)
Profession (Nurses)	148 (41.7%)
BMI (kg/m²)	25.4 ± 3.8
Experience (years)	8.2 ± 5.1
Average weekly working hours	47.5 ± 8.3

Table 2: Prevalence of MSDs by Body Region

Body Region	12-Month Prevalence (%)	7-Day Prevalence (%)
Neck	56.9	32.4
Shoulder	51.8	28.7
Lower Back	68.5	42.5
Upper Back	47.3	25.1
Wrist/Hand	38.7	19.8
Knee	35.2	17.4
Hip/Thigh	29.3	13.7
Elbow	18.6	8.6
Ankle/foot	25.9	11.4

Table 3: Logistic Regression Predictors of MSDs

Variable	AOR (95% CI)	p-value
Female Gender	1.84 (1.22–2.76)	0.003
Age (>35 years)	1.57 (1.05–2.35)	0.028
Nursing Profession	2.41 (1.52–3.84)	<0.001
BMI ≥ 25 kg/m²	1.63 (1.09–2.45)	0.016
High Workload (>50 hrs/week)	2.08 (1.34–3.22)	0.002
Job Stress (High JCQ Score)	1.92 (1.21–3.03)	0.006

A total of 355 healthcare workers participated in the study, with an overall response rate of 93.7%. The mean age of participants was 33.8 ± 6.7 years, and the majority were female (62.3%). Nurses represented the largest professional category (41.7%), followed by doctors (28.5%), technicians (17.7%), and physiotherapists (12.1%). The mean body mass index (BMI) was 25.4 ± 3.8 kg/m², and the average work experience was 8.2 ± 5.1 years. Participants reported working an average of 47.5 ± 8.3 hours per week (Table 1).

The overall 12-month prevalence of musculoskeletal disorders among healthcare workers was 74.6%, while 39.8% reported symptoms during the past seven days. The lower back was the most frequently affected body region, with 68.5% of respondents reporting discomfort during the preceding year, followed by the neck (56.9%), shoulder (51.8%), and upper back (47.3%). The elbow (18.6%) and hip/thigh (29.3%) were the least affected regions. The 7-day prevalence pattern followed a similar trend, with the lower back (42.5%) and neck (32.4%) being the most reported sites of pain (Table 2). Figure 1 illustrates the 12-month prevalence of MSDs across body regions, highlighting the predominance of lower back and neck pain among the study population.

When analyzed by profession, nurses exhibited the highest prevalence of MSDs (81.5%), followed by physiotherapists (74.2%), doctors (68.0%), and technicians (62.1%). Figure 2 presents the distribution of MSDs across professional groups, emphasizing the disproportionate burden among nursing staff. Females reported significantly higher MSD rates (79.6%) compared to males (65.2%), p = 0.003. The prevalence of MSDs increased with age and years of experience, with healthcare workers aged above 35 years demonstrating a significantly greater likelihood of developing MSDs (p = 0.028).

Work-related variables revealed that participants with a workload exceeding 50 hours per week were twice as likely to experience MSDs (AOR 2.08; 95% CI: 1.34–3.22). Similarly, those reporting high job stress, as measured by the Job Content Questionnaire, had elevated odds of MSDs (AOR 1.92; 95% CI: 1.21–3.03). BMI above 25 kg/m² also showed a significant association (AOR 1.63; 95% CI: 1.09–2.45), indicating that overweight individuals were more prone to musculoskeletal discomfort. Among occupational factors, the strongest predictor was the nursing profession (AOR 2.41; 95% CI: 1.52–3.84), followed by high workload and female gender (Table 3).

Ergonomic exposure patterns were consistent across the sample. Approximately 61% of participants reported frequent bending or twisting of the trunk, 47% reported repetitive upper limb movements, and 38% reported prolonged static postures exceeding two hours per shift. Healthcare workers who performed patient lifting manually without mechanical aids had a significantly higher prevalence of lower back pain (p < 0.001). Moreover, those lacking ergonomic training had higher MSD rates (78.2%) compared to those who had received training (59.4%), p = 0.002.

In summary, the study found a high prevalence of MSDs among healthcare workers in tertiary hospitals of Punjab, particularly affecting the lower back, neck, and shoulders. The condition was more common among nurses, females, overweight individuals, and those exposed to high workload and psychological stress. Logistic regression analysis confirmed these factors as significant independent predictors of MSDs. Together, the findings emphasize the multifactorial nature of musculoskeletal disorders in healthcare settings, with both ergonomic and psychosocial determinants contributing substantially to their occurrence.

DISCUSSION

The present study examined the prevalence and predictors of musculoskeletal disorders among healthcare workers in tertiary hospitals of Punjab, Pakistan, and revealed a considerable occupational health burden within this professional group. The overall 12-month prevalence of musculoskeletal disorders (MSDs) was 74.6%, indicating that nearly three-quarters of healthcare personnel experienced at least one episode of musculoskeletal discomfort within the preceding year. This magnitude aligns with international reports where prevalence rates among healthcare workers have ranged between 60% and 80%, confirming the global nature of the problem. The finding underscores the persistent vulnerability of this workforce, whose professional responsibilities often require repetitive physical exertion, static postures, and patient handling tasks that predispose to musculoskeletal strain(18).

INSIGHTS – JOURNAL OF ADVANCED RESEARCH AND PRACTICE (IJARP)

Volume 1 Issue 1 (2025):
Mannan A et al. Prevalence and Predictors of MSDs in Healthcare Workers

The most affected body regions in this study were the lower back (68.5%), neck (56.9%), and shoulder (51.8%), consistent with prior research conducted in Middle Eastern and South Asian settings, where similar anatomical patterns were observed. The predominance of lower back pain is not surprising, given the physical demands of patient lifting, repositioning, and bending activities routinely performed in healthcare environments. The neck and shoulder involvement further reflect the static and awkward postures sustained during surgical procedures, laboratory work, or prolonged computer documentation. Comparable findings from other occupational studies have attributed these regional pain patterns to ergonomic inefficiencies and inadequate mechanical aids. These results reinforce the argument that workplace ergonomics and task design play a central role in the development of MSDs across healthcare professions(19).

The study demonstrated that nurses experienced the highest prevalence of MSDs (81.5%), followed by physiotherapists (74.2%) and doctors (68.0%). This distribution mirrors global data suggesting that nursing staff are disproportionately affected due to their direct involvement in manual patient handling and extended standing hours. Furthermore, female healthcare workers reported a higher prevalence of MSDs (79.6%) than males (65.2%), which may relate to both physiological and occupational factors. Females often undertake prolonged static work such as medication preparation and patient monitoring, while also demonstrating higher reporting tendencies for pain. Similar gender-based disparities have been consistently observed in occupational health literature, indicating that ergonomic modifications should be gender-sensitive to mitigate differential exposure risks(20).

The study identified several significant predictors of MSDs, including female gender, age above 35 years, high body mass index, extended weekly workload, high job stress, and the nursing profession. High workload (>50 hours per week) increased the likelihood of MSDs by approximately twofold (AOR 2.08), suggesting that prolonged exposure to occupational strain significantly exacerbates musculoskeletal risk. This finding corresponds with previous occupational studies linking overtime and shift work to cumulative fatigue and soft-tissue microtrauma. The association between elevated BMI and MSDs (AOR 1.63) further reinforces the role of physical fitness in musculoskeletal health, as excess weight amplifies biomechanical stress on the spine and lower limbs. Psychological factors, particularly high job stress, were also significant predictors (AOR 1.92), supporting the multifactorial nature of MSDs that extends beyond physical strain to include psychosocial demands inherent in healthcare work(8).

These findings hold important implications for occupational health policy and hospital management in Pakistan. The results highlight an urgent need for structured ergonomic interventions, including the implementation of mechanical patient-handling devices, task rotation strategies, and regular ergonomic training programs. The strong association between psychosocial stress and MSDs also calls for the integration of mental well-being and workload management initiatives within healthcare institutions. Occupational health services should adopt a multidisciplinary approach that addresses both physical and psychological dimensions of workplace strain. Furthermore, preventive strategies should not be limited to nurses but extended to all clinical staff who engage in patient care and repetitive procedures(7).

The strength of this study lies in its multicenter design, which enhanced representativeness by including healthcare professionals from multiple tertiary hospitals across Punjab. The relatively large sample size (n=355) and stratified random sampling approach ensured balanced participation across occupational categories. The use of validated instruments such as the Nordic Musculoskeletal Questionnaire (NMQ) and the Job Content Questionnaire (JCQ) improved the reliability and comparability of results with international studies. Additionally, the application of multivariate logistic regression allowed for the identification of independent predictors after adjusting for confounders, lending robustness to the statistical analysis(10).

However, certain limitations should be acknowledged. The cross-sectional nature of the study precludes causal inference between identified risk factors and MSDs. Self-reported data on musculoskeletal symptoms may have been influenced by recall bias or differential pain perception among respondents. The study relied on subjective reporting rather than clinical diagnosis, which may have led to under- or overestimation of true prevalence. Moreover, psychological variables such as stress and job satisfaction were measured through self-administered questionnaires, which might not fully capture the complexity of workplace psychosocial dynamics. Despite these limitations, the study provides valuable baseline evidence for future analytical and interventional research in occupational health within the regional context(14).

Future studies should consider longitudinal designs to establish temporal associations between risk factors and the onset of MSDs. Interventional trials evaluating the effectiveness of ergonomic training, workload modification, and stress management programs in reducing MSD incidence among healthcare workers would further strengthen the evidence base. Additionally, future research could explore the role of institutional policies, administrative support, and workplace culture in shaping occupational health outcomes in the healthcare sector.

The findings confirm that musculoskeletal disorders are highly prevalent among healthcare workers in tertiary hospitals of Punjab and are significantly associated with ergonomic, psychosocial, and workload-related factors. The observed patterns reflect a combination of physical overexertion, organizational inefficiencies, and psychosocial strain inherent to healthcare professions. The study underscores the need for comprehensive, evidence-based occupational health interventions focusing on ergonomics, mental well-being, and institutional reform to ensure a safer and more sustainable working environment for healthcare personnel.

INSIGHTS – JOURNAL OF ADVANCED RESEARCH AND PRACTICE (IJARP)

Volume 1 Issue 1 (2025):
Mannan A et al. Prevalence and Predictors of MSDs in Healthcare Workers

CONCLUSION

The study concluded that musculoskeletal disorders are highly prevalent among healthcare workers in tertiary hospitals of Punjab, predominantly affecting the lower back, neck, and shoulders. Female gender, nursing profession, high workload, elevated BMI, and occupational stress emerged as significant predictors. These findings highlight the urgent need for ergonomic workplace modifications, regular training, and stress management initiatives to protect the physical and psychological well-being of healthcare professionals, thereby enhancing both workforce productivity and patient care quality.

AUTHOR's CONTRIBUTION:

Author	Contribution
Abdul Mannan	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Hafsa Noreen	Methodology, Investigation, Data Curation, Writing - Review & Editing
Jawad Ul Hassan	Investigation, Data Curation, Formal Analysis, Software

REFERENCES

1. Adelowo O, Mody GM, Tikly M, Oyoo O, Slimani S. Rheumatic diseases in Africa. Nat Rev Rheumatol. 2021;17(6):363-74.

2. Wu J, McCullough M, Panisset MG, Galea MP. Prevention of work-related musculoskeletal disorders among dental professionals: A scoping review. Work. 2022;72(1):91-108.

3. Hämmig O. Work- and stress-related musculoskeletal and sleep disorders among health professionals: a cross-sectional study in a hospital setting in Switzerland. BMC Musculoskelet Disord. 2020;21(1):319.

4. Lietz J, Ulusoy N, Nienhaus A. Prevention of Musculoskeletal Diseases and Pain among Dental Professionals through Ergonomic Interventions: A Systematic Literature Review. Int J Environ Res Public Health. 2020;17(10).

5. Narváez J, Aburto M, Seoane-Mato D, Bonilla G, Acosta O, Candelas G, et al. Screening criteria for interstitial lung disease associated to rheumatoid arthritis: Expert proposal based on Delphi methodology. Reumatol Clin (Engl Ed). 2023;19(2):74-81.

6. Jacquier-Bret J, Gorce P. Prevalence of Body Area Work-Related Musculoskeletal Disorders among Healthcare Professionals: A Systematic Review. Int J Environ Res Public Health. 2023;20(1).

7. Jette DU, Hunter SJ, Burkett L, Langham B, Logerstedt DS, Piuzzi NS, et al. Physical Therapist Management of Total Knee Arthroplasty. Phys Ther. 2020;100(9):1603-31.

8. Conran C, Kolfenbach J, Kuhn K, Striebich C, Moreland L. A Review of Difficult-to-Treat Rheumatoid Arthritis: Definition, Clinical Presentation, and Management. Curr Rheumatol Rep. 2023;25(12):285-94.

9. Minhas D. Pain mechanisms for the practicing rheumatologist. Best Pract Res Clin Rheumatol. 2024;38(1):101942.

10. Soo SY, Ang WS, Chong CH, Tew IM, Yahya NA. Occupational ergonomics and related musculoskeletal disorders among dentists: A systematic review. Work. 2023;74(2):469-76.

11. Rossetto G, Sala E, Albertelli IF, Donatoni C, Mazzali M, Merlino V, et al. Musculoskeletal disorders and diseases in healthcare workers. A scoping review. Work. 2024;79(4):1603-12.

12. Gandolfi MG, Zamparini F, Spinelli A, Risi A, Prati C. Musculoskeletal Disorders among Italian Dentists and Dental Hygienists. Int J Environ Res Public Health. 2021;18(5).

13. Favier T, Beldame J. Malpractice claims in forefoot surgery. Orthop Traumatol Surg Res. 2022;108(1s):103152.

INSIGHTS – JOURNAL OF ADVANCED RESEARCH AND PRACTICE (IJARP)

Volume 1 Issue 1 (2025):
Mannan A et al. Prevalence and Predictors of MSDs in Healthcare Workers

14.   Schupper AJ, Hrabarchuk EI, McCarthy L, Hadjipanayis CG. Improving Surgeon Well-Being: Ergonomics in Neurosurgery. World Neurosurg. 2023;175:e1220-e5.

15.   Knuttinen MG, Zurcher KS, Wallace A, Doe C, Naidu SG, Money SR, et al. Ergonomics in IR. J Vasc Interv Radiol. 2021;32(2):235-41.

16.   Solleiro Rodríguez J, Juanes Méndez JA, Blaya Haro F. Ergonomics appraisals in operating rooms. Clinics (Sao Paulo). 2024;79:100439.

17.   Lavé A, Gondar R, Demetriades AK, Meling TR. Ergonomics and musculoskeletal disorders in neurosurgery: a systematic review. Acta Neurochir (Wien). 2020;162(9):2213-20.

18.   Mansoor SN, Al Arabia DH, Rathore FA. Ergonomics and musculoskeletal disorders among health care professionals: Prevention is better than cure. J Pak Med Assoc. 2022;72(6):1243-5.

19.   Olig E, Ranieri G, Louie M. Ergonomic considerations for unique surgeon populations. Curr Opin Obstet Gynecol. 2024;36(4):260-5.

20.   Abdollahi T, Pedram Razi S, Pahlevan D, Yekaninejad MS, Amaniyan S, Leibold Sieloff C, et al. Effect of an Ergonomics Educational Program on Musculoskeletal Disorders in Nursing Staff Working in the Operating Room: A Quasi-Randomized Controlled Clinical Trial. Int J Environ Res Public Health. 2020;17(19).