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Original Article

Prevalence of work-related musculoskeletal disorders and vision problems among electronics industry employees in Chennai, India

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ABSTRACT

Introduction: Employees of the electronics industry are exposed to ergonomic hazards due to repetitive tasks, prolonged standing, awkward posture, and sustained near work activities resulting in work-related musculoskeletal disorders (WMSD) and vision problems. The presence of these hazards could affect the productivity and well-being of the individual. The study was conducted to estimate the prevalence of WMSDs and vision problems among the employees and to assess factors associated with these occupational health outcomes.

Methods: A cross-sectional study was done during December 2024 – January 2025 among 259 employees of an electronics company in Chennai using simple random sampling. A semi-structured questionnaire containing demographic details and work profile, Nordic musculoskeletal questionnaire to assess the prevalence of work-related musculoskeletal disorders and a questionnaire to assess the prevalence of vision problems were used for collecting data. Data was entered in MS excel and analyzed using SPSS version 16. Descriptive statistics were used, and associations were tested using the Chi-square test with odds ratios and 95% confidence intervals.

Results: The mean age of the participants was 24.16 ± 4.03 years and 76.1% were women. The prevalence of WMSDs was 61.4% and vision problems were reported by 40.2%. The shoulder (52.1%) and neck (49%) were the most commonly affected body regions. Eye strain (49%) was the most frequent visual complaint. WMSDs and vision problems showed significant associations with gender, job process, work shift, work experience, and health-related leave taken ($p < 0.05$).

Conclusion: The study showed a high prevalence of WMSD and vision problems in the electronics workforce. These findings highlight the need for ergonomics risk assessment and routine health screening to enable early identification and prevention of these occupational health problems.

Keywords: Electronics Industry, Ergonomics, Occupational Health, Vision Problems, Work-related Musculoskeletal Disorders.

Introduction

Occupational hazards have a wide range of physical, ergonomic, and environmental risks encountered in the workplace. The electronics component manufacturing industry requires its employees to stand for long hours on the assembly line while making the product, as well as to use microscopes for quality checks of the final product. This exposes them to multiple ergonomic and visual stressors. These occupational exposures increase the risk of developing work-related

musculoskeletal disorders (WMSDs) and vision-related symptoms, both of which can adversely affect workers' functional capacity, work performance, and overall well-being.[1] Work-related Musculoskeletal Disorders are diseases and disorders of the musculoskeletal system and connective tissue due to overexertion or repetitive motion induced by the work environment, leading to pain and discomfort in the body.[2] According to the World Health Organization (WHO), musculoskeletal disorders are the most frequent reasons for disability and restrictions on daily functioning and finding meaningful employment.[3]

With over 149 million years lived with disability (YLDs) or 17% of all YLDs worldwide, musculoskeletal diseases are the main cause of YLDs worldwide. According to the 2019 Global Burden of Disease report, low back pain accounts for the majority of musculoskeletal diseases, which together account for 7.4% of YLDs worldwide.[4] Workers in assembly-line manufacturing, particularly in electronics industries, are especially vulnerable due to repetitive hand movements, static postures, and inadequate ergonomic design of workstations. A study done among technical workers also demonstrated a high prevalence of musculoskeletal disorders, particularly affecting the neck, shoulder and upper back regions due to similar occupational exposures.[5] Long-term microscope usage and continuous near work may also precipitate visual fatigue, eye strain and symptoms of asthenopia among electronics workers.[6] Occupational exposure to microscope-related lighting and visual demands has been identified as a potential risk factor among laboratory workers.[7] Vision-related problems not only reduce work efficiency but may also contribute to errors, reduced concentration, and increased occupational stress.

Understanding the prevalence and determinants of these occupational health problems is essential for planning effective preventive strategies, improving workplace ergonomics, and strengthening occupational health services. Thus, the present study was conducted to estimate the prevalence of work-related musculoskeletal disorders and vision problems among employees of an electronics company in Chennai and to assess factors associated with these occupational health outcomes.

Methods

A cross-sectional study was conducted to assess the work-related musculoskeletal disorders and vision problems among employees of an electronics company in Chennai from December 2024 to January 2025. The sample size was calculated using the formula: $n = z^2pq / d^2$, assuming a prevalence (p) of WMSD as 62% according to Jain and Shetty study in Mangalore,[8] with a 95% confidence level and relative precision of 6.2% with 10% additional allowance for non-response rate, the final sample size of 259 was derived. A list of electronics manufacturing companies registered in Tamil Nadu was obtained from the Ministry of Corporate Affairs. Companies employing skilled and semi-skilled workers were identified, and one company was selected using simple random sampling. Employees who were involved in production-related activities and had been in the current job position for a minimum of one year were included. Only those who provided written informed consent and were present during the period of data collection were enrolled in the study.

Employees with a documented history of WMSD or vision problems diagnosed prior to joining the industry were excluded. Workers with a history of recent trauma, surgery, or acute illness affecting the musculoskeletal or visual system at the time of data collection were also excluded. From the sampling frame, study participants were chosen using simple random sampling.

Data were collected using a semi-structured questionnaire consisting of socio-demographic and work-related variables, the Standard Nordic Musculoskeletal Questionnaire (to determine site-specific musculoskeletal symptoms in the past 12 months), and the Asthenopia questionnaire (to

assess prevalence of vision problems) which was administered through face-to-face interviews.

The Nordic musculoskeletal questionnaire, developed by Kuorinka et al,[9] in 1987, is a general questionnaire of 40 forced-choice items identifying areas of the body causing musculoskeletal problems. Completion is aided by a body map that indicates nine symptom sites: neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knees, and ankles/feet. Respondents were asked if they had any musculoskeletal trouble in the last 12 months which has prevented normal activity and whether they had seen a doctor regarding the site-specific pain.[10] Vision-related problems were evaluated using a modified questionnaire proposed by Ames et al.[11] The questionnaire included items assessing common visual symptoms, such as eye strain, eye fatigue, blurred vision, headache, dryness, and eye discomfort experienced during or after work. Participants were asked to report whether they experienced each symptom during the past one year.

The study was conducted after obtaining ethical clearance from the Institutional Ethics Committee of Madras Medical College, Chennai (ECR/270/Inst./TN/2013/RR-16) and permission from the General Manager of the Electronics Company where the study was carried out. Confidentiality of the information was maintained throughout the study. Microsoft Excel was used to enter the data, and a master chart was created. The master chart's data was also double-checked for any mistakes. The Statistical Package for the Social Sciences (SPSS) version 16 was used to export the master chart for analysis. Descriptive data were analyzed using frequency, percentage, mean, and standard deviation. Chi-square test was used to examine the association between categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

The study was conducted among employees of an electronics company to assess the prevalence of work-related musculoskeletal disorders and vision problems among 259 participants.

The mean age of the study participants was 24.16 ± 4.03 years, with the majority (74.9%) aged 21 to 30 years. The employees were predominantly women, contributing to 76.1%. About 38.6% did their graduation. Nearly 30.1% are married. Only 3.1% had morbidities like hypertension and asthma. (Table 1)

According to the job process, 58.3% of the employees were in the winding and soldering part, whereas only 18.9% were in quality control. The mean years of working in the current position is 1.93± 1.49 years, with 55.2% having more than 2 years of work experience. Only 32.1% had taken leave in the past year for health reasons, of which about 29% had taken leave from work for more than 3 days. The maximum number of days taken leave for health reasons was 10 days (Table1). The mean number of days taken as leave was 3.13 ± 2.18 days.

The prevalence of work-related musculoskeletal disorders was about 61.4%, and vision problems were about 40.2%. (Table 2) Only 42.7% of the study participants visited the doctor for their work-related musculoskeletal disorder and about 29.8% visited related to their vision. More than half of the employees (59.1%) had never undergone an eye check-up. The most affected body part was the shoulder (52.1%), followed by the neck (49%), for the past one year. Lower prevalence was observed for the elbow (3.5%) and ankle/foot regions (9.3%). (Figure 1)

There was a significant association seen between gender, job process, work shift, work experience, leave taken, and the number of days leave was taken and work-related musculoskeletal disorders. Males had 3.36 times increased odds of having work-related musculoskeletal disorders (WMSD) compared to females.

Table 1: Socio-demographic characteristics of the employees (n=259)

Variables		**Frequency (Percentage)**
Age (In years)	≤ 20	44 (17%)
	21 to 30	194 (74.9%)
	> 30	21 (8.1%)
Gender	Male	62 (23.9%)
	Female	197 (76.1%)
Education	Secondary school	65 (25.1%)
	Higher secondary	57 (22%)
	Diploma	37 (14.3%)
	Professional degree	100 (38.6%)
Marital status	Unmarried/Divorced	181 (69.9%)
	Married	78 (30.1%)
Morbidity	Hypertension	3 (1.2%)
	Asthma	5 (1.9%)
	None	251 (96.9%)

Table 2: Prevalence of occupational health problems and health seeking behavior in the employees for the past one year

Variables		**Frequency & Percentage**
Work related Musculoskeletal disorder	Yes	159 (61.4%)
	No	100 (38.6%)
Seen a doctor for musculoskeletal disorder	Yes	68 (42.7%)
	No	91 (57.3%)
Vision problem	Yes	104 (40.2%)
	No	155 (59.8%)
Seen a doctor for vision problem	Yes	31 (29.8%)
	No	73 (70.2%)
Visits for eye check-up	Zero	153 (59.1%)
	1 visit	57 (22%)
	≥ 2 visits	49 (18.9%)

Employees on the evening shift had 4.54 times the odds of having WMSD compared to those on the morning shift. Those who had taken leave for more than 3 days had 4.82 times increased odds of having WMSD compared to those who had taken less than 3 days leave. (Table 3) The most common problem affecting the vision was eye strain (49%) followed by eye fatigue in 35.1% of the employees. (Figure 2) The least troublesome problem was dry eye, affecting 3.5% of the study participants. There was a significant association between gender, overall job process, work shift, work experience, leave taken, and Vision problems. (Table 4) Males had 5.58 times increased odds of having vision problems compared to females. Workers in the soldering section had 4.71 times higher odds of vision problems compared to workers in the winding section. Employees of the evening shift had 10.22 times increased odds of having vision problems compared to the morning shift. Employees of more than 2 years of work experience had 2.48 times increased odds of having vision problems.

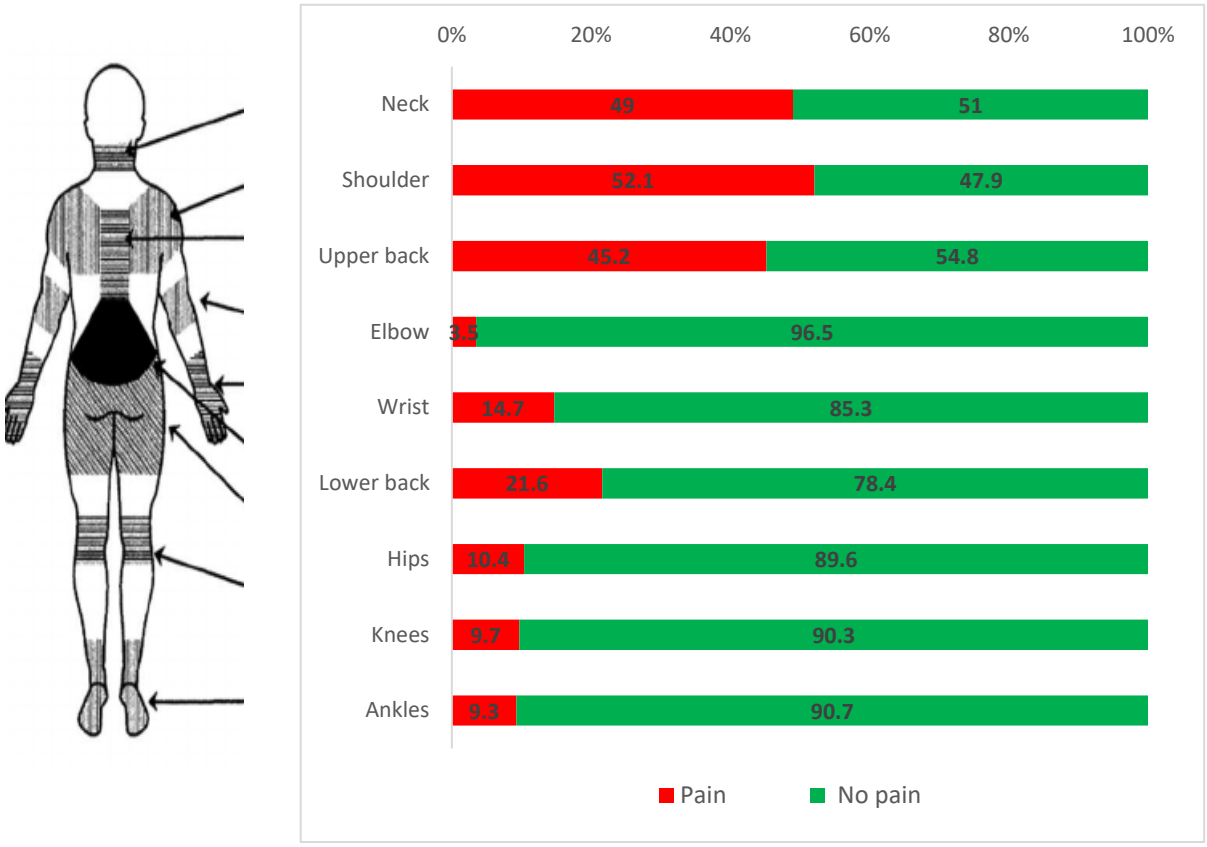

Figure 1: Prevalence of musculoskeletal disorder by body part over the past 1 year

Table 3: Association between work profile and Work-related Musculoskeletal disorders (WMSD)

Factors		WMSD		OR	CI	P value
		Present	Absent			
Gender	Male	50	12	3.36	1.68-6.70	**<0.0001**
	Female	109	88			
Job Process	Winding (Ref)	34	40	1	-	**-**
	Soldering	56	21	3.14	1.59-6.18	**0.0009**
	Epoxy Potting	36	23	1.84	0.92-3.69	0.085
	Quality Check	33	16	2.43	1.15-5.16	**0.021**
Shift	Evening	45	8	4.54	2.03-10.11	**0.0002**
	Morning	114	92			
Work experience	≥ 2 years	99	44	2.1	1.26-3.49	**0.004**
	1- 2 years	60	56			
Taken leave	Yes	64	20	2.69	1.50-4.83	**0.001**
	No	95	80			
No of days taken leave	> 3 days	22	2	4.82	1.02-22.75	**0.0465**
	≤ 3 days	41	18			

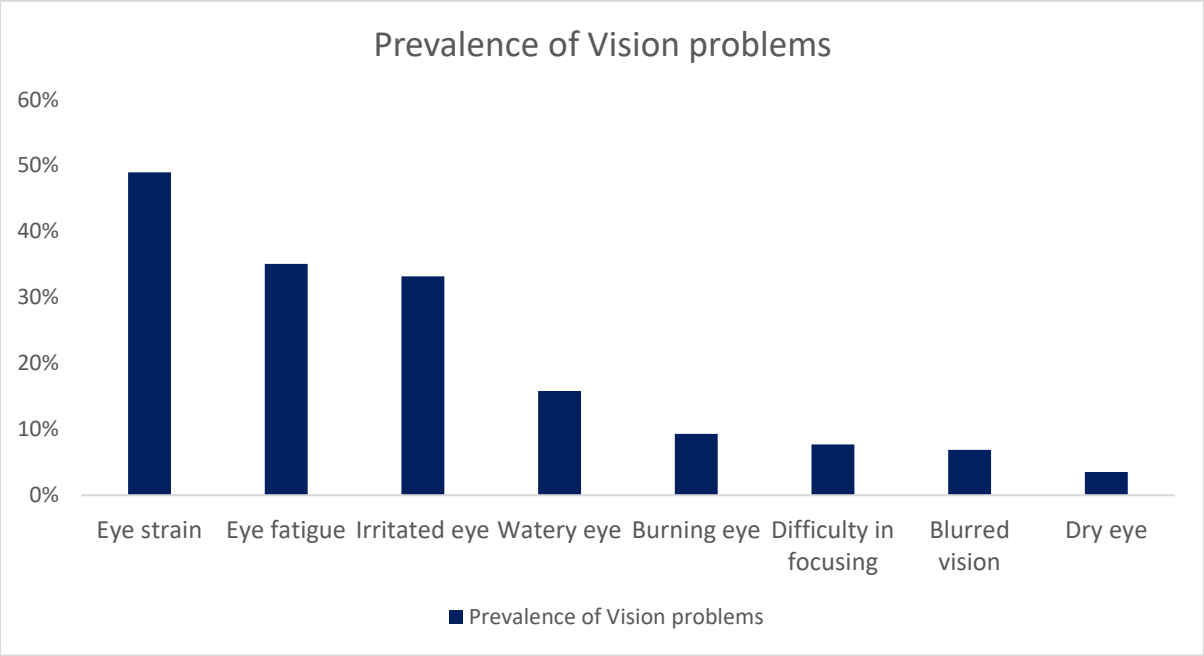

Figure 2: Prevalence of Vision problems in the employees

Table 4: Association between work profile and Vision problems

Factors		Vision problem		OR	CI	P value
		Present	Absent			
Gender	Male	44	18	5.58	2.98-10.44	**<0.0001**
	Female	60	137			
Job Process	Winding (Ref)	17	57	1	-	**-**
	Soldering	45	32	4.71	2.30-9.64	**<0.0001**
	Epoxy Potting	15	44	1.14	0.52-2.52	0.73
	Quality Check	27	22	4.11	1.88-8.98	**0.0004**
Shift	Evening	43	10	10.22	4.82-21.64	**<0.0001**
	Morning	61	145			
Work experience	≥ 2 years	71	72	2.48	1.47-4.17	**0.001**
	1- 2 years	33	83			
Taken leave	Yes	48	36	2.83	1.65-4.84	**0.001**
	No	56	119			
No of days taken leave	> 3 days	17	6	2.74	0.95-7.89	0.06
	≤ 3 days	31	30			

Discussion

The present study assessed the prevalence of WMSD and vision-related problems among employees of an electronics manufacturing company in Chennai. A high prevalence of both conditions was observed, with nearly two-thirds of the employees reporting musculoskeletal symptoms and over two-fifths experiencing one or more vision-related symptoms during the past year. These findings underscore the occupational health burden faced by workers in electronics manufacturing settings.

The prevalence of WMSD in the present study was 61.4%, higher than that reported by Yin et al. in China (40.6%).[12] The most affected sites in our study were the shoulder (52.1%) and the neck (49%), which is consistent with the study done by

Daneshmandi et al. among assembly line workers in an electronics company in Iran, where the prevalence was 63.8% for the neck and 60.9% for the shoulders.[13] Similar findings were also seen in employees of the manufacturing sector, the petrochemical industry, the hand weaving industry, and the healthcare industry, where the prevalence ranged from 25% to 56% . This may be attributed to the same kind of repetitive movements and forward head posture.[14] Upper body musculoskeletal strain is an ergonomic risk in occupations requiring precision work and prolonged static posture.

In our study, about 42.7% sought medical consultation for work-related musculoskeletal disorders, in contrast to the study by Akinpelu et al. in Nigeria among sewing machine operators, where only 4% sought medical consultation. This could be due to the operators' socioeconomic status or to the pain not being severe enough to warrant a visit to the doctor.[15] The male employees had a higher risk of developing work-related musculoskeletal disorders compared to females [OR = 3.36, 95% CI (1.68, 6.70)], which is in line with the study done by Kee in Korea [OR = 1.59, 95% CI (1.51, 1.68)].[16] The employees who had been on the job for more than two years [OR = 2.1, 95% CI (1.26, 3.49)] had a higher risk of developing WMSD, which is in line with the study done by Yang in China and by Roli et. al. in India probably due to the fact that they are more exposed to the same kind of movements than new employees.[1,5]

The prevalence of vision problems among employees was 40.2%, similar to the finding of Untimanon et al. in Thai workers, where the prevalence was 56.4%.[17] The most common symptom was eye strain (49%), followed by eye fatigue (35.1%), which is similar to the study done by Jain and Shetty in Mangalore, where the prevalence for eye fatigue was 59.6% and eye discomfort was 38.3%.[8] Those who had more years of work experience had a higher prevalence of developing visual problems [OR=2.48, 95% CI (1.47, 4.17)], which is similar to the study done by Lin in Taiwan [OR= 1.03, 95% CI (1.01, 1.06)].[18]

Similarly, recent literature has documented significant occupational health challenges, including musculoskeletal strain and visual fatigue, among workers engaged in precision-based and repetitive tasks, such as those in manufacturing and service sectors. The studies by Jayadi Y et al and Kaewjunda J et al. reinforce that prolonged static posture, repetitive hand movements, and visual demands are critical determinants of both musculoskeletal and visual morbidities.[19,20] Similar findings were documented in a Chennai-based study by Sujitha S et al., stating the associated health risks among employees across the petroleum supply chain.[21] The consistency of these findings across different occupational settings strengthens the evidence that ergonomic risk factors play a central role in the development of these conditions and underscores the urgent need for workplace interventions focused on ergonomic redesign, task variation, and periodic health surveillance.

We had limitations, as this study sample was from a single company; the results cannot be generalized, as each company would differ in its working conditions and organizational practices. The assessment of musculoskeletal and vision-related symptoms was based on self-reported information, which may be subject to recall bias and reporting bias. Objective ergonomic assessments and clinical evaluations were not performed, which could have provided more precise estimates of exposure and health status.

Conclusion

This study revealed that employees in the electronics industry experience a high burden of work-related musculoskeletal disorders (61.4%) and vision problems (40.2%). Gender, job process, shift timing, work experience, and health-related leave were significantly associated with both conditions. These findings emphasized an urgent need to strengthen workplace ergonomics, regular awareness and training on workplace posture and stretching exercises to reduce

biomechanical strain on the body. Regular eye screenings and vision care initiatives, such as proper lighting and eye relaxation practices, might reduce vision problems among employees. Integrating these preventive strategies into workplace health policies can ultimately improve workforce well-being, reduce absenteeism, and enhance productivity.

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References

1. Yang F, Di N, Guo W, Ding W, Jia N, Zhang H, et al. The prevalence and risk factors of work-related musculoskeletal disorders among electronics manufacturing workers: A cross-sectional analytical study in China. BMC Public Health. 2023;23:10. Available from: https://doi.org/10.1186/s12889-022-14952-6
2. Abebaw T, Destaw B, Yenealem DG, Tesfaye AH, Melaku C, Mamaye Y, et al. Work-related musculoskeletal disorders: prevalence, associated factors, and impact on quality of life among kitchen workers in hospitality industry, Bahir Dar City, Northwest Ethiopia, 2023. Front Public Health. 2024 May 14;12. Available from: https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2024.1358867/full
3. WHO Report. Musculoskeletal health. 2022. Available from: https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions
4. Briggs AM, Woolf AD, Dreinhöfer K, Homb N, Hoy DG, Kopansky-Giles D, et al. Reducing the global burden of musculoskeletal conditions. Bull World Health Organ. 2018;96(5):366–8. Available from: https://doi.org/10.2471/BLT.17.204891
5. Roli D, Ali I, Neekhra V. Work Related Musculoskeletal Disorders in Electrical, Telecommunication and Instrument Mechanics of Armed forces. International Journal of Occupational Safety and Health. 2020;10(1):18-27. Available from: https://doi.org/10.3126/ijosh.v10i1.29878
6. George E. Occupational hazards for pathologists: Microscope use and musculoskeletal disorders. Am J Clin Pathol. 2010;133(4):543–8. Available from: https://doi.org/10.1309/AJCPUXDS5KJKRFVW
7. Yılmaz FK, Karakuş S. Laboratory Risk Analysis in a Branch Hospital: The L-type Matrix. International Journal of Occupational Safety and Health. 2024;14(2):194–200. Available from: https://doi.org/10.3126/ijosh.v14i2.53996
8. Jain G, Shetty P. Occupational concerns associated with regular use of microscope. Int J Occup Med Environ Health. 2014;27(4):591–8. Available from: https://doi.org/10.2478/s13382-014-0288-2
9. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon. 1987;18(3):233–7. Available from: https://doi.org/10.1016/0003-6870(87)90010-X
10. Crawford JO. The Nordic Musculoskeletal Questionnaire. Occup Med (Lond). 2007;57(4):300–1. Available from: https://doi.org/10.1093/occmed/kqm036
11. Ames SL, Wolffsohn JS, McBrien NA. The development of a symptom questionnaire for assessing visual fatigue during near-vision tasks. Optom Vis Sci. 2005;82(3):168–76. Available from: https://doi.org/10.1097/01.opx.0000156307.95086.6
12. Yin Y, Di N, Guo W, Ding W, Jia N, Wang Z, et al. Multi-site musculoskeletal symptoms in the electronics manufacturing industry: A cross-sectional study. Int J Environ Res Public Health. 2022;19(20):13315. Available from; https://doi.org/10.3390/ijerph192013315
13. Daneshmandi H, Kee D, Kamalinia M, Oliaei M, Mohammadi H. An ergonomic intervention to

relieve musculoskeletal symptoms of assembly line workers at an electronic parts manufacturer in Iran. Work. 2018;61(4):515–21. Available from: https://doi.org/10.3233/WOR-182822

14. Choobineh A, Daneshmandi H, Saraj Zadeh Fard SK, Tabatabaee SH. Prevalence of work-related musculoskeletal symptoms among Iranian workforce and job groups. Int J Prev Med. 2016;7:130. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5200977/

15. Akinpelu AO, Oyewole OO, Odole AC, Ogunbamowo FO. Work-related musculoskeletal pain and health-seeking behaviour among Nigerian sewing machine operators. Trop J Med Res. 2016;19(2):152–8. Available from: https://www.researchgate.net/publication/304793690_Work-related_musculoskeletal_pain_and_health-seeking_behavior_among_Nigerian_sewing_machine_operators

16. Kee D. Characteristics of work-related musculoskeletal disorders in Korea. Int J Environ Res Public Health. 2023;20(2):1024. Available from: https://doi.org/10.3390/ijerph20021024

17. Untimanon O, Pacharatrakul W, Boonmeepong K, Thammagarun L, Laemun N, Taptagaporn S, et al. Visual problems among electronic and jewelry workers in Thailand. J Occup Health. 2006;48(5):407–12. Available from: https://doi.org/10.1539/joh.48.407

18. Lin KH, Su CC, Chen YY, Chu PC. The effects of lighting problems on eye symptoms among cleanroom microscope workers. Int J Environ Res Public Health. 2019;16(1):101. Available from: https://doi.org/10.3390/ijerph16010101

19. Jayadi YD, Lestari F, Tejamaya M, Prasetyo S, Fikawati S, Sugiarti S, et al. Occupational safety and health education for reducing workplace accidents in oil palm plantations. Int J Occup Saf Health. 2025 Dec 16;15(4):361–9. Available from: https://doi.org/10.3126/ijosh.v15i4.76198

20. Kaewjunda J, Jiraponkul C, Neubert MS, Limmongkon Y. Prevalence and factors affecting work-related musculoskeletal disorders among faculty members at Northeastern Universities in Thailand. Int J Occup Saf Health. 2025 Dec 16;15(4):380–90. Available from: https://doi.org/10.3126/ijosh.v15i4.77176

21. Sujitha S, Rajmohan M, Dhamodhar D, Sindhu R, Fathima L, Prabu D, et al. Profiling occupational exposure and associated health risks among employees across the petroleum supply chain in Chennai: a cross-sectional study. Int J Occup Saf Health. 2025 Dec 16;15(4):391–403. Available from: https://doi.org/10.3126/ijosh.v15i4.79543