

Case Studies

RISK OF MUSCULOSKELETAL DISORDERS IN A PHARMACY UNIT: A CASE STUDY FROM KUALA PILAH HEALTH CLINIC

Imanul Hassan **Abdul Shukor**¹, Fadly Syah **Arsad**², Shahrir **Nurul-Farehah**^{1*}, Mohd Faiz **Ibrahim**¹

1. Environmental Health Research Centre, Institute for Medical Research, National Institutes of Health, Ministry of Health Malaysia, Jalan Setia Murni U13/52, Setia Alam, 40170 Shah Alam, Selangor, Malaysia

2. Lembah Pantai Health Office, Jalan Cenderasari, Tasik Perdana, 50480 Kuala Lumpur, Malaysia

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***Corresponding author:**

Shahrir Nurul-Farehah,
farehah.shahrir@moh.gov.my,
my,

Tel: +603-3362 7810

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ABSTRACT

Musculoskeletal disorders (MSDs) are prevalent among pharmacy workers due to suboptimal ergonomic conditions. However, research on this issue in low-income and middle-income countries remains limited. This study aimed to assess ergonomic risks among workers in a pharmacy unit within a primary health clinic in Malaysia. Hazard identification of high-demand tasks was conducted. Workers were interviewed to identify MSD symptoms using the Cornell Musculoskeletal Questionnaire. Initial ergonomic risk assessments were conducted for detection of ergonomic risk factors. The risk factors were further evaluated using advanced ergonomic risk assessment tools, such as the Assessment of Repetitive Tasks (ART), Rapid Office Strain Assessment (ROSA), Rapid Entire Body Assessment (REBA), and Rapid Upper Limb Assessment (RULA). The high-demand tasks identified were data entry, pre-packing of medicine tablets, and pre-packing of cough syrups. Significant ergonomic risks were found, particularly in tasks involving data entry and pre-packing of cough syrups. Data entry had high ROSA scores, indicating strain from poor workstation setups. The syrup packaging task had high REBA scores, highlighting the impact of awkward postures and prolonged standing. The medicine tablet packing task received a medium ART score, suggesting that continuous packing contributes to cumulative strain. The study highlights significant ergonomic risks for pharmacy workers, particularly from awkward postures and prolonged standing. Ergonomic improvements, such as workstation optimization and task rotation, are crucial to prevent MSDs. Further research and interventions are recommended to mitigate these risks and enhance occupational health in similar settings.

KEYWORDS: Work-related musculoskeletal disorders, ergonomic risk assessment, occupational health, healthcare workers

INTRODUCTION

Musculoskeletal disorders (MSDs) represent a significant global public health concern, particularly affecting workers across various industries, including healthcare professionals. The World Health Organization (WHO) has identified MSDs as the leading cause of disability, impacting both daily life and work activities [1]. The risk of developing MSDs among healthcare professionals varies depending on the specific nature of their working environment, particularly in physically demanding settings [2]. Pharmacy units, in health clinics, are responsible for tasks like procurement, storage, quality control, manufacturing, and dispensing of medicines. These activities expose personnel in the pharmacy unit to health hazards, mainly biomechanical risks, which are major causes of musculoskeletal problems. A study conducted in Iran showed that 87.7% of pharmacy personnel are at high risk of musculoskeletal disorders due to factors like prolonged standing, repetitive motions, and poor ergonomics [3]. Moreover, an ergonomic evaluation report on pharmacy workers in the United States shown that repetitive motions, awkward wrist postures, and forceful exertions were the ergonomic risk factors for the prevalence of MSDs among the workers [4]. The consequences of MSDs are profound, leading to physical discomfort, reduced productivity, increased absenteeism, and ultimately, a decline in the quality of healthcare delivery [4].

Despite the pharmacy professional's growth in tandem with the healthcare sector, research on the ergonomics of pharmacy workers remains limited, particularly when compared to other healthcare professionals. Previous local studies have focused on doctors [5,6], nurses [7,8], dentists [9] and physiotherapists [10], with most conducted in hospitals or urban clinics. However, there is no such studies conducted among pharmacists in the Malaysian healthcare settings. Given the sizeable workforce, with 19,778 pharmacists registered in 2023 and 63.2% employed in the government sector, this professional group warrants greater attention in ergonomic research [11]. In addition, there were 6,249 assistant pharmacy officers, with three-quarters of them work in government health clinics. Hence, the ergonomic burden of pharmacy workers in Malaysia is yet to be discovered. The workload in pharmacy units is exclusively managed by pharmacy workers, encompassing a range of tasks such as data entry into the pharmacy online system, packing prescribed medications, printing and labelling medication orders, dispensing and consulting clients. Before the dispensing process, various preparatory tasks are necessary to ensure adequate stock of medications, including ordering new supplies from drug suppliers, as well as receiving and unloading the medicines from delivery boxes.

The primary health clinics in Malaysia are equipped with in-house pharmacies, allowing medications to be dispensed immediately after a consultation, eliminating the need for patients to purchase them elsewhere. However, primary health care clinics' dispensaries often face unique challenges such as limited resources, high patient-to-worker ratios, and inadequate infrastructure, which can worsen ergonomic risks [12]. In addition, Malaysia's pharmacy workforce is well below the global mean of 6.02 pharmacy workers per 10,000 population, contributing to a fast-paced work environment [13]. Despite these challenges and the associated risk factors for musculoskeletal disorders (MSDs), no studies have yet assessed the ergonomic conditions of Malaysian pharmacy workers in primary health clinics. This case study aims to address this gap by assessing the ergonomic risks in pharmacy work tasks in a primary health clinic in Malaysia. By identifying and analysing the specific ergonomic challenges faced by pharmacy workers, this study seeks to highlight the areas requiring intervention and to propose viable recommendations to mitigate these risks.

MATERIALS AND METHODS

Sample Population and Sampling Methods

The study was conducted at a pharmacy unit in a primary health clinic located in the state of Negeri Sembilan for one week in April 2022. All three workers in the pharmacy unit were invited to participate in this study. The inclusion criteria were workers permanently employed in the clinic's pharmacy unit. Exclusion criteria included workers with underlying musculoskeletal diseases prior to employment in the current position, a history of orthopaedic surgery for any reason prior to working in the current workplace, workers with less than one year of service, pregnant workers or physically disabled workers due to any condition.

Data Collection and Analysis

Data were collected via hazard identification. There were three common work tasks identified. Investigator-guided questionnaire was conducted for musculoskeletal symptoms using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). This standardized questionnaire assessed each part of the body for presence of discomfort or pain in the previous work week, its severity, and ability to perform daily work tasks. The CMDQ, developed by Alan Hedge from Cornell University in 1998 [14], has been validated for use in Malaysia, demonstrating a Cronbach Alpha coefficient exceeding 0.95 [15].

Subsequently, ergonomic risk assessment was conducted in two phases: initial ergonomic assessment followed by advanced ergonomic risk assessment. These assessments were carried out by observing the ergonomic conditions while the workers performed their daily tasks. The assessment was conducted by certified assessors authorized by the Department of Safety and Health (DOSH) Malaysia. The flow chart of the assessment is presented in Figure 1.

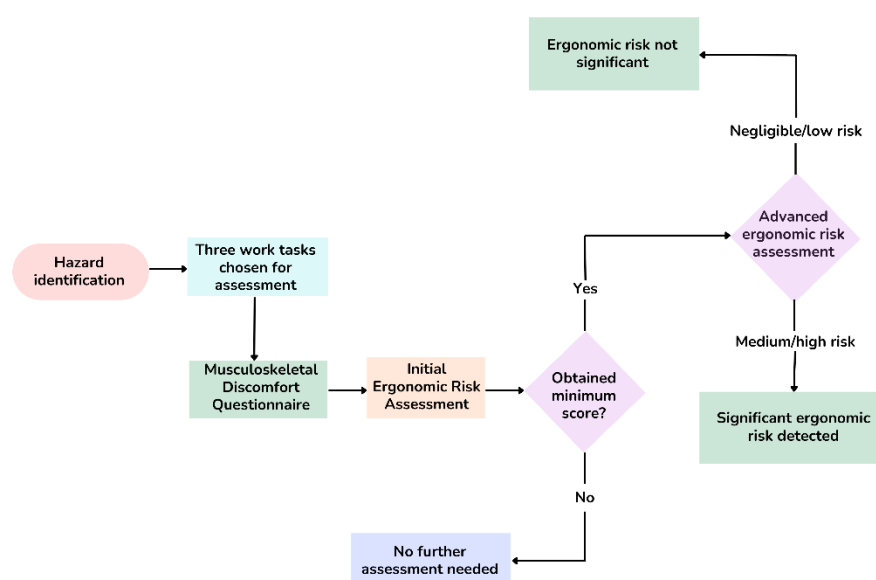


Figure 1. Flow chart process in conducting the hazard identification and ergonomic risk assessment in the study.

Initial Ergonomic Risk Assessment: The initial ergonomic risk assessment is a rapid observation of common risk factors involved, such as awkward postures, forceful exertion, repetitive motion, workstation design, and environmental factors. Advanced ergonomic risk assessment was conducted for any risks exceeding the minimum score outlined in the Guidelines on Ergonomics Risk Assessment at Workplace by the Department of Occupational Safety and Health Malaysia [16].

Advanced Ergonomic Risk Assessment: Each particular risk factor has its specific advanced ergonomic risk assessment tool. In this study, the following tools were used:

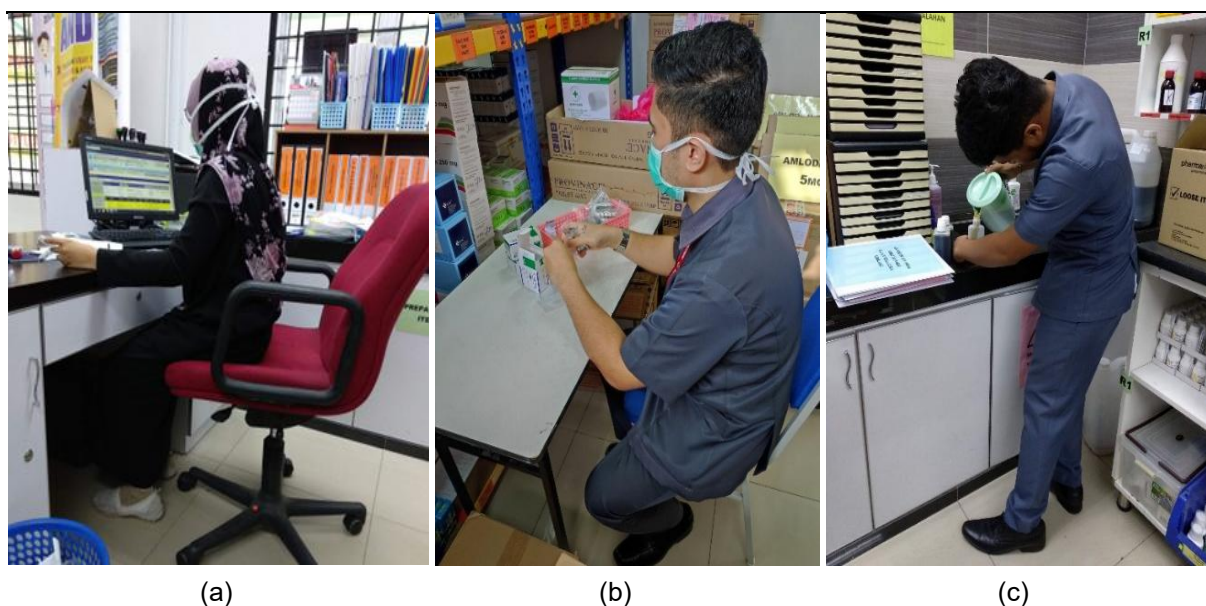
- **Assessment of Repetitive Tasks (ART):** To evaluate repetitive tasks of the upper limbs and hands performed by the participants. This tool assesses the frequency, duration, and recovery time of repetitive actions, as well as factors such as force, posture, and movement. Each task was observed and scored according to the ART criteria, which provided a quantitative measure of the risk associated with repetitive movements. Total score of 11 and below is considered low ergonomic exposure level, 12 to 21 is medium exposure, and 22 or higher score indicates high ergonomic exposure level [17]. The task of pre-packaging of tablets and data entry into computer were evaluated using ART tool independently.
- **Rapid Office Strain Assessment (ROSA):** To assess the ergonomic risks related to sustained posture in office workstations, particularly for the tasks performed at the pharmacy counters. This assessment includes factors such as workstation layout, seating, monitor position, and keyboard/mouse placement. Observations were made on the participants' workstation setups, and each aspect was scored according to the ROSA guidelines to determine the overall ergonomic risk. A total score of greater than 5 is deemed to be high-risk [18]. The assessment of task in entering data into the pharmacy database was conducted using this tool.
- **Rapid Entire Body Assessment (REBA):** To evaluate the whole-body postural risks associated with the participants' work tasks. This assessment considers the postures of the neck, trunk, and upper and lower limbs, types of movements, load handling, and grip. Thus, this assessment is suitable for awkward or sustained postures. Each observed task was analysed using the REBA tool, yielding an ergonomic risk score. A score of 1 is negligible risk, 2 to 3 is low risk, 4 to 7 is medium risk, 8 to 10 is high risk, 11 and above is considered as very high risk [19]. Task of packaging of cough syrup was assessed using REBA.
- **Rapid Upper Body Assessment (RULA):** To quantify the magnitude of exposure to ergonomic risk factors associated with upper extremities of the body. A total score of 1 to 2 is negligible risk, 3 to 4 is low risk, 5 to 6 is medium risk, with 7 and above considered high risk [20].

RESULTS

Based on hazard identification, three work tasks were selected involving three workers in the pharmacy unit: one pharmacist and two assistant pharmacy officers, all of whom agreed to participate in this case study. Worker 1, a 32-year-old female pharmacist with six years of experience in her current role, along with the assistant pharmacy officers (Worker 2 and Worker 3), aged 26 and 24 respectively, with two and one year(s) of experience. Table 1 and Figure 2 provide an observational summary of work tasks of these pharmacy workers. The tasks are categorized as 'Data Entry' for dispensing prescribed drugs, 'Packing Tablets' for packaging medicine tablets, and 'Packing Syrups' for transferring cough syrups into containers.

Table 1. Sociodemographic, task and workstation set up of respondents.

Worker	Task	Workstation setup
Worker 1 Role: 32-year-old female pharmacist, 6 years of experience	Data entry: Entering 80 to 100 prescriptions into a computerized database. Duration of task: 8 a.m. to 5 p.m., Monday to Friday with a 1-hour lunch break	Workstation: Non-adjustable table, 5-wheeled chair, LCD monitor, wired keyboard and mouse
Worker 2 Role: 25-year-old male pharmacy assistant, with 1 year of experience	Packing tablets: Packing 3,000 blisters of tablets into plastic containers, with each blister containing 10 tablets and 3 blisters per package. Work Hours: 8 a.m. to 5 p.m., Monday to Friday, with a 1-hour lunch break	Workstation: Non-adjustable table, banquet chair with a fixed seat height
Worker 3 Role: 26-year-old male pharmacy assistant, with 2 years of experience	Packing syrups: Transferring cough syrup from an 8-liter container into 120ml packages. Frequency: Twice a week Work Hours: 2 p.m. to 5 p.m.	Workstation: Non-adjustable countertop, performed while standing

**Figure 2.** Work tasks assessed: (a) Data entry; (b) Packing of tablets; (c) Packing syrups.

The results of the CMDQ, as summarized in Table 2, indicate that all participants experienced musculoskeletal discomfort in multiple body regions. Notably, shoulder discomfort was reported across all tasks by each participant. Additional symptoms, including upper back pain and wrist discomfort, were frequently associated with the 'Data Entry' and 'Packing Tablets' tasks.

Table 2. CMDQ musculoskeletal symptoms of respondents by task and body area.

Body area	Data Entry	Packing Tablets	Packing Syrups
Neck	Yes	No	No
Shoulders	Yes	Yes	Yes
Upper back	Yes	Yes	Yes
Upper arms	No	No	Yes
Lower back	No	No	Yes
Forearms	No	No	No
Wrists	Yes	Yes	No
Hands	Yes	Yes	No
Hips	No	No	No
Thigh	No	No	No
Knee	No	No	No
Lower leg	No	No	No
Feet	No	No	No

The initial ergonomic risk assessment scores for each work task, along with the required Ergonomic Risk Assessment (ERA) tools for further evaluation, are presented in Table 3. The assessment was based on various risk factors, including awkward postures, static posture, forceful exertion, repetitive motion, vibration, lighting, temperature, ventilation, and noise. For each task, two advanced ERA tools were required, except for the packing of cough syrups, which can be assessed using REBA.

Table 3. Initial ERA scores and advanced ERA tools required by tasks of respondents.

Risk factors	Total score	Minimum score	Score	Tasks				
				Data entry		Packing tablets		Packing syrups
				Advanced ERA tool	Score	Advanced ERA tool	Score	Advanced ERA tool
Awkward Postures	13	6	1	not required	0	not required	6	REBA
Static Posture	3	1	2	ROSA	1	RULA	1	REBA
Forceful Exertion	1	1	0	not required	0	not required	0	not required
Repetitive Motion	5	1	1	ART	3	ART	0	not required

Vibration	4	1	0	not required	0	not required	0	not required
Lighting	1	1	0	not required	0	not required	0	not required
Temperature	1	1	0	not required	0	not required	0	not required
Ventilation	1	1	0	not required	0	not required	0	not required
Noise	2	1	0	not required	0	not required	0	not required

Note: ART = Assessment of Repetitive Tasks; ERA = Ergonomic Risk Assessment; REBA = Rapid Entire Body Assessment; ROSA = Rapid Office Strain Assessment; RULA = Rapid Upper Limb Assessment

Table 4 presents the results of the advanced ergonomic risk assessments for each task, using various assessment tools. The table provides a heat map format showing the scores obtained for each tool, with the scores expressed as a proportion of the maximum possible score. The scores indicate the level of ergonomic risk associated with each task, categorized into low, medium, and high risk.

Table 4. Heat map of advanced ergonomic risk assessment by task assessment tool for assessed task of respondents.

Task	Advanced ergonomic risk assessment tool and score	
	Tool	Score / Maximum score (Risk level)
Data entry	ROSA	8/10 (High)
	ART	9/72 (Low)
Packing tablets	RULA	4/7 (Low)
	ART	13/72 (Medium)
Packing syrups	REBA	9/15 (Medium high)

Note: ART = Assessment of Repetitive Tasks; ERA = Ergonomic Risk Assessment; REBA = Rapid Entire Body Assessment; ROSA = Rapid Office Strain Assessment; RULA = Rapid Upper Limb Assessment

DISCUSSION

The findings indicate notable ergonomic risks faced by pharmacy workers in these settings. Various ergonomic risk scores from the assessment tools suggest that the working conditions may not fully support optimal ergonomic practices, hence may contribute to work-related MSDs. The predominant MSD symptoms observed in this study involve the upper limbs, likely due to the job's demands, which require extensive use of the upper limbs compared to the lower limbs and other body parts. Similarly, the Centre for Disease Control and Prevention (CDC) in the US reported that pharmacists and pharmacy technicians are exposed to work-related MSDs, including de Quervain tenosynovitis, carpal or radial tunnel syndrome, and upper extremity tendinitis, due to repetitive and forceful movements, awkward wrist and shoulder postures, and contact stress, such as opening or closing bottle caps [21]. However, a different study conducted in Taiwan observed that 16.6% of 10,470 pharmacists reported low back pain, potentially due to repetitiveness and prolonged standing [22]. These differences may also be influenced by other factors such as age and comorbidities [23–25].

The data entry task in this study resulted in a high ROSA score but a low ART score, which can be attributed to the specific nature of the tasks. The high ROSA score reflects ergonomic issues related to workstation setup, such as a non-adjustable table and monitor misalignment, which contribute to strain in the neck, back, and shoulders. The low ART score suggests that while repetitive, the task involves low intensity and force. This indicates that the primary ergonomic concerns are related to workstation setup and posture rather than task repetition. Similar ergonomic challenges have been observed in other healthcare settings [26]. For instance, a study conducted in Iran among 150 computer users at two hospitals in Qom found that 87.3% of participants recorded undesirable ergonomic scores using the ROSA tool, with seating-related postures having the highest frequency of undesirable scores (86.7%), followed by those associated with the use of mouse/keyboard (26.7%) and the other peripheral devices (44%) [27]. As healthcare digitization expands, similar ergonomic issues may arise, echoing the musculoskeletal disorders observed during previous IT expansions in US healthcare [28]. This highlights the need for proactive ergonomic measures in low- and middle-income countries like Malaysia transitioning to digital healthcare [29,30], where workstation design and posture may be more significant ergonomic factors than task repetition alone.

The medicine tablets packing task in this study showed a low-risk score using RULA and a medium risk score with ART. The low RULA score suggests that the participant's posture, though influenced by a non-adjustable table and fixed-height chair, does not pose a severe risk to the upper limb. However, the task of continuous packing contributes to cumulative strain, which is reflected in the medium ART score. This finding is consistent with a study on medical laboratory technicians reported similar issues, with carpal tunnel syndrome linked to repetitive tasks and the use of non-adjustable chairs or desks (OR: 4.60 95% CI: 1.39-15.70 for repetitive tasks; OR: 3.35 95% CI: 1.23-9.15 for non-adjustable furniture) [31]. In contrast, a study on dental professionals in Poland highlighted significant upper limb disorders attributed to both awkward postures and repetitive work [32]. This shows that the nature of tasks brings different risk factors, indicating that targeted ergonomic interventions should focus on the specific occupational activities.

The high REBA score for the syrup packaging task indicates that improper execution, including prolonged standing and awkward postures involving twisting and bending, significantly increase the risk of developing MSDs for the worker. This finding aligns with research showing that prolonged standing is a significant risk factor for MSDs. For instance, a study of nursing staff in the Netherlands found a marked increase in MSDs among nurses hindered by standing (OR: 4.90 CI 2.84 - 8.47) [33]. Similarly, long-term static postures have been associated with elevated inflammatory cytokines linked to lower back MSDs in university workers [34]. In medical laboratory settings, technicians also reported

high levels of discomfort due to prolonged static postures and poor ergonomic design, which compounded the risk of MSDs [35].

RECOMMENDATIONS

Given that ergonomics contributing to MSDs across various work tasks are evident, corrective measures such as improving the workstation of those workers by placing the computer monitor slightly higher, to accommodate the eye level of the user and subsequently eliminates tilting of monitor and bending of the worker's neck. Moreover, the process of syrup packaging can be done by sitting to reduce awkward posture. In addition, the risk of repetitive motion of packing tablets can be reduced by implementing administrative control measures such as job rotation and buddy system. Hence, it is recommended for policymakers and healthcare management to integrate ergonomic principles into workstations, especially in primary health clinics and resource-limited settings, to mitigate the risk of musculoskeletal disorders among workers. This includes providing ergonomic training, implementing work rotation, periodic ergonomic risk assessment, and investing in ergonomically designed workstations. Future research may benefit from exploring longitudinal studies to evaluate the long-term effects of ergonomic interventions and expanding the focus beyond pharmacy settings to encompass a wider range of healthcare roles. Investigating the costs associated with ergonomics-related MSDs could also be valuable. Additionally, research should examine healthcare workers' knowledge and practices regarding ergonomics to identify gaps and develop targeted interventions. It is essential to develop effective ergonomic guidelines that are tailored to the specific needs of different healthcare disciplines.

STRENGTH AND LIMITATIONS

This case study has several strengths and limitations. To the best of the authors knowledge, this is the first study that analysed ergonomic risks among pharmacists in primary health clinics in Malaysia. It provides pioneering insights into ergonomic risks among pharmacy workers in primary health clinics in Malaysia, an area that has been under-researched. The use of multiple assessment tools (ROSA, ART, REBA, and RULA) allows for a comprehensive evaluation of both postural and repetitive task-related risks. However, due to the nature of this study design, it is difficult to generalize the findings to be applied to all pharmacy workers in primary health clinics due to its small number of participants. It offers only a snapshot of ergonomic risks at a single point in time, and reliance on subjective observations and self-reported data introduces potential measurement bias. To address these limitations, future research should aim to include a larger, more diverse sample, conduct longitudinal studies, and incorporate objective measurements to enhance data accuracy.

CONCLUSION

In conclusion, this study highlights critical ergonomic risks faced by pharmacy workers in primary health clinics in Malaysia, underscoring the need for improved workstation design and posture management to mitigate work-related MSDs. The findings show that both awkward postures and prolonged standing contribute to ergonomic issues, as indicated by high ROSA and REBA scores. Addressing these ergonomic challenges through targeted interventions and comprehensive ergonomic improvements is essential for enhancing worker health and preventing MSDs.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability: The datasets generated and/or analysed during the current study are not publicly available due to privacy and third-party restrictions.

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