

## Ergonomic Risk Factors and Work-Related Musculoskeletal Disorders among Rehabilitation Staff During Patient Handling and Therapy Activities

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Date Received: 22 April 2026, Date Revised: 15 May 2026, Date Accepted: 10 Jun 2026

### ABSTRACT

*This study evaluated ergonomic risk factors and work-related musculoskeletal disorders (WMSDs) among rehabilitation staff during patient handling and therapy activities at a private medical centre in Kota Kinabalu, Sabah. Rehabilitation staff are consistently exposed to ergonomic hazards due to the physical nature of their work activities such as lifting and transferring patients, assisting with mobility exercises, maintaining static postures during treatment sessions, and performing repetitive manual tasks increase the likelihood of musculoskeletal strain. A quantitative cross-sectional study was conducted among 40 rehabilitation staff. Data were collected using a structured self-administered questionnaire and observational ergonomic tools. Descriptive statistics and Pearson correlation analysis were performed using Jamovi. Forward bending during patient handling showed the highest ergonomic risk exposure (mean 3.15, SD 0.853), followed by torso twisting during lifting or transfer (mean 3.05, SD 0.973). Thirty respondents (75%) reported work-related musculoskeletal discomfort. Ergonomic awareness was moderate (mean 2.92, SD 0.997). Strong positive correlations were found among the major ergonomic risk factors, with the strongest association between torso twisting and working in a stooped or crouched position ( $r = 0.789$ ,  $p < 0.001$ ). These findings indicate that ergonomic risk management in rehabilitation settings should be approached as a comprehensive workplace priority. Effective prevention will require a combination of staff training, workplace redesign, safer patient handling strategies, better equipment support, and regular ergonomic monitoring.*

**Keywords:** Ergonomic risk assessment, patient handling, rehabilitation staff, work-related musculoskeletal disorders

### 1. INTRODUCTION

The healthcare sector is one of the most physically demanding work environments, particularly for rehabilitation professionals who are directly involved in patient handling and therapeutic intervention [1-4]. Rehabilitation staff, including physiotherapists, occupational therapists, and therapy assistants, routinely perform repetitive movement, sustained awkward posture, manual lifting, patient transfer, and direct physical support during therapy sessions. These activities place considerable biomechanical stress on the musculoskeletal system and increase the likelihood of work-related musculoskeletal disorders (WMSDs) [2-5].

**Figure 1** until **Figure 6** shows the rehabilitation therapy session involving ergonomic posture and patient support techniques.



**Figure 1.** Therapist-assisted ambulation using parallel bars, illustrating patient handling and staff posture during gait training.



**Figure 2.** A rehabilitation therapy session involving balance training, used to observe ergonomic posture and patient support techniques.



**Figure 3.** Therapist-assisted mobility training using a walking aid, illustrating patient handling techniques and therapist posture during functional ambulation.



**Figure 4.** Therapist-assisted sitting balance training illustrating patient positioning and staff posture during rehabilitation activity.



**Figure 5.** Therapist performing manual therapy illustrating upper limb posture and force application during rehabilitation treatment.



**Figure 6.** Therapist-assisted patient transfer from wheelchair, illustrating manual handling techniques and staff posture.

WMSDs remain among the most frequently reported occupational health problems in healthcare. In rehabilitation practice, repeated strain on the lower back, neck, shoulders, and upper limbs may lead to pain, fatigue, functional limitation, absenteeism, increased medical cost, and reduced quality of patient care [5,6]. Ergonomics therefore plays a key role in identifying, assessing, and controlling occupational risks associated with these job demands. Poor ergonomic design, improper patient-handling techniques, and inconsistent use of assistive devices may contribute to cumulative trauma and long-term musculoskeletal injury among rehabilitation personnel [7,8].

At the private medical centre in Kota Kinabalu, Sabah, rehabilitation services are delivered in a fast-paced clinical environment that involves patient mobilization, manual therapy, therapeutic exercise, and functional training. Staff frequently manage patients with different levels of mobility limitation and dependency, requiring ongoing manual assistance and close-contact therapeutic intervention [9]. Despite the importance of ergonomic safety in such settings, ergonomic risk assessment is often limited or informal, resulting in the persistence of unrecognized hazards and preventable injuries [10,11].

Although occupational safety and health in healthcare have received increasing attention, there is still limited documented evidence on ergonomic risk among rehabilitation staff in private medical centres in Malaysia. A study specifically highlighted that local data on musculoskeletal disorders and occupational health issues in Malaysian private hospitals remain scarce, indicating a need for further research in private healthcare environments [28]. A private hospital was selected as the study setting because its organisational and operational characteristics differ from those of public healthcare facilities. Private hospitals are generally associated with greater responsiveness, flexible service delivery, and a stronger emphasis on patient-centred care [16,17]. These characteristics may influence staff workload patterns, rehabilitation practices, and ergonomic exposures differently from public hospitals, which often manage larger patient volumes and experience greater operational pressures [15,18,19]. Despite these differences, most Malaysian healthcare-related occupational studies have been conducted in public institutions, leaving limited evidence regarding ergonomic risks among rehabilitation personnel in private healthcare settings. Consequently, this study aims to address this gap by providing empirical evidence from a private rehabilitation environment.

Therefore, local evidence is needed to identify high-risk tasks, quantify exposure, and support prevention. Therefore, this study aimed to evaluate ergonomic risk factors and WMSDs among rehabilitation staff during patient handling and therapy activities at private medical centre in Kota Kinabalu, Sabah. Specifically, the study assessed ergonomic risk exposure, determined the prevalence of WMSDs, evaluated ergonomic practices and ergonomic awareness, and examined the relationships among ergonomic risk factors [12].

## **2. MATERIAL AND METHODS**

### **2.1 Participants**

This quantitative cross-sectional study was conducted in the Rehabilitation Department of private medical centre in Kota Kinabalu, Sabah [13]. The department provides physiotherapy and rehabilitation services that frequently involve repetitive movement, forceful exertion, manual patient handling, and sustained awkward posture.

The target population consisted of physiotherapists, occupational therapists, and therapy assistants working in the department. Eligible participants were currently employed in the rehabilitation department, directly involved in patient handling and therapy activities, and had at least 6 months of work experience. Staff were excluded if they were not directly involved in

patient handling activities, had less than 6 months of experience, were on leave during data collection, had pre-existing non-occupational musculoskeletal conditions, or did not consent to participate.

Purposive sampling was used to ensure that only staff exposed to relevant ergonomic risk factors were included [14]. Because the accessible population was small, total population sampling was adopted [15]. Forty eligible staff members were invited, and all completed the questionnaire, giving a response rate of 100%.

## **2.2 Assessment criteria**

A structured self-administered questionnaire was used to collect data on demographic and work profile, patient handling and workload, frequency of awkward posture, musculoskeletal discomfort, ergonomic awareness, reporting behaviour, and recommendations for ergonomic improvement. Questionnaire construction followed good practice for health and behavioural measurement [19]. Musculoskeletal discomfort was assessed using body regions adapted from the Nordic Musculoskeletal Questionnaire [20].

## **2.3 Data collection**

Data were collected using observation and questionnaire methods. During routine rehabilitation sessions, the researcher observed selected treatment tasks, including patient transfer, assisted ambulation, repositioning, lifting and supporting patients, manual therapy, and repetitive treatment procedures.

The questionnaire was administered to all eligible rehabilitation staff. The questionnaire consists of eight sections designed to assess ergonomic exposure, musculoskeletal discomfort, and workplace practices. The sections include:

- a) Participant Information and Consent
- b) Demographic and Work Profile
- c) Patient Handling and Workload
- d) Frequency of Awkward Postures
- e) Musculoskeletal Discomfort (MSD)
- f) Ergonomic Improvement Recommendations
- g) Reporting Behaviour
- h) Additional recommendation/suggestion

## **2.4 Statistical analysis**

Data were analyzed using Jamovi. Descriptive statistics, including frequency, percentage, mean, standard deviation, minimum, and maximum values, were used to summarize ergonomic exposure, ergonomic practices, awareness scores, and musculoskeletal discomfort [21]. Pearson correlation analysis was used to examine relationships among ergonomic risk factors. Correlation coefficients of 0.00-0.29 were interpreted as weak, 0.30-0.49 as moderate, and 0.50-1.00 as strong. Statistical significance was set at  $p < 0.05$  [21,22].

## **3. RESULTS AND DISCUSSION**

A total of 40 respondents from the Rehabilitation Department of private medical centre in Kota Kinabalu, Sabah participated in this study. The sample comprised physiotherapists, occupational therapists, and therapy assistants. Results are presented according to the study objectives.

This study showed that rehabilitation staff at Private medical centre in Kota Kinabalu, Sabah were routinely exposed to multiple ergonomic risk factors during patient handling and therapy activities.

### 3.1 Ergonomic risk factors during patient handling

**Table 1** shows among the identified factors, bending the back forward during patient handling recorded the highest mean score ( $3.15 \pm 0.853$ ), followed by twisting the torso while lifting or transferring a patient ( $3.05 \pm 0.973$ ), maintaining awkward postures ( $3.02 \pm 0.935$ ), and reaching forward or sideways repeatedly ( $3.00 \pm 0.866$ ). Working in a stooped or crouched position showed the lowest mean score, although it remained moderately frequent ( $2.88 \pm 0.812$ ). These findings indicate regular exposure to multiple ergonomic stressors in daily rehabilitation work.

**Table 1** Descriptive statistics for ergonomic risk factors experienced by rehabilitation staff.

| Ergonomic risk factor                                      | Mean | SD    | Min | Max |
|------------------------------------------------------------|------|-------|-----|-----|
| Bending the back forward during patient handling           | 3.15 | 0.853 | 1   | 5   |
| Maintaining awkward postures (bending, twisting, reaching) | 3.02 | 0.935 | 1   | 5   |
| Reaching forward or sideways repeatedly                    | 3.00 | 0.866 | 1   | 5   |
| Twisting the torso while lifting or transferring a patient | 3.05 | 0.973 | 1   | 5   |
| Working in a stooped or crouched position                  | 2.88 | 0.812 | 1   | 5   |

The moderate to high mean scores indicates that ergonomic risk factors are not occasional but rather routine components of rehabilitation work. This suggests that rehabilitation staff are continuously exposed to biomechanical stress throughout their working hours. Prolonged exposure to such conditions may result in cumulative trauma, particularly affecting the lower back and upper limbs.

Furthermore, the relatively consistent standard deviation values indicate that these risk factors are experienced across most respondents, rather than being isolated to specific individuals. This highlights that ergonomic risk is a systemic issue within the department rather than an individual problem, requiring organisational-level interventions.

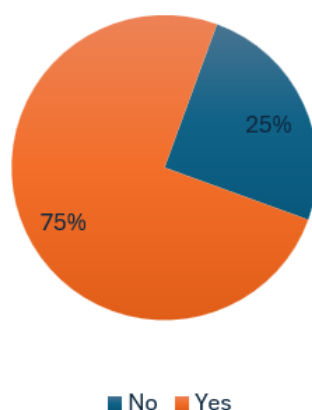
The findings indicate that rehabilitation staff are consistently exposed to a range of ergonomic risk factors during patient handling activities. Among the identified factors, bending the back forward during patient handling recorded the highest mean score ( $\bar{x} = 3.15$ ,  $\sigma = 0.853$ ), suggesting that this posture is frequently adopted during therapy sessions. This finding is particularly important as forward bending has been widely associated with increased spinal loading and a higher risk of lower back injuries. Prolonged or repetitive bending may lead to cumulative musculoskeletal strain over time. Similarly, twisting of the torso ( $M = 3.05$ ) and maintaining awkward postures ( $M = 3.02$ ) also recorded moderate mean values, indicating that these movements are common during patient handling tasks. These postures are often unavoidable due to patient dependency, limited workspace, and the dynamic nature of rehabilitation activities.

These findings are consistent with previous research, which highlights that physiotherapists and rehabilitation professionals frequently perform physically demanding tasks involving bending, twisting, and reaching movements (27)(23). The combined exposure to these ergonomic risk factors suggests that rehabilitation staff operate in environments with significant biomechanical demands, which may contribute to long-term musculoskeletal health issues.

Overall, the results demonstrate that ergonomic risk factors are not isolated occurrences but are routinely encountered during daily rehabilitation practices, reinforcing the need for targeted ergonomic interventions.

### 3.2 Prevalence of work-related musculoskeletal disorders

Thirty respondents (75%) reported work-related musculoskeletal discomfort, whereas 10 (25%) reported no such discomfort in **Figure 7** below. This indicates that WMSDs are a substantial occupational health concern among rehabilitation staff.



**Figure 7.** Prevalence of WMSDs among respondents.

The high prevalence of WMSDs observed in this study is particularly concerning, as it reflects a substantial occupational health burden among rehabilitation staff. The fact that three-quarters of respondents reported discomfort suggests that musculoskeletal issues are not only common but may also be under-recognised or underreported in clinical settings.

This finding also implies that existing ergonomic controls and preventive strategies may be insufficient or not consistently implemented. From an occupational safety perspective, such a high prevalence indicates a need for immediate intervention to prevent long-term disability and reduced work performance among staff.

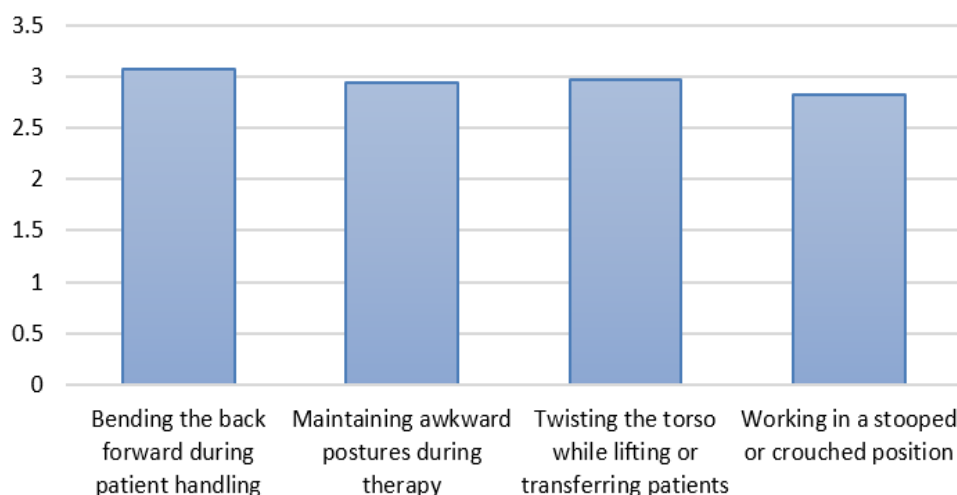
This high prevalence rate indicates that WMSDs are a significant occupational health concern within the rehabilitation department. The results are consistent with global findings, where healthcare professionals involved in patient handling are recognised as one of the highest-risk groups for musculoskeletal disorders (1; 27).

Moreover, the nature of rehabilitation work, which involves repetitive physical tasks, manual handling of patients, and sustained awkward postures, contributes significantly to the development of WMSDs. Previous studies have reported that physiotherapists frequently experience discomfort in areas such as the lower back, neck, and shoulders due to continuous physical exertion and biomechanical strain (23). The high prevalence observed in this study highlights the urgent need for preventive measures, including ergonomic training, workload management, and the implementation of assistive devices to reduce physical strain.

### 3.3 Ergonomic practices during therapy activities

**Figure 8** shows bending the back forward during patient handling recorded the highest mean score for ergonomic practice ( $3.08 \pm 0.730$ ), followed by twisting the torso while lifting or transferring patients ( $2.98 \pm 0.862$ ), maintaining awkward postures during therapy ( $2.95 \pm 0.815$ ), and working in a stooped or crouched position ( $2.83 \pm 0.747$ ). These findings suggest that ergonomically unfavourable postures remain common during routine therapy activities.





**Figure 8.** Descriptive statistics of ergonomic practices.

The findings on ergonomic practices suggest a gap between knowledge and actual practice. Although rehabilitation staff may be aware of proper ergonomic techniques, the nature of their work may limit their ability to consistently apply these practices. This highlights the influence of environmental and organisational factors, such as workload demands, patient dependency levels, and availability of assistive equipment. Therefore, improving ergonomic practices requires not only individual training but also structural changes within the workplace.

The findings indicate that rehabilitation staff frequently adopt postures that are ergonomically unfavourable. The highest mean score was recorded for bending the back forward ( $M = 3.08$ ), indicating that this practice is commonly performed during patient handling. The frequent use of such postures suggests that ergonomic principles may not always be fully applied in clinical practice, possibly due to constraints such as patient dependency, limited equipment, or time pressure. Additionally, moderate scores for twisting movements and awkward postures further indicate that therapists are exposed to repetitive biomechanical stress during therapy sessions.

These findings align with previous studies demonstrating that healthcare workers often operate in constrained environments that limit their ability to maintain optimal ergonomic postures (7). The results suggest that while rehabilitation staff are aware of proper techniques, practical limitations in the work environment may hinder the consistent application of safe ergonomic practices.

### 3.4 Ergonomic awareness among rehabilitation staff

The mean score for awareness of proper ergonomic posture was  $2.92 \pm 0.997$ , indicating a moderate level of ergonomic awareness among respondents. The relatively high standard deviation ( $SD = 0.997$ ) indicates variability in awareness levels among staff, suggesting inconsistencies in knowledge or training exposure.

Previous research has shown that awareness alone is insufficient to ensure safe work practices, as external factors such as workload and workplace design significantly influence behaviour (10). This finding highlights the need for structured and continuous ergonomic training programs.

The moderate level of ergonomic awareness observed among respondents indicates that while staff possess a basic understanding of safe working postures, this knowledge may not be sufficient to prevent injury. Additionally, the variation in awareness levels suggests inconsistency in training or experience among staff members. This highlights the importance of implementing

continuous professional development programs focused on ergonomics, particularly for newly employed or less experienced staff.

The results indicate that the mean level of ergonomic awareness among rehabilitation staff was 2.92 (SD = 0.997). Based on the Likert scale used in the questionnaire, this score suggests a moderate level of awareness regarding proper ergonomic postures during patient handling activities. Previous studies have shown that although healthcare workers may possess basic knowledge of ergonomic practices, workplace constraints such as time pressure and workload often limit the practical application of these principles (10). The variation in responses observed in this study suggests that additional ergonomic education and training may be beneficial in improving awareness and promoting safer work practices.

### 3.5 Correlation between ergonomic risk factors

**Table 2** shows the correlation results demonstrate that ergonomic risk factors are interrelated rather than independent. Strong correlations ( $r = 0.589\text{--}0.789$ ) indicate that when one risk factor occurs, others are likely to occur simultaneously, demonstrating a clustering effect of ergonomic risk factors in the workplace, which is consistent with findings reported by (10).

This reinforces the concept of cumulative ergonomic exposure, where multiple stressors act together to increase injury risk. Such findings are supported by occupational ergonomics research, which emphasises that combined exposure significantly increases the likelihood of WMSDs (WHO, 2022).

The correlation analysis revealed strong positive relationships between several ergonomic risk factors. For example, bending the back forward during patient handling was strongly correlated with maintaining awkward postures during therapy activities ( $r = 0.696$ ,  $p < 0.001$ ). Similarly, bending the back forward was strongly correlated with twisting the torso while lifting or transferring patients ( $r = 0.737$ ,  $p < 0.001$ ).

The strongest relationship observed in this study was between twisting the torso while lifting or transferring patients and working in a stooped or crouched position ( $r = 0.789$ ,  $p < 0.001$ ). These findings indicate that rehabilitation staff are often exposed to multiple ergonomic risk factors simultaneously during patient handling tasks, which is consistent with previous ergonomic studies in healthcare environments (Oakman et al., 2022). The presence of multiple ergonomic stressors may increase the risk of developing work-related musculoskeletal disorders among rehabilitation staff.

**Table 2** Pearson correlation matrix of ergonomic risk factors.

| Ergonomic risk factors                                              | 1        | 2        | 3        | 4 |
|---------------------------------------------------------------------|----------|----------|----------|---|
| 1. I bend my back forward during patient handling                   | -        |          |          |   |
| 2. I maintain awkward postures during therapy activities            | 0.696*** | -        |          |   |
| 3. I twist my torso while lifting or transferring a patient         | 0.737*** | 0.765*** | -        |   |
| 4. I work in a stooped or crouched position when assisting patients | 0.589*** | 0.743*** | 0.789*** | - |

Note: \*\*\* $p < 0.001$ .

## 4. CONCLUSION

In conclusion, this study has identified and analysed the ergonomic risk factors experienced by rehabilitation staff during patient handling and therapy activities at private medical centre in Kota Kinabalu, Sabah.



The findings demonstrate that rehabilitation staff are frequently exposed to multiple ergonomic risk factors, including bending, twisting, and maintaining awkward postures, which are inherent in their daily work activities. The high prevalence of work-related musculoskeletal disorders (WMSDs) observed in this study highlights the significant occupational health risks faced by rehabilitation professionals.

This underscores the urgent need for effective ergonomic interventions to reduce physical strain and prevent long-term injuries. Furthermore, the moderate level of ergonomic awareness among staff indicates that while some knowledge exists, there is a need for continuous education and training to ensure that ergonomic principles are consistently applied in clinical practice. The strong correlations identified between ergonomic risk factors further emphasise the cumulative nature of ergonomic exposure, where multiple stressors interact to increase the risk of musculoskeletal disorders.

Future research could expand on the findings of this study by including a larger and more diverse sample of rehabilitation professionals from multiple healthcare facilities. This would allow for a broader understanding of ergonomic risks across different clinical environments.

Additionally, future studies may incorporate observational ergonomic assessment methods to evaluate actual working postures and movements during therapy sessions. Tools such as Rapid Entire Body Assessment (REBA) or Rapid Upper Limb Assessment (RULA) could provide more objective measurements of ergonomic risks. Researchers may also explore the effectiveness of ergonomic intervention programs, such as training workshops, ergonomic equipment implementation, and workplace redesign, in reducing musculoskeletal injuries among rehabilitation staff.

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