

Impact of Ergonomic Training Programs on the Prevalence of Musculoskeletal Disorders Among Nurses: A Comprehensive Study

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Abstract:

Objective: This study evaluated the impact of an ergonomic training program on the prevalence of musculoskeletal disorders (MSDs) among nurses.

Methods: A quasi-experimental design with a pretest-posttest approach was used. Two hundred nurses from a tertiary care hospital participated in the study. The ergonomic training program included educational workshops, personalized ergonomic assessments, and follow-up sessions. Data on MSD prevalence and ergonomic knowledge were collected using the Nordic Musculoskeletal Questionnaire and an Ergonomic Knowledge and Practices Survey at baseline and six months post-intervention.

Results: Post-intervention, there was a significant reduction in the overall prevalence of MSDs from 68% to 50% ($p < 0.001$). Specific reductions were observed in the lower back (from 45% to 30%, $p < 0.01$), neck (from 30% to 20%, $p < 0.05$), and shoulders (from 25% to 15%, $p < 0.05$). Ergonomic knowledge and adherence to ergonomic practices significantly improved ($p < 0.001$ and $p < 0.01$, respectively).

Conclusion: The ergonomic training program effectively reduced the prevalence of MSDs among nurses and improved their ergonomic knowledge and practices. These findings support the implementation of similar training programs in healthcare settings to enhance nurse well-being and reduce work-related MSDs.

Keywords: Ergonomic Training, Musculoskeletal Disorders, Nursing, Occupational Health, Ergonomics

Introduction

Musculoskeletal disorders (MSDs) are a prevalent and significant occupational health issue among nurses, characterized by pain and discomfort in the muscles, nerves, tendons, and supporting structures of the body. These disorders not only affect the physical well-being of nurses but also impact their productivity, job satisfaction, and overall quality of care provided to patients (Alwabli et al., 2020). According to the World Health Organization (WHO), healthcare workers, particularly nurses, are at high risk for MSDs due to the physically demanding nature of their work, including patient handling, repetitive tasks, and long working hours (WHO, 2020).

The high prevalence of MSDs among nurses has prompted the exploration of various preventive measures, including ergonomic training programs designed to reduce the physical strain associated with nursing tasks. Ergonomic training programs focus on educating healthcare workers about proper body mechanics, posture, and the use of ergonomic equipment to minimize the risk of injury (Karahana et al., 2009). These programs

have been implemented in various healthcare settings with the goal of reducing the incidence and severity of MSDs among nurses (Chiou et al., 2013).

Despite the potential benefits of ergonomic training, the effectiveness of these programs in reducing the prevalence of MSDs among nurses remains underexplored. Some studies have reported positive outcomes, such as reduced pain and improved functional capacity, while others have found limited or no significant impact (Waters et al., 2007; Amick et al., 2003). Therefore, there is a need for further research to evaluate the impact of ergonomic training programs on the prevalence of MSDs among nurses.

This study aims to investigate the effectiveness of an ergonomic training program in reducing the prevalence of MSDs among nurses in a hospital setting. By examining the changes in MSD prevalence before and after the implementation of the training program, this research seeks to provide evidence-based recommendations for enhancing workplace ergonomics in the nursing profession. Specifically, the study will address the following research questions: (1) What is the prevalence of MSDs among nurses before the implementation of an ergonomic training program? (2) How does the prevalence of MSDs change after the implementation of the training program? (3) What are the perceptions of nurses regarding the effectiveness of the ergonomic training program?

By addressing these questions, this research will contribute to a better understanding of the role of ergonomic training in mitigating the risk of MSDs among nurses, ultimately promoting a healthier and more productive workforce.

Literature Review

Prevalence of Musculoskeletal Disorders Among Nurses

Musculoskeletal disorders (MSDs) are highly prevalent among nurses, with numerous studies highlighting the extensive impact of these conditions on the nursing workforce. Alwabli et al. (2020) reported that over 70% of nurses in mainland China experienced MSDs, particularly in the lower back, shoulders, and neck. This high prevalence is attributed to the physically demanding nature of nursing tasks, such as patient handling, prolonged standing, and repetitive movements (Karahan et al., 2009). In a similar vein, Lorusso et al. (2007) found that 80% of nurses in Italy reported experiencing work-related MSDs, emphasizing the global nature of this occupational health issue.

Risk Factors for Musculoskeletal Disorders in Nursing

Several risk factors contribute to the development of MSDs among nurses. According to Nelson and Baptiste (2004), patient handling activities, including lifting, transferring, and repositioning patients, are significant contributors to musculoskeletal injuries. These tasks often involve awkward postures and excessive physical exertion, increasing the risk of strain and injury. Moreover, insufficient staffing levels and high patient-to-nurse ratios exacerbate the physical demands on nurses, leading to increased incidence of MSDs (Trinkoff et al., 2008).

Ergonomic Training Programs in Healthcare

Ergonomic training programs have been proposed as an effective intervention to mitigate the risk of MSDs among healthcare workers. These programs focus on educating employees about proper body mechanics, posture, and the use of ergonomic equipment to reduce physical strain (Karahan et al., 2009). Research by Chiou et al. (2013) demonstrated that ergonomic training programs could significantly reduce the incidence of MSDs among hospital staff. In their study, participants who received ergonomic training reported lower levels of musculoskeletal pain and discomfort compared to those who did not receive the training.

Impact of Ergonomic Training on Musculoskeletal Health

The effectiveness of ergonomic training programs in reducing MSD prevalence among nurses has been examined in various studies with mixed results. Waters et al. (2007) conducted a comprehensive review of ergonomic interventions in healthcare settings and concluded that such programs could effectively reduce musculoskeletal injuries when properly implemented. Their findings indicated that training programs focusing on patient handling techniques, use of assistive devices, and workplace modifications were particularly beneficial.

Conversely, Amick et al. (2003) found that while ergonomic training improved knowledge and awareness of ergonomic principles, its impact on reducing MSD symptoms was limited without complementary interventions, such as organizational support and changes in workplace design. This suggests that the success of ergonomic training programs may depend on a multifaceted approach that includes environmental modifications and supportive policies.

Gaps in the Literature

Despite the growing body of research on ergonomic training programs, several gaps remain. Many studies have focused on short-term outcomes, with limited investigation into the long-term effectiveness of these programs. Additionally, there is a need for more research on the specific components of ergonomic training that are most effective in reducing MSD prevalence. The variability in study designs, sample sizes, and assessment methods also makes it challenging to draw definitive conclusions about the overall impact of ergonomic training on musculoskeletal health.

Theoretical Framework

The Job Demands-Resources (JD-R) model provides a useful theoretical framework for understanding the relationship between ergonomic training and MSDs among nurses. According to this model, job demands (e.g., physical workload) can lead to strain and health problems if not balanced by adequate resources (e.g., ergonomic training, supportive equipment) (Demerouti et al., 2001). Ergonomic training programs can be viewed as a resource that helps nurses manage physical demands, thereby reducing the risk of MSDs.

In summary, the literature highlights the significant burden of MSDs among nurses and the potential benefits of ergonomic training programs in mitigating this issue. However, further research is needed to explore the long-term effectiveness of these programs and identify the most effective components. By addressing these gaps, future studies can contribute to the development of evidence-based interventions that enhance the health and well-being of nurses.

Methodology

Study Design

This study employed a quasi-experimental design with a pretest-posttest approach to evaluate the impact of an ergonomic training program on the prevalence of musculoskeletal disorders (MSDs) among nurses. The study was conducted over a period of six months in a large tertiary care hospital.

Participants

The study included 200 registered nurses working in various departments of the hospital. Participants were selected using stratified random sampling to ensure representation from different units, including intensive care, medical-surgical, and outpatient departments. Inclusion criteria were: (1) being a full-time nurse with at

least one year of experience, and (2) willingness to participate in the study. Nurses who were on medical leave or had pre-existing severe musculoskeletal conditions were excluded from the study.

Intervention: Ergonomic Training Program

The ergonomic training program was developed in collaboration with occupational health experts and consisted of three main components:

1. Educational Workshops: Nurses attended a series of three workshops focused on ergonomics, proper body mechanics, and safe patient handling techniques. Each workshop lasted two hours and included interactive sessions and practical demonstrations.
2. Ergonomic Assessments: Each nurse received a personalized ergonomic assessment conducted by trained ergonomists. The assessments identified individual risk factors and provided recommendations for adjustments in workstations and equipment usage.
3. Follow-Up Sessions: Monthly follow-up sessions were held to reinforce the training, address any concerns, and provide ongoing support. These sessions included group discussions, problem-solving activities, and feedback on implementation of ergonomic practices.

Data Collection

Data were collected at two time points: baseline (pre-intervention) and six months post-intervention. The following instruments were used for data collection:

1. Demographic Questionnaire: Collected information on participants' age, gender, years of nursing experience, and department.
2. Nordic Musculoskeletal Questionnaire (NMQ): Assessed the prevalence and severity of musculoskeletal symptoms in different body regions (neck, shoulders, back, wrists, hips, knees, and ankles).
3. Ergonomic Knowledge and Practices Survey: Evaluated nurses' knowledge of ergonomic principles and their self-reported adherence to ergonomic practices (adapted from Chiou et al., 2013).

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarize the demographic characteristics and prevalence of MSDs. Paired sample t-tests were conducted to compare the prevalence of MSDs before and after the intervention. Chi-square tests were used to assess the association between ergonomic training and changes in musculoskeletal symptoms.

Ethical Considerations

The study was approved by the ethics committee. Informed consent was obtained from all participants, ensuring confidentiality and the right to withdraw from the study at any time. Data were anonymized to protect participants' privacy.

Findings

Demographic Characteristics

The study included 200 registered nurses with diverse backgrounds. The average age of the participants was 35 years (SD = 7.4), and they had an average of 10 years (SD = 6.2) of nursing experience. The sample was

predominantly female (85%), with nurses working in various departments such as intensive care (30%), medical-surgical units (40%), and outpatient departments (30%).

Characteristic	Value
Total Participants	200
Average Age (years)	35 (SD = 7.4)
Gender Distribution	
Female (%)	85
Male (%)	15
Average Years of Nursing Experience	10 (SD = 6.2)
Department Distribution	
Intensive Care (%)	30
Medical-Surgical Units (%)	40
Outpatient Departments (%)	30

Prevalence of Musculoskeletal Disorders

At baseline, the Nordic Musculoskeletal Questionnaire (NMQ) revealed a high prevalence of musculoskeletal disorders (MSDs) among the nurses. A total of 68% of the participants reported experiencing MSDs in at least one body region in the past 12 months. The most commonly affected areas were the lower back (45%), neck (30%), and shoulders (25%).

Impact of the Ergonomic Training Program

Overall Prevalence of MSDs

Post-intervention, there was a significant reduction in the overall prevalence of MSDs among the nurses. The paired sample t-test results indicated a significant decrease in the prevalence of MSDs from 68% at baseline to 50% post-intervention ($t = 4.56$, $p < 0.001$).

Specific Body Regions

Significant reductions were observed in the prevalence of MSDs in specific body regions:

- Lower Back: The prevalence decreased from 45% to 30% ($t = 3.89$, $p < 0.01$).
- Neck: The prevalence decreased from 30% to 20% ($t = 2.45$, $p < 0.05$).
- Shoulders: The prevalence decreased from 25% to 15% ($t = 2.37$, $p < 0.05$).

These reductions indicate that the ergonomic training program had a positive impact on reducing musculoskeletal symptoms in critical areas affected by nursing tasks.

Ergonomic Knowledge and Practices

The ergonomic knowledge and practices survey showed significant improvements post-intervention:

- Ergonomic Knowledge: There was a significant increase in the nurses' knowledge of ergonomic principles ($t = 5.12$, $p < 0.001$).
- Ergonomic Practices: There was a significant improvement in the self-reported adherence to ergonomic practices ($t = 3.78$, $p < 0.01$).

Variable	Pre-Intervention	Post-Intervention	t-value	p-value
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Overall Prevalence of MSDs (%)	68	50	4.56	< 0.001
Lower Back MSDs (%)	45	30	3.89	< 0.01
Neck MSDs (%)	30	20	2.45	< 0.05
Shoulders MSDs (%)	25	15	2.37	< 0.05
Ergonomic Knowledge (Mean Score)	4.2 (out of 5)	4.8 (out of 5)	5.12	< 0.001
Ergonomic Practices (Mean Score)	3.5 (out of 5)	4.1 (out of 5)	3.78	< 0.01

Qualitative Findings

Theme 1: Increased Awareness of Ergonomics

Sub-theme 1.1: Understanding Ergonomic Principles

Participants reported a heightened awareness and understanding of ergonomic principles as a result of the training program.

- Participant A: "I never realized how much my posture during patient transfers was affecting my back until the training highlighted the correct techniques."
- Participant B: "The workshops made it clear how important proper body mechanics are. I am now more conscious of how I move during my shifts."

Sub-theme 1.2: Recognition of Risk Factors

Nurses became more adept at identifying risk factors in their work environment that could contribute to musculoskeletal disorders.

- Participant C: "I now recognize the awkward postures I often adopt while reaching for supplies. The training has taught me how to adjust my movements to minimize strain."
- Participant D: "The ergonomic assessment helped me pinpoint specific tasks that were causing discomfort. It was eye-opening to see how small changes could make a big difference."

Theme 2: Practical Application of Ergonomic Practices

Sub-theme 2.1: Implementation of Safe Patient Handling Techniques

Nurses applied the techniques learned during the training to their daily patient handling tasks.

- Participant E: "Using the new lifting techniques has reduced the strain on my back significantly. I feel more confident in my ability to handle patients safely."
- Participant F: "The training on assistive devices was very useful. I now regularly use these tools, which makes patient transfers much easier and safer."

Sub-theme 2.2: Modifications in Work Environment

Participants made adjustments to their workstations and utilized ergonomic equipment as recommended during the training.

- Participant G: "I adjusted the height of my workstation based on the ergonomic assessment. This simple change has reduced the discomfort in my neck and shoulders."
- Participant H: "I've started using the ergonomic tools provided by the hospital. They have made my tasks less physically demanding, and I experience less fatigue."

Theme 3: Reduction in Physical Discomfort and Fatigue

Sub-theme 3.1: Decrease in Pain Levels

Many nurses reported a noticeable reduction in pain and discomfort in various body regions following the implementation of ergonomic practices.

- Participant I: "Since the training, the pain in my lower back has decreased significantly. I can work longer shifts without feeling as much discomfort."
- Participant J: "I used to have constant shoulder pain, but after applying the techniques learned in the training, the pain has almost completely gone away."

Sub-theme 3.2: Improved Physical Well-being

Overall physical well-being improved among the participants, leading to increased job satisfaction and productivity.

- Participant K: "I feel less physically drained at the end of my shifts. The training has definitely made a positive impact on my overall well-being."
- Participant L: "Implementing ergonomic practices has not only reduced my pain but also made me more efficient at work. I can now focus better on patient care."

Discussion

Interpretation of Key Findings

The results of this study indicate that the ergonomic training program had a significant impact on reducing the prevalence of musculoskeletal disorders (MSDs) among nurses. The decrease in overall MSD prevalence from 68% to 50%, and significant reductions in specific regions such as the lower back, neck, and shoulders, demonstrate the effectiveness of targeted ergonomic interventions. These findings align with previous research indicating that ergonomic training can mitigate the risk of work-related MSDs in healthcare settings (Hemati et al., 2020; Abareshi et al., 2015).

Improvement in Ergonomic Knowledge and Practices

The significant improvements in ergonomic knowledge and self-reported adherence to ergonomic practices post-intervention highlight the importance of education and training in promoting safe work practices. Enhanced understanding and implementation of ergonomic principles are crucial for preventing MSDs, as nurses are often exposed to repetitive motions, awkward postures, and heavy lifting. Similar studies have shown that increased ergonomic awareness and practice lead to better musculoskeletal health outcomes (Chiou et al., 2013; Abdollahi et al., 2020).

Practical Applications and Behavioral Changes

Qualitative feedback from participants underscored the practical benefits of the training program. Nurses reported increased awareness of ergonomic principles, practical application of safe patient handling techniques, and modifications in their work environment. These behavioral changes contributed to a noticeable reduction in physical discomfort and fatigue. This finding is supported by the literature, which emphasizes that ergonomic interventions are most effective when they are comprehensive and include education, ergonomic assessments, and ongoing support (Tullar et al., 2010; Nelson et al., 2006).

Implications for Nursing Practice

The study's findings suggest several implications for nursing practice:

1. **Institutional Support for Ergonomic Training:** Healthcare institutions should prioritize the implementation of ergonomic training programs to promote the health and well-being of nursing staff. Such programs can lead to reduced incidence of MSDs, lower absenteeism, and increased job satisfaction.
2. **Continuous Ergonomic Assessments:** Regular ergonomic assessments and follow-up sessions can help sustain the benefits of training by addressing new risk factors and reinforcing safe practices.
3. **Policy Development:** Policies that mandate ergonomic training and provide access to ergonomic equipment can create a safer work environment for nurses and other healthcare workers.

Limitations and Recommendations for Future Research

This study has several limitations that should be considered when interpreting the findings:

- **Sample Size and Generalizability:** The study was conducted in a single tertiary care hospital with a sample size of 200 nurses. Future research should include larger, more diverse samples across multiple institutions to enhance generalizability.
- **Short-Term Follow-Up:** The six-month follow-up period may not capture the long-term effects of the ergonomic training program. Longitudinal studies with extended follow-up periods are needed to assess the sustainability of the intervention's impact.
- **Self-Reported Data:** The use of self-reported questionnaires may introduce bias. Objective measures, such as direct observation of ergonomic practices and clinical assessments of musculoskeletal health, could provide more accurate data.

Conclusion

The ergonomic training program significantly reduced the prevalence of MSDs among nurses and improved their knowledge and practices related to ergonomics. These findings support the implementation of comprehensive ergonomic training programs in healthcare settings to enhance the safety and well-being of nursing staff. By fostering a culture of safety and promoting ergonomic best practices, healthcare institutions can mitigate the risk of MSDs and improve the overall quality of patient care. Future research should aim to build on these findings by exploring the long-term effects of ergonomic interventions and identifying best practices for their implementation and sustainability.

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