

“A Study to Evaluate the Effectiveness of Body Mechanics Training Program on Low Back Pain Among Nurses Working in Intensive Care Unit at Nmch, Jamuhar, Rohtas”

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Abstract—Background: Low back pain (LBP) is common among ICU nurses due to repetitive bending, lifting, and long periods of standing, yet formal training on body mechanics is limited.

Aim: To evaluate how effective a Body Mechanics Training Program is in reducing LBP among ICU nurses at NMCH, Jamuhar.

Methods: We used a true experimental pretest-posttest control group design with 60 randomly selected ICU nurses (30 in the experimental group and 30 in the control group). The experimental group went through a 7-day training program while the control group continued with routine care. We collected data using a sociodemographic tool and the NPRS. Statistical tests included descriptive analysis, t-tests, and Chi-square.

Results: Pain levels at the start were similar ($p = 0.432$). After the intervention, the experimental group had a significant reduction in pain (Mean = 2.90) compared to the control group (Mean = 5.43) ($p < 0.001$). Income was the only demographic factor linked to pain levels ($p < 0.05$).

Conclusion: The Body Mechanics Training Program significantly reduced LBP among ICU nurses. We recommend regularly including ergonomic education and therapeutic exercises.

Index Terms—Low back pain, Body mechanics, ICU nurses, Ergonomics, Nursing intervention.

I. INTRODUCTION

Background of the Study Low back pain (LBP) is defined as pain in the lumbosacral region which is commonly located at the L4–L5 level and varies from acute, subacute, or chronic. Due to its impact on daily activities, work performance, and overall quality of life, LBP is one of the medical conditions that most people worldwide consult doctors about. [1] The pain can be mild to severe and the causes can be sudden strain, accidents, or gradual degeneration that comes with age. Low back pain, LBP, has become a prevalent health-related challenge and a major issue of concern in the world. The condition has enormous economic impacts. [2] A rough estimate puts one-third of the patients with the disease to be those in the working class, and health care facilities are recognized as the areas with the highest incidence of LBP. [3] Among healthcare professionals, nurses report up to 77% prevalence of low back pain during the year when heavy workloads, patient handling, prolonged standing, bending, and uncomfortable postures are considered. Nurses working in Intensive Care Units (ICUs) are at greater heights among healthcare professionals and suffer from LBP because of the frequent lifting of patients, moving of patients, and continuous physical strain.[4]

Need for the Study: Low Back Pain (LBP) is a considerable health issue in connection to work among nurses, especially in staff working in ICUs where the load, patient handling, and moving them around are the main activities that cause injuries of the musculoskeletal system. [5] Studies worldwide and in India are reporting a very high extent of LBP among nurses (40%–80%), which results in absenteeism, decreased productivity, increased health-care costs, and the consequent decline in the quality of patient care. [6] ICU nurses undergo additional hazards from long working hours, stressful surroundings, overweight patients, and poor or untrained body mechanics. [7] The majority of the LBP in the nursing profession is due to improper posture, repetitive movements, and insufficient ergonomic training.[8] Thus, body mechanics education is not only useful but actually necessary for the prevention of injuries. It has been shown that exercise-based body mechanics training can lead to better posture, flexibility, core strength, and safe patient-handling practices. Unfortunately, it is seldom that such training is offered or officially incorporated into the routine of nursing. [9]

II. PROBLEM STATEMENT

A Study to evaluate the effectiveness Of Body Mechanics Training Program on Low Back Pain Among Nurses Working in Intensive Care Unit at NMCH, Jamuhar, Rohtas.

Aim and Objectives

- To assess and compare the pre-test level of low back pain among nurses working in intensive care unit between study and control group.
- To assess and compare the post-test level of low back pain among nurses working in intensive care unit between study and control group.
- To evaluate the effectiveness of body Mechanics Training Program on Low Back Pain among nurses working between intensive care unit in the study group.
- To determine the association between pre-test and post-test level of low back pain among nurses working in intensive care unit with their demographic variables in the study and control group.

III. HYPOTHESIS

H¹: - There is a significant difference in the pre-test level of pain among nurses working In Intensive Care Unit between study and control group.

H²: - There is a significant difference in the post-test level of pain among nurses working In Intensive Care Unit between study and control group.

H³: - There is a significant difference in the pre-test and post-test level of pain among nurses working In Intensive Care Unit in study group.

H⁴: - There is a significant association between pre-test and post-test level of low back pain among nurses working in ICU with their socio demographic variables in the study and control group.

IV. OPERATIONAL DEFFINITION

Evaluate: in this study, it refers to judge or determine the effectiveness of body mechanics training program reduction low back pain among nurses working in intensive care unit.

Effectiveness: in this study, it is referred to the in improvement in the low back pain as determined by difference in pretest and posttest score.

Body mechanics training programme: in this study, it is referring to the use of proper posture, alignment, and movement techniques by nurses while performing clinical tasks such as lifting, transferring, repositioning patients, or handling equipment in the intensive care unit.

Body mechanics & exercise: in this study, it is referred to the systematic teaching and demonstration given regarding knee-to-chest stretch, low back rotational stretch, lower back flexibility exercise, bridge exercise, cat stretch training session on 45 min. followed by reverse demonstration with use of ppt video and photos.

Knee-to-chest stretch: lie on back with knees bent and feet flat on the floor (a). using both hands, pull up one knee and press it toward chest (b). tighten the muscles in belly and press your spine to the floor. hold for five seconds. return to the starting position and repeat with the other leg (c). go back to the starting position. then repeat with both legs at the same time (d). repeat each stretch 2 to 3 times.

Low back rotational stretch: - lie on back with knees bent and feet flat on the floor

(a). keep shoulders firmly on the floor, and slowly roll bent knees to one side (b). hold for 5 to 10 seconds. slowly go back to the starting position (c). repeat on the other side (d). repeat each stretch 2 to 3 times.

Lower back flexibility exercise: - lie on back with knees bent and feet flat on the floor (a). tighten the muscles in your belly so that lower back pulls up, away from the floor (b). hold for five seconds and then relax. flatten back, pulling your bellybutton toward the floor (c). hold for five seconds and then relax.

Bridge exercise: - lie on back with knees bent and feet flat on the floor (a). keep your shoulders and head relaxed on the floor and tighten the muscles in belly and buttocks. then raise hips to form a straight line from knees to shoulders (b). try to stay that way long enough to take three deep breaths. go back to where you started and repeat. begin by doing five repetitions a day and slowly work up to 30.

Cat stretch exercise: - kneel on knees and hands (a). slowly arch back, as if you're pulling belly up toward the ceiling as bring head down (b). then slowly let back and belly sag toward the floor as bring head up (c). go back to where started (a). repeat 3 to 5 times.

Low back pain: - in this study, it is referred to the unpleasant feeling in the lower part of the spine involving the muscles, nerves and bone, which will be measured by numerical rating scales and graded as mild to severe pain.

Nurses: - in this study, it is referred to the one whose registered nurses with b.sc nursing and GNM degrees, who provides nursing care to patients in intensive care units with minimum standing for a 6 to 8 hours in per day.

V. ASSUMPTIONS

The study assumes that:

- ICU nurses are standing for longer period to provide care to the patient.
- Low back pain is hazards for health care professional

- Body Mechanics Training Program will help in Reducing Low Back Pain.

Delimitation

Study is delimited to:

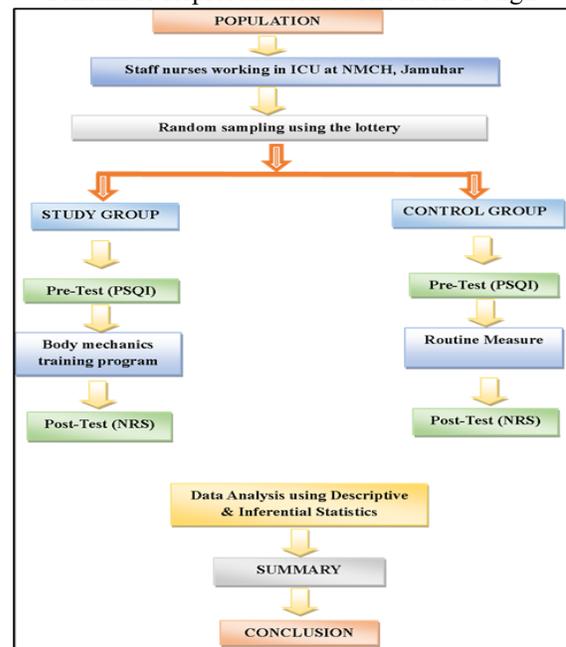
- The data will be collected for 4 weeks.
- Nurses Who are working in intensive care unit. Nurses who are having Low back pain.

VI. METHODOLOGY

Research Approach: A quantitative research approach was used to measure the effect of a structured body mechanics training program on low back pain (LBP) among ICU nurses. This approach allowed objective assessment through numerical data and statistical analysis.

Research Design: The study employed a true experimental pretest–posttest control group design with random assignment. The experimental group received the training program, while the control group continued routine work. This design helped establish a cause-and-effect relationship.

Schematic Representation of Research Design



Variables:

- Dependent Variable: Low back pain, measured using the Numerical Pain Rating Scale (NPRS).

- Independent Variable: Body mechanics training program (theoretical teaching + practical exercises).
- Sociodemographic Variables: Age, gender, education, income, diet, marital status, experience, duration of back pain, and previous training.

Setting of the Study: The pilot study was conducted at Sadar Hospital, Sasaram, to test feasibility and refine tools. The main study was conducted at NMCH, Jamuhar, a tertiary hospital with multiple ICUs and adequate staff support, providing an ideal environment for training and observation.

Population:

The study population included all staff nurses. The accessible population was ICU nurses at NMCH, who are at higher risk of LBP.

Sample:

A total of 60 ICU nurses were selected and randomly divided into:

- 30 in the experimental group
- 30 in the control group

Inclusion Criteria:

- ICU nurses
- Willing to participate
- Nurses experiencing low back pain

Exclusion Criteria:

- Sick nurses
- Those taking pain medication
- Nurses with musculoskeletal complications

Sampling Technique: Simple random sampling (lottery method) was used to ensure equal selection probability and reduce bias.

Sample Size: A total of 60 ICU nurses formed the final sample, ensuring reliability and comparability between groups for meaningful analysis.

VII. DESCRIPTION OF THE TOOL & ITS INTERPRETATION

The following tool were developed and utilized for data collection: -

Tool I: - a structured questionnaire designed to collect socio-demographic information, including age, gender, education, dietary pattern, income, marital status, work experience, duration of pain, type of ICU, and any prior exposure to body mechanics training. This helped in understanding the background of the participants and identifying any variables that might influence the level of back pain.

Tool II: - Numerical Pain Rating Scale (NPRS), which was used to assess the intensity of low back pain experienced by the nurses. The NPRS is a standardized and reliable tool that asks participants to rate their pain on a scale from 0 to 10, where 0 indicates no pain and 10 indicates the worst possible pain. The scores were interpreted as follows: 1–3 as mild pain, 4–6 as moderate pain, and 7–10 as severe pain. This tool was used both before and after the body mechanics training program to evaluate changes in pain levels.

VIII. DESCRIPTION OF THE INTERVENTION

The intervention in the experimental group was a 7-day body mechanics training program, delivered for one hour per day. The training included theoretical teaching, demonstrations, return demonstrations, and reinforcement sessions at the 2nd and 3rd week. The content covered spine anatomy, causes of low back pain, principles of body mechanics, safe lifting/transferring/posturing techniques, ergonomics, and five key exercises: knee-to-chest stretch, low back rotational stretch, lower back flexibility exercise, bridge exercise, and cat stretch. Nurses were instructed to perform the exercises 3–5 times, twice daily, for a week.

IX. INTERVENTION OF THE STUDY

Duration and Frequency

The training was conducted over seven consecutive days, with each session lasting approximately one hour per day. The exercise component of the program was to be practiced twice daily by the participants, with each movement repeated 3 to 5 times, based on the individual's comfort and capability.

Teaching Methodology

The intervention was delivered using a multi-modal approach to ensure maximum engagement and comprehension. It included lectures, group discussions, return demonstrations, video presentations, role play,

and interactive sessions. This diverse instructional method was chosen to accommodate various learning styles and reinforce both theoretical knowledge and practical skills.

Training Content

The content of the program was comprehensive and clinically relevant. It included:

- Anatomy of the spine and biomechanics of movement
- Common causes and risk factors for low back pain in nursing
- Principles of body mechanics applicable in clinical settings
- Correct techniques for lifting, transferring, and repositioning patients
- Ergonomic guidelines for ICU nurses during prolonged standing or bedside care

Therapeutic Exercises

A critical part of the training focused on five targeted therapeutic exercises aimed at reducing pain and improving flexibility and posture. These exercises were:

1. Knee-to-Chest Stretch – for spinal decompression
2. Low Back Rotational Stretch – for spinal mobility
3. Lower Back Flexibility Exercise – to increase range of motion
4. Bridge Exercise – for strengthening core and gluteal muscles
5. Cat Stretch – for promoting spinal flexibility and alignment

Reinforcement and Monitoring

To ensure retention and proper application, reinforcement sessions were conducted at the 2nd and 3rd weeks. Nurses were observed during their routine work to assess integration of body mechanics principles, and corrections were made if necessary.

Evaluation of Skill and Feedback

Each participant underwent a skills checklist-based evaluation, which included posture assessment, technique accuracy, and safe handling during simulated patient care activities. After completing the program, a feedback session was conducted to clarify doubts, reinforce concepts, and motivate nurses to adopt the practices in their daily routines.

The intervention concluded with a post-test assessment using the Numerical Pain Rating Scale (NPRS) and a structured questionnaire to evaluate changes in pain level and knowledge. The overall aim of the intervention was not only to reduce existing low back pain but also to build long-term preventive behaviors among ICU nurses through knowledge, skill, and regular exercise.

Content Validity: was established by submitting the tool and its blueprint to six experts in nursing and clinical practice. Their feedback and suggestions were incorporated to enhance the relevance, clarity, and adequacy of the tool items, ensuring alignment with study objectives.

Reliability of the tool, particularly the NPRS, was accepted based on previous studies that have validated its use in clinical research. In this study, test-retest and inter-rater reliability checks were conducted during the pilot phase to ensure consistency in measurement.

Ethical Considerations

All ethical considerations were strictly followed. Ethical clearance was obtained from the Institutional Review Board. Participants were informed about the purpose of the study, and their voluntary participation was ensured through written informed consent. Confidentiality and the right to withdraw at any time were also emphasized.

Method Of Data Collection

The method of data collection was systematic.

- After obtaining administrative permission, the investigator introduced herself to the participants and explained the study's purpose.
- Following informed consent, a pretest using NPRS was conducted.
- The body mechanics training program was then implemented over 7 days.
- A posttest using the same NPRS tool was conducted three weeks after the intervention to assess its effectiveness.

X. RESULT

The results of the study were organized into the following sections:

Section A: - Description of the demographic variable. Both groups showed a similar age pattern, with most

participants aged 32 to 41 years. The gender distribution was nearly balanced. There were slightly more females in the control group and more males in the study group. Educational backgrounds varied. The control group had more M.Sc. Nursing graduates, while the study group had more GNM nurses. The study group also had more experienced nurses, with many having over 3 years of experience. Dietary habits differed. Most people in the study group were vegetarian. Income levels in both groups mainly fell in the middle range. Prior exposure to body mechanics programs was higher in the study group. Most learned through formal training or practical demonstrations.

Section B: - Compare the pre-test level of low back pain among nurses working In Intensive Care Unit between the study and control group.

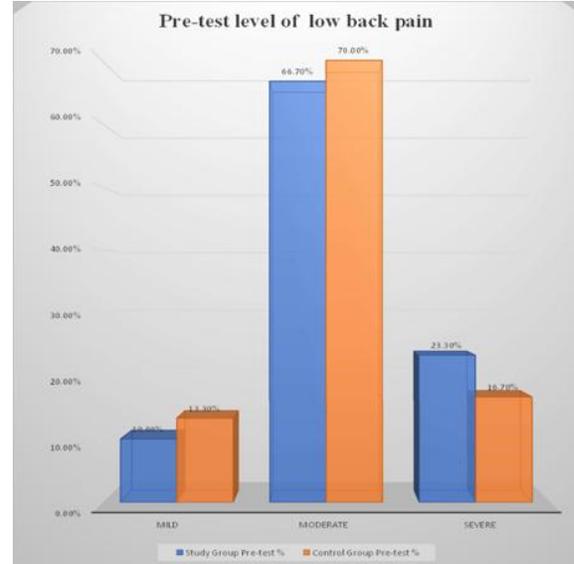


Figure: 3.1 Comparison of Pretest Scores Between Experimental and Control Groups.

Table 3.1: Comparison of Pretest Mean & S.D of the study subject in relation to Level of low back pain of research participants in Control group and Study group.

Variables	Control Group		Study Group N=30		t	df	p-Value
	Mean	SD	Mean	SD			
Pretest level of Pain	5.93	0.83	6.1	0.803	0.79	58	0.432

The comparison of pre-test pain levels between the control and study groups revealed that the mean pain score in the control group was 5.93 (SD = 0.828), while the study group had a slightly higher mean score of 6.10 (SD = 0.803). The independent t-test analysis showed a t-value of 0.792 with 58 degrees of freedom, and the p-value was 0.432. Since the p-value is greater than 0.05, the difference in pre-test pain levels between the two groups was not statistically significant, indicating that both groups were comparable at baseline in terms of pain intensity.

Section C: - Compare the post-test level of low back pain among nurses working In Intensive Care Unit between study and control group.

Table 3.2: Comparison of post-test Mean & S.D of the study subject in relation to Level low back pain of research participants in Control group and Study group.

Variables	Control Group N=30		Study Group N=30		t	df	p-Value
	Mean	SD	Mean	SD			
Post test level of Pain	5.43	1.14	2.9	0.923	9.49	58	<0.001

The post-test comparison of pain levels between the control and study groups demonstrated a significant difference. The control group had a mean pain score of 5.43 (SD = 1.135), whereas the study group reported a much lower mean score of 2.90 (SD = 0.923). The independent t-test yielded a t-value of 9.485 with 58 degrees of freedom, and the p-value was less than 0.001. This statistically significant result indicates that the intervention applied to the study group was highly effective in reducing pain levels compared to the control group.

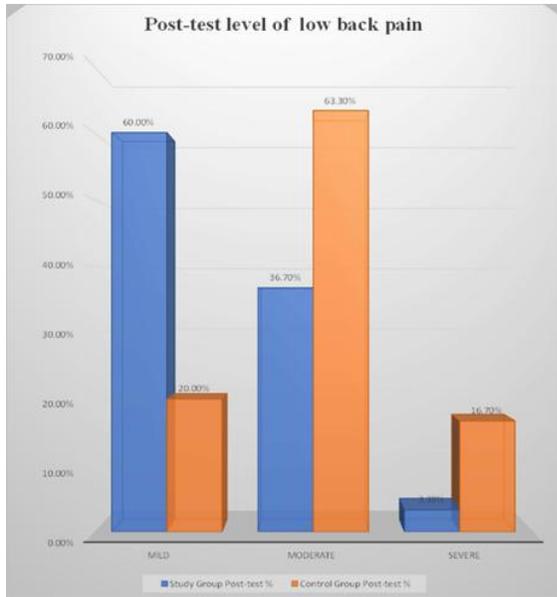


Figure 3.2 Comparison of Posttest Scores Between Experimental and Control Groups.

Section D: - Compare the pre-test and post-test level of low back pain among nurses working In Intensive Care Unit in study group.

Provides the statistical analysis of pre-test and post-test pain scores in the study group using a paired t-test. The mean pain score before the intervention was 6.10, which decreased to 2.90 after the intervention, resulting in a mean difference of 3.20. The standard deviation of the difference was 1.186, and the t-value was 14.777 with 29 degrees of freedom. The p-value was found to be less than 0.001, indicating a highly statistically significant reduction in pain levels.

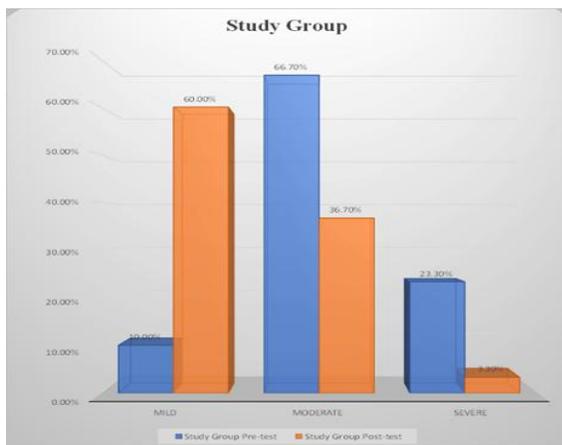


Figure 3.3 Comparison of Pre-tests and Post-tests level of low back pain among nurses working In Intensive Care Unit in study group.

Section E: - Associate between the pre-test and post-test level of low back pain among nurses working in ICU with their socio demographic variables in the study and control group.

In the study group had slightly higher baseline pain scores (Mean ≈ 6.0–6.3) compared to the control group (Mean ≈ 5.7–6.0). The chi-square (χ^2) analysis showed that income was significantly associated with pain levels in the study group ($p = 0.029$), while other variables such as age, gender, and ICU type did not show statistically significant associations in either group. These findings help understand the distribution and possible influence of demographic factors on low back pain among ICU nurses.

XI. DISCUSSION

Pre-test analysis showed no significant difference in low back pain between the study and control groups (mean scores 6.10 vs. 5.93, $p = 0.432$), confirming that both groups were equivalent at the start. This meant that any changes after the intervention could be linked to the training. Similar findings appeared in earlier studies that emphasized the need to establish baseline equality before interventions.

Post-test results showed a strong difference. The study group’s mean pain score fell to 2.90, while the control group stayed at 5.43. A t-value of 9.485 and $p < 0.001$ confirmed a significant effect of the body mechanics training. Sixty percent of the study group reported mild pain, compared to only 20 percent in the control group. This demonstrates the clear effectiveness of the intervention in reducing pain.

Looking at demographic variables, almost all had no significant effect on pain levels in either group, except for income in the study group during the pre-test ($p = 0.029$) and post-test ($p = 0.042$). Overall, the training was effective across different demographic subgroups, proving its broad applicability for ICU nurses.

Nursing Education

1. Integrate structured body mechanics training into nursing curricula at both diploma and degree levels.
2. Emphasize ergonomics and musculoskeletal safety during clinical skill labs.
3. Use simulation-based learning to demonstrate proper posture and lifting techniques.
4. Include case-based discussions on work-related injuries to promote preventive awareness.

5. Regularly update students on current best practices in occupational health safety.
6. Promote reflective practice on body posture during clinical rotations and internships.

Nursing Practice

1. Encourage nurses to apply correct body mechanics techniques during all patient care activities.
2. Promote the use of ergonomically safe equipment like patient transfer aids.
3. Reinforce stretching and strengthening exercises as part of daily nursing routines.
4. Foster a culture of self-care and musculoskeletal health awareness among staff.
5. Monitor and audit staff compliance with safe patient handling protocols.
6. Involve clinical mentors in demonstrating and correcting unsafe postures in real time.

Nursing Administration

1. Implement mandatory body mechanics workshops for ICU and high-risk units.
2. Schedule regular refresher training sessions on ergonomic practices.
3. Invest in ergonomically designed workspaces and lifting aids.
4. Track injury reports and absenteeism to assess training impact.
5. Encourage interdisciplinary collaboration to promote a culture of safety.
6. Allocate budget for continuous staff development on occupational health.

Nursing Research

1. Conduct longitudinal studies to assess the sustainability of body mechanics training.
2. Explore the impact of ergonomic training on nurse retention and job satisfaction.
3. Compare different training modalities (e.g., video-based vs hands-on).
4. Investigate barriers to implementation of body mechanics in daily practice.
5. Evaluate outcomes in different hospital settings and specialties.
6. Study the cost-benefit analysis of preventive training vs injury treatment.

XII. LIMITATIONS

1. The sample size was limited to 60 participants from a single institution.
2. The study duration was short; long-term outcomes remain unknown.
3. Self-reported pain levels may introduce response bias.
4. Demographic homogeneity may limit generalizability.
5. No blinding or randomization could allow unmeasured confounding factors.
6. The study focused only on ICU nurses, excluding other high-risk departments like orthopedics and emergency.
7. Environmental and organizational factors (e.g., workload, staffing ratio) were not controlled.
8. The intervention's effectiveness may have been influenced by participant motivation and attendance.

Recommendations for future research

- Expand sample size and multi-center participation.
- Use objective physical assessments along with self-reports.
- Conduct longitudinal studies to measure sustained effects.
- Explore cost-benefit analysis of periodic training.
- Investigate effectiveness across different nursing specialties.
- Study psychological and psychosocial factors affecting pain perception and training.

Suggestions

- Develop institutional protocols for ergonomic training.
- Incorporate short exercise breaks in ICU schedules.
- Encourage nurses to self-monitor posture and report discomfort early.
- Establish peer-training modules for continuous reinforcement.
- Promote collaborative research across institutions for broader policy impact.
- Display ergonomic posters and reminder signage in ICU units to reinforce correct posture.

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