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Research Article

Pressure Pain Threshold Maps and Self-Assessed Musculoskeletal Discomfort Among ER Nurse II in a Tertiary Hospital in Iloilo City, Philippines

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Abstract

Introduction: Emergency room nurses frequently perform physically demanding tasks, placing them at high risk for Work-Related Musculoskeletal Disorders (WMSDs). These persistent aches and pains can significantly impact their well-being and ability to provide critical care. This study investigates regional pain sensitivity in this group.

Objectives: This study generated and illustrated Pain Pressure Threshold (PPT) maps of the low-back region for ER nurses and quantify PPT values. Finally, it correlated these values with demographic, work-related factors, and self-reported discomfort.

Methods: Conducted from January to April 2025 at a tertiary hospital in Iloilo City, Philippines, the study included seven ER nurses. PPT was measured at the tibialis anterior (control) and low-back regions using a digital algometer. Heat maps were generated to visualize pain sensitivity. Questionnaires collected demographic and work-related data, and self-reported musculoskeletal pain. Kendall's Tau-b correlation analysis was performed.

Results: PPT heat maps revealed hyperalgesia primarily in the central, left, and right lower back. Correlation analysis showed a significant negative correlation between age and pain sensitivity at specific low-back points.

Conclusion and Recommendations: Despite the small sample size, the study provides preliminary evidence that age may influence regional pain sensitivity in ER nurses, as visualized in PPT heat maps. Further research with larger samples is recommended to validate these findings and inform interventions to reduce musculoskeletal discomfort.

Keywords: Pressure Pain Threshold, Mapping, ER nurse, Musculoskeletal discomfort, Work-related musculoskeletal disorders

Introduction

Musculo Skeletal Disorder (MSD) is a connective tissue condition that results in muscular discomfort or damage because of abrupt or repetitive pressure, exertion, tension, vibration, or inappropriate postural changes [1]. Work-Related Musculoskeletal Diseases (WMSDs) are primarily caused or exacerbated by work-related activities and involve various bodily components, including tendons, joints, muscles, and nerves; often affecting those of the upper, lower, and middle limbs, and the back and neck [2]. Repetitive hand or arm motions (65%) are the most often cited risk factor in the EU-27, according to the 2019 European Survey of Enterprises on New and Emerging Risks by the EU-OSHA [3] Other MSD hazards include extended sitting (61%), lifting or moving persons or large goods (52%), time pressure (45%), and exhausting or unpleasant situations (45%).

Work-related musculoskeletal disorders are common among healthcare professionals, especially those in direct contact with patients, such as surgeons, nurses, and therapists, with over 80% prevalence [4-6]. The incidence of musculoskeletal pain is particularly high in nurses as their physical duties include frequent manual lifting of patients, often involving awkward body postures. These tasks are usually performed without help from colleagues or use of adequate lifting equipment; therefore, carrying a high risk of developing musculoskeletal problems and soft-tissue injuries to the back [7]. MSDs in the lower limbs were found to be of highest prevalence among nurses while in the lower back, its prevalence is more than 50% [8]. It is thought that the quality of the work and working conditions of the nurses are related to the frequency of musculoskeletal pain [9]. Numerous research has demonstrated the detrimental effects WMSDs have on nurses. Among which are more sick days taken annually, early retirement, and poor health.4 WMSDs are also associated with increased turnover tendency, depression risk, and a decreased quality of life [10]. Additionally, WMSDs have been linked to a decline in care quality, sick days, and patient safety concerns [11].

Filipino nurses face significant health and safety issues in the Philippines. About 40% reported being ill or injured at least once in the previous year, and 80% reported having back pain [12]. Nurses, especially in the intensive care unit, have been well documented to complain of experiencing WMSDs due to their hectic schedule and stressful environments. Similarly, nurses working in the emergency department are also at high risk, as they handle various critical cases and catastrophic injuries. ER nurses oversee transferring patients in and out of bed, lifting patients onto a bed and these tasks require them to continually maintain bent-forward, twisted, and other awkward, non-ergonomic postures. This exposes them to higher risk of developing MSDs with a positive correlation between work demand and severity of pain [13].

To quantify mechanical hyperalgesia, defined as increased pressure sensitivity, semi-objective criteria, such as Pressure Pain Threshold (PPT) measurements, are often used [14]. PPT mapping is beneficial in detecting multiple areas of pain sensitivity as well as the underlying mechanical hyperalgesia [15,16,17]. The trapezius muscle, especially its upper part which encompasses the shoulder blade and neck regions, is more sensitive to pressure than its other subdivisions, such as the lower and middle areas. Similarly, differences in PPT have been discovered across muscle groups in the lower back [18].

It is known that the implementation of ergonomic principles and use of lifting aids lead to safe patient handling and a reduction in the physical burden on musculoskeletal systems; furthermore, it promotes patient self-mobility and independence [9]. By learning and adopting the right body posture and ergonomics skills, the everyday load on the spine could be decreased, which, in turn, decreases the pain. Decreased disability may have to do with the adoption of the right body posture and consequently, with decreased pain, as well as with the practice of functional exercises and a spine-friendly lifestyle, which decrease the load on the spine [19].

There have been a few types of research that have looked at MSD effects in nurses. Currently, there have been few studies on nurses in Iloilo City, Philippines, despite the number of hospitals in the city. This study will pioneer investigations on MSDs in nurses, especially from the emergency department.

General Objective

The study aimed to create pain pressure threshold maps of the low-back regions and investigate self-assessed musculoskeletal discomfort symptoms among ER nurses (II) from a tertiary hospital in Iloilo City, Philippines.

Specific Objectives

The study specifically aimed to:

a) Generate pain pressure threshold (PPT) maps in the low-back region for ER nurses (II),

b) Illustrate the PPT maps of ER nurses (II),

c) Quantify the PPT values of ER nurses (II), and

d) Correlate sex, age, BMI, job seniority, and weekly hours worked with the PPT values and self-reported musculoskeletal discomfort variables.

Materials and Methods

Overview

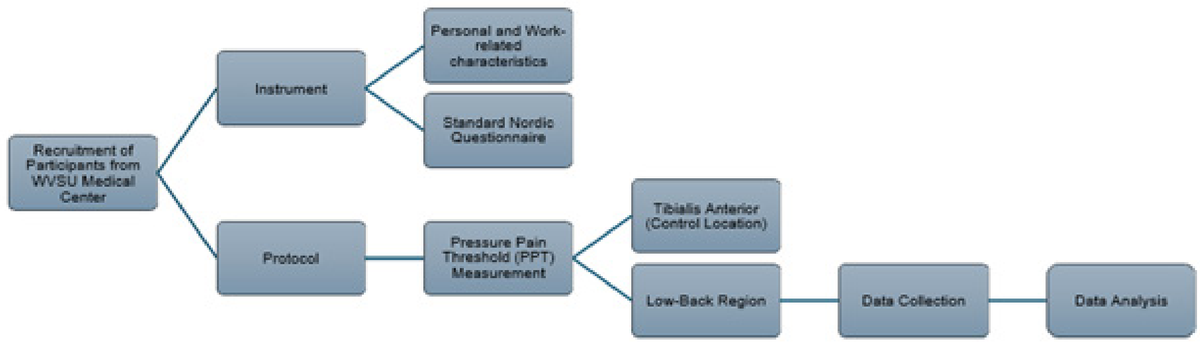

Figure 1: Flowchart of the study.

Figure 1 outlined the step-by-step process for measuring Pain Pressure Thresholds (PPT) and assessing self-reported discomfort among ER nurses. Participants completed a standardized self-administered questionnaire on well-being, employment factors, and Musculo Skeletal Disorders (MSDs). Data was collected at a single time point, with measurements taken after their shift to capture post-work musculoskeletal pain. The study recruited Emergency Room (ER) nurses from the WVSU Medical Center in Iloilo City, Philippines. A digital algometer was used to measure Pressure Pain Threshold (PPT) at the tibialis anterior (control location), and the low-back region.

Subjects and Materials

Participants

The study was conducted from January to April 2025 at the WVSU Medical Center in Iloilo City, Western Visayas, Philippines. The target population included ER nurses from the medical center. Participants that were categorized as Nurse II were included in the study. This was done to homogenize the nurses according to their work requirements in the hospital setting. Participants were assessed based on their post-work musculoskeletal pain status, as determined by a screening questionnaire administered after their shift. Inclusion and exclusion criteria are outlined in (Table 1).

Table 1: Inclusion and exclusion criteria for the study.

Inclusion Criteria	Exclusion Criteria
ER Nurse from West Visayas State University Medical Center, Iloilo City, Philippines	Diagnosed neurological conditions affecting pain perception
Should be a Nurse II	Current use of pain medications
	Recent injuries to the tested areas

Nurses in critical care settings, particularly in high-intensity settings such as the Emergency Room (ER), are more likely to experience musculoskeletal disorders due to the physically demanding nature of their work. Inclusion criteria included ER nurses from West Visayas State University Medical Center. The definitive exclusion criteria were diagnosis of neurological conditions affecting pain perception, current use of medications, and recent injuries to the tested areas.

Sampling Design

To ensure representativeness of the ER nursing population, all 15 ER nurses classified under the Nurse II position were invited to participate in the study. However, only seven nurses consented to take part and were subsequently included in the final analysis. These participants form the basis of the study findings and provide valuable insight into the experiences and conditions relevant to the Nurse II cohort in the Emergency Room setting.

Sampling Frame and Participant Selection

The sampling frame comprised all nurses who met the study's inclusion criteria and were actively working in the ER unit during the study period (January to April 2025). A total of fifteen nurses were classified as Nurse II, all of whom were provided with consent forms and evaluated based on the predefined inclusion and exclusion criteria.

Sampling Methodology Consistency

To ensure consistency in data collection, all Pressure Pain Threshold (PPT) assessments were conducted uniformly post-shift, immediately after each nurse's duty. This standardized timing aimed to minimize variability due to work-related fatigue that may affect pain sensitivity. All assessments were performed in a designated room within WVSUMC, ensuring a controlled and consistent environment for data collection.

Study Site

The research was conducted at the West Visayas State University Medical Center (WVSUMC) in Iloilo City, Philippines. WVSUMC is a government-owned, tertiary-level teaching and training hospital affiliated with West Visayas State University. It serves as a clinical training facility for students in medicine, nursing, and other allied health programs. It serves as a critical hub for advanced medical care and academic excellence in the region, which aligned with the objectives of this study.

Informed Consent Procedure

The informed consent process was illustrated in Figure 2. The researchers collaborated closely with the hospital administration to ensure that entry to the vicinity and contact with the study population were with due permission and abided by the rules and regulations of the institution. Permission to conduct the research among the study population and within the hospital grounds was acquired from the medical center chief.

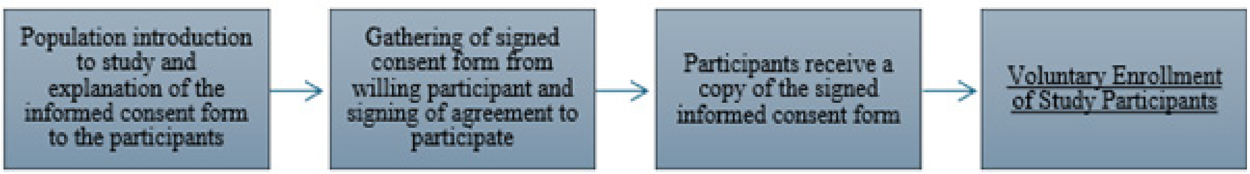

Figure 2: Flow of informed consent process of the study.

The researchers explained the contents of the informed consent form and ensured that all concerns raised by the research subjects regarding their participation in the study were addressed prior to signing. Each participant was given a copy of their signed consent form. The final research participants were selected from individuals who provided informed consent. Lastly, the research participants did not receive any financial incentives for participation. They were given the option to withdraw at any point during the conduct of the study without needing to provide any reason or justification for their decision (Figure 2).

Data Collection Plan

Personal Data Gathering

The researchers gathered the following personal and work-related data:

i. Demographic information: age, gender, height (feet), and weight (kilograms)

ii. Work-Related Information: unit of assignment, duration of experience (years, months), weekly working hours

iii. Health and Pain-Related Information: self-reported musculoskeletal pain within the last 12 months and within the last 7 days

Questionnaire Administration

Data was collected in a designated, quiet room at the West Visayas State University Medical Center to ensure participant comfort and minimize distractions. Questions and PPT measurements were conducted immediately after work shifts to accurately capture post-work musculoskeletal pain. The duration of questionnaire completion was 5-10 minutes, and PPT measurements were approximately 45 minutes per participant. The completion of the self-administered questionnaire in paper format was under the researcher's supervision and completed forms were reviewed on-site to ensure all responses were clear and complete.

Data Authentication and Validation

To ensure accuracy and consistency of collected data, the researchers clarified any unclear questions during the process, completed questionnaires were reviewed at once for completeness and correctness, the same researchers conducted the Pressure Pain Threshold (PPT) measurements to reduce variability.

Duration of Participant Involvement

The extent of human participation in this study involved a single session lasting 1 hour conducted immediately after the participants shifts. This included time for completing the study tools and measurements, ensuring minimal disruption to participants' schedules. The streamlined process was designed to reduce burden while collecting high-quality data within the data collection period of January to May 2025.

Procedures

Instrumentation

Personal and Work-related Characteristics: a form was distributed to participants, gathering information on age, gender, height, weight, work duration, weekly working hours, and experienced musculoskeletal pain, if any. A cover letter explaining the study procedures was also provided (Appendix A). Musculoskeletal Disorders (MSDs): The Standardized Nordic Questionnaire, adopted from Kuorinka et al. (1987), was used as the diagnostic tool [20] This self-reported questionnaire assessed pain in specific regions of the body (Appendix B).

Protocol

Pressure Pain Threshold (PPT) Measurement: A portable algometer (Wagner Pain TestTM FPX) was used to measure the participant's PPT. The examiner applied steady pressure perpendicularly to the skin using the algometer's broad rubber tip. Upon the initial perception of pain, participants self-initiated termination of the experimental procedure by employing a termination signal of their choice. The pain pressure value was recorded in pound-force (lbf). An initial measurement of PPT was taken on the tibialis anterior, directly lateral to a point located 10 cm distal to the tibial tuberosity. This served as the control point. A total of 27 measurement points were then assessed in the low-back region (see in Figure 3), following a protocol established in previous research.18 The PPT measurement were done in three trials and the mean of the measurements were calculated. Normalized PPT values were obtained by subtracting the pain pressure measurement in the low-back region from the control point value. A positive value indicated hyperalgesia, and a negative value indicated otherwise (Figure 3).

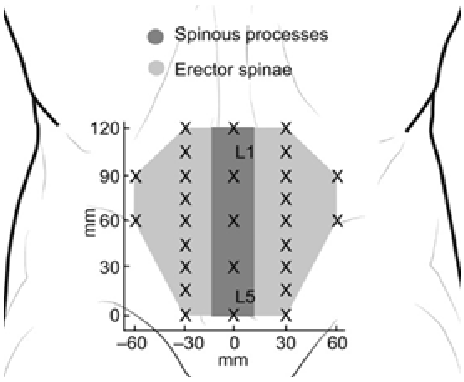

Figure 3: Points of assessment for topographical pressure pain sensitivity maps of the low back region [18].

Mapping

PPT maps were generated using HeatMapper.ca to visualize both individual and group data. Standard deviation values, calculated from each individual's mean PPT, were used to represent deviations from the control. A color scale was applied: yellow indicated increased sensitivity (hyperalgesia), while blue represented normal or decreased sensitivity. The intensity of the color corresponded to the magnitude of deviation from the control, with higher intensity reflecting greater hyperalgesia.

Data Analysis

To address the research objectives, the following analyses were conducted:

a) PPT maps were generated for each participant using HeatMapper.ca and visualized to identify patterns and regional differences for the ER nurses [18].

b) Mean PPT values for specific low-back regions (left side lumbar, right side lumbar, spinal processes L1-L5, and a control point) were calculated.

c) Kendall's-Tau B correlation was employed using IBM SPSS to investigate the relationships between:

i. PPT values for each region and demographic/work-related factors (sex, age, BMI, job seniority);

ii. PPT values and self-reported pain.

Kendall's Tau-B correlation was employed as a non-parametric alternative to assess the association between pain pressure threshold and other variables. The test was favored over other statistical tools due to its suitability for non-normally distributed data, ordinal variables, and small sample sizes. The strength and direction of the relationships were assessed, and statistical significance was set at p≤0.05 for all analyses [18].

Ethical Considerations

The ethical considerations in the study prioritized the protection of participants' rights, safety, and privacy. The research required approval from the institution's ethics committee, which ensured adherence to ethical guidelines. Participants were informed about the study's purpose, procedures, and potential risks through an informed consent process, which emphasized voluntary participation and the right to withdraw at any time without repercussions. To maintain confidentiality, the study employed data encryption and password protection to safeguard personal information, which ensured anonymity in all reported results. Additionally, while the research involved pain threshold assessments, measures were in place to minimize discomfort, and participants were given the autonomy to stop the assessment if it became intolerable. These ethical protocols demonstrated a commitment to respecting participants' autonomy, ensuring informed consent, and maintaining confidentiality throughout the research.

Results

This study investigated the relationship between demographic and work-related factors and regional pressure pain sensitivity, operationalized using pain deviation scores, in a population of 17, only sample of 7 Emergency Room (ER) nurses agreed to be tested (Table 2).

Table 2: Characteristics (mean±SD) of the patients.

Parameters	Average with standard deviation
Age	40.3±7.1
Height (cm)	165.8±6.5
Weight (kg)	82.3±17.7
Body mass index	29.9±6.9
Gender	6 male, 1 female
Years of Work Experience	13.7±5.3

As seen in Table 2, The presented demographic and anthropometric data pertain to a small cohort of seven individuals, predominantly male (six males and one female). This group exhibits an average age of approximately 40 years and four months (40.3±7.1 years), suggesting a middle-aged demographic with a moderate degree of age variability within the group. Their professional experience, as indicated by job seniority, averages nearly 14 years (13.7±5.3 years), implying a relatively experienced workforce with a similar level of variability in tenure.

In terms of physical characteristics, the average height of the group is approximately 1.66 meters (165.8±6.5 cm), with a relatively tight distribution around this mean. The average weight is notably higher at 82.3 kilograms (±17.7kg), exhibiting a larger standard deviation which suggests a greater range in body mass among the individuals. Consequently, the calculated average body mass index (BMI) for the group is 29.9 kg/m^2 (±6.9kg/m^2). According to standard BMI classifications, a value of 29.9 falls within the upper end of the overweight category, bordering on obesity. The substantial standard deviation for weight and BMI indicates considerable heterogeneity in body composition within this small sample. Pain deviation scores were calculated for each of the 27 measurement points as the difference between a control average Pressure Pain Threshold (PPT) and the participant's PPT at that point (Deviation Score = Average Control PPT - Participant PPT). Lower deviation scores indicate higher PPT (lower pain sensitivity) relative to the control average. Averages of these scores were calculated for the left (points X1, 3, 5, 7, 9, 11, 13, 15, 17, 26, 27), right (points X2, 4, 6, 8, 10, 12, 14, 16, 18, 24, 25), and center low-back regions (points X19, 20, 21, 22, 23).

Normalized Pressure Pain Threshold Mapping

(Table 3) presented the average normalized PPT values for each of the 27 measurement points in the lower back region across the 7 participants. Positive normalized PPT values indicate areas with increased pain sensitivity, suggestive of hyperalgesia. The results reveal that regions exhibiting hyperalgesia are primarily located in the central lower back (points X21 and X22), the left lower back (points X26 and X27), and the right lower back (points X24 and X25). In contrast, the remaining measurement points demonstrated negative normalized PPT values, indicating lower sensitivity relative to the mean.

Table 3: Average of Normalized PPT of the 27 lower-back region points.

Point	Average of Normalized PPT	Point	Average of Normalized PPT
X1	-2.25	X15	-3.22381
X2	-3.73095	X16	-3.67619
X3	-3.9381	X17	-4.3
X4	-3.25714	X18	-4.50476
X5	-1.95714	X19	-1.22143
X6	-3.30714	X20	-0.2381
X7	-2.42381	**X21**	**0.747619**
X8	-2.58095	**X22**	**1.969048**
X9	-1.65952	X23	-1.43476
X10	-2.40952	**X24**	**1.830952**
X11	-1.94286	**X25**	**1.15**
X12	-3.44524	**X26**	**1.616667**
X13	-2.28571	**X27**	**1.290476**
X14	-3.08333		

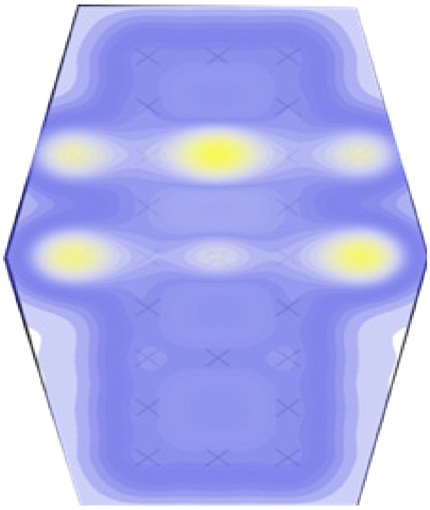

Figure 4: Pressure Pain Threshold Mapping of Normalized PPT Values (n=7).

(Figure 4) displays a heat map generated using the average normalized PPT values from the 27 measurement points across the 7 participants. In the map, blue-colored points represent negative normalized PPT values, while yellow-colored points indicate positive values, corresponding to regions with suggestive hyperalgesia. Six specific sites on the lower back are marked yellow: the central lower back (points X21 and X22), the right lower back (points X24 and X25), and the left lower back (points X26 and X27). The remaining points, associated with negative normalized PPT values, are shown in blue (Table 4).

Table 4: Correlation Coefficient of Profiling Variables and Deviation X1 - X27 (Using Kendall's Tau - b).

Point	Gender	Age	Height	Weight	BMI	Years of work	Lower Back Pain	12 months Pain	7 days Pain
X11	0.471	-.775*	0.265	0	0	-0.68	0.417	0.471	0.471
X22	0.354	-.710*	0.066	0.252	0.252	-0.408	0.167	0.354	0.354
X24	0.354	-.710*	0.066	0.252	0.252	-0.408	0.167	0.354	0.354

As seen in Table 4, age exhibited a strong and statistically significant negative correlation with points X11 (τb=−0.775), X22 (τb=−0.710), and X24 (τb=−0.710), as indicated by Kendall's Tau-b correlation coefficients and corresponding p-values (p=0.032 for X11 and p=0.05 for X22 and X24, all p<0.05). Furthermore, the data revealed that respondents presenting with hyperalgesia were, on average, 9 to 10 years younger than those without.

(Table 5) shows that of the seven respondents, three patients (43%) exhibiting hyperalgesia at point X11 were significantly younger (mean age 33.33±3.51 years) compared to the four patients without hyperalgesia at this point (mean age 43.00±7.35 years). A similar trend was observed for points X22 and X24, where patients with hyperalgesia presented with a younger mean age (34.75±4.03 years) compared to those without (44.33±8.39 years). Findings for the remaining assessment points did not reach statistical significance and are detailed in Appendix D.1 and D.2.

Table 5: Correlation P-Values of Profiling Variables and Normalized PPT values for X1 - X27 (Using Kendall's Tau - b).

Point	Gender	Age	Height	Weight	BMI	Years of work	Lower Back Pain	12 months Pain	7 days Pain
X11	0.248	0.032*	0.471	1	1	0.067	0.307	0.248	0.248
X22	0.386	0.050*	0.857	0.48	0.48	0.271	0.683	0.386	0.386
X24	0.386	0.050*	0.857	0.48	0.48	0.271	0.683	0.386	0.386

Discussion

This study aimed to explore the relationship between Pressure Pain Threshold (PPT) mapping and self-assessed musculoskeletal discomfort among Emergency Room (ER) nurses in a tertiary hospital in Iloilo City, Philippines, aiming to understand pain distribution and sensitivity in this demanding profession. Given the prevalence of WMSDs in nursing, particularly in high-stress ER environments, identifying PPT patterns could inform occupational health interventions and ergonomic improvements.

This study built upon prior research particularly that of Binderup et al. (2011), who utilized high-density Pressure Pain Threshold (PPT) mapping to show strong links between low PPTs and higher self-reported pain in cleaners, especially in the neck, shoulder, and upper back, which are areas commonly affected by repetitive and physically demanding work [14,21] While their study population consisted of cleaners with relatively homogenous work tasks and low physical variation, our investigation focused on Emergency Room (ER) nurses, a group similarly exposed to repetitive movements, static postures, and physically demanding patient care tasks, but within a dynamic and high-stress healthcare environment [22] The lack of local studies on PPT and WMSDs among Filipino nurses highlights the relevance of this research in guiding clinical and policy level interventions.

The primary finding exhibited regions with heightened sensitivity interpreted as mechanical hyperalgesia in the central (points X21 and X22), right (points X24 and X25), and left (points X26 and X27) lower back. This observed heterogeneity in pain sensitivity across the lower back aligns with previous research employing PPT mapping techniques in various body regions, including the neck-shoulder and lower back [16,23]. Affected areas correspond anatomically to structures commonly involved in low back pain, such as the erector spinae, facet joints, and interspinous ligaments. Positive normalized values indicated these regions required less pressure to elicit pain, confirming localized hyperalgesia. The correlation analysis between age and average low-back pain deviation scores, particularly in points X11, X22, and X24 indicates that younger subjects are more susceptible to acquiring hyperalgesia than older subjects. Existing literature suggests that higher thresholds for mild pain developing with advancing age are due to physiologic changes in the pain processing pathways in the peripheral and central nervous system that occur with natural aging, such as reduced A-delta nerve fibers and increased glial cell activity, which alter pain processing [24,25].

Additionally, work-related factors may also play a role. The "healthy worker effect" was first described suggests that individuals who remain employed in demanding occupations as they age are likely to be healthier and more resilient, potentially including a higher pain tolerance due to a "survival effect" where those less tolerant may have left the workforce or transferred to less physically demanding stations [26]. Therefore, observed higher pain thresholds in older working populations might be partly attributed to this selection bias, where a less pain-sensitive cohort remains employed.

No significant correlation was found between sex and PPT, aligning with foam rolling studies that showed no sex-based differences in PPT response [27]. However, other literature shows that males generally have higher PPTs than females, suggesting increased pain sensitivity in females due to hormonal influences, nervous system differences and social gender roles [28,29]. The discrepancy between our findings and previous literatures may be explained by our small sample size, which includes only one female and 6 males, limiting statistical power to detect significant differences. Further studies with a larger and more balanced sample size are needed to better explore the relationship between sex and normalized PPT.

Similarly, no significant correlation emerged between BMI and PPT. This might reflect the limitations of BMI itself, as it does not distinguish lean versus fat mass.30 While obesity can involve inflammatory processes potentially heightening pain sensitivity, factors like muscle mass could offer support. Existing evidence on the link between body composition and pain sensitivity remains conflicting, with some studies finding no difference in pain sensitivity based on obesity in otherwise healthy individuals [30-32].

Furthermore, years of work experience also showed no significant correlation with PPT. This aligns with findings suggesting pain thresholds might be shaped more by early life factors or genetics than cumulative job exposure [33] Studies on Temporo Mandibular Disorders (TMD) also found duration of pain did not significantly affect PPT [34] Supporting this, large scale studies like the Raine Study also found no association between chronic pain history and mechanical pain sensitivity, emphasizing that pain experience does not necessarily predict mechanical thresholds [35]. Furthermore, psychosocial factors like menstrual pain, and central sensitization, resilience, optimism, and mental toughness, rather than just time on the job, are known to influence pain tolerance and perception [36,37].

Overall, the findings highlight the multifactorial nature of pain sensitivity and suggest that effective interventions must go beyond physical ergonomics to include psychosocial support and individualized strategies.

Conclusion and Recommendations

The study revealed heightened pain sensitivity, indicative of mechanical hyperalgesia, in the central, right, and left lower back, consistent with the heterogeneous nature of pain sensitivity. The localization of hyperalgesia to anatomical structures commonly involved in low back pain highlights the clinical importance of pain mapping to identifying distinct zones of altered nociception for improved diagnosis and treatment.

The correlation analysis in this preliminary study, despite being limited by a very small sample size which restricts statistical power and generalizability, reveals a notable inverse relationship between age and pain sensitivity at specific lower back points, with younger participants showing greater pain deviation scores. However, while statistically significant within this small, predominantly male sample, these age-related correlations require cautious interpretation and further investigation using more representative samples to confirm broader trends.

To validate these findings and improve generalizability, future research should include larger, demographically diverse, and gender-balanced samples of ER nurses. Researchers should consider using both absolute and normalized Pressure Pain Threshold (PPT) values to enhance understanding of pain sensitivity and apply clear and specific inclusion and exclusion criteria. For instance, researchers may include active ER nurses aged 25 to 55 with more than 1 year of experience and exclude individuals on chronic pain medication, those with recent injuries, or individuals diagnosed with fibromyalgia or other chronic pain syndromes. Specifying these criteria will minimize the influence of confounding factors, leading to a more homogenous study group and therefore enhance the internal validity and clarity of the research outcomes. Additionally, expanding research to other high-risk healthcare workers, such as ICU nurses, surgeons, and therapists, is also recommended.

In clinical settings, targeted ergonomic interventions should be implemented, focusing on the lower back through safe patient-handling protocols, adjustable equipment, and ergonomics-focused training. Early screening for musculoskeletal discomfort, particularly among younger nurses, is encouraged. Integrating PPT assessments into routine occupational health checks may aid in early detection and intervention. At the policy level, findings can inform workplace reforms aimed at preventing musculoskeletal disorders, including improved staffing, access to lifting aids, and adequate rest periods. Health agencies should consider adopting PPT-based tools to enhance WMSD monitoring. Lastly, these insights can can guide both institutional and systemic efforts to promote safer, more ergonomically sound environments across healthcare settings.

Acknowledgements

None.

Conflict of Interest

None.

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