

**Original Article**

# Effectiveness of Progressive Muscle Relaxation on Pain and Sleep Quality in Lung Cancer Patients Undergoing Chemotherapy: A Quasi-Experimental Study



Mira<sup>1</sup>, Izma Daud<sup>1</sup>, Laiya Ruwaida<sup>1</sup>, Mahmud<sup>1</sup>, Mahrida Dwi Ariyani<sup>1</sup>

<sup>1</sup> Department of Nursing, Faculty of Nursing and Health Sciences, University of Muhammadiyah Banjarmasin, Banjarmasin, South Kalimantan, Indonesia

**ARTICLE INFO****Article History**

Submit : August 17, 2025  
Accepted : October 30, 2025  
Published : November 7, 2025

**Correspondence**

Mira; Department of Nursing, Faculty of Nursing and Health Sciences, University of Muhammadiyah Banjarmasin, Banjarmasin, South Kalimantan, Indonesia.

**Email:**

mira28@umbj.ac.id

**Citation:**

Mira, M., Daud, I. ., Ruwaida, L. ., Mahmud, M., & Ariani, M. D. (2025). Effectiveness of Progressive Muscle Relaxation on Pain and Sleep Quality in Lung Cancer Patients Undergoing Chemotherapy: A Quasi-Experimental Study. *Journal of Applied Nursing and Health*, 7(3), 432-441. <https://doi.org/10.55018/janh.v7i3.395>

**ABSTRACT**

**Background:** Pain and sleep disturbances are common among lung cancer patients undergoing chemotherapy, negatively affecting comfort and quality of life. Progressive Muscle Relaxation (PMR) is a non-pharmacological intervention that potentially alleviates these issues. However, few studies have specifically examined the effects of PMR on chemotherapy-induced symptoms in lung cancer patients, particularly in Indonesia.

**Methods:** A quasi-experimental pretest-posttest study with a control group was conducted in Banjarmasin, Indonesia, involving 60 purposively selected lung cancer patients. Participants were assigned to an intervention group (n = 30) and a control group (n = 30). The intervention group performed daily PMR exercises for 14 consecutive days, while the control group received standard care. Pain was measured using the Numeric Rating Scale (NRS), and sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Data were analyzed using the Wilcoxon signed-rank test, and ethical approval was obtained from the institutional review board.

**Results:** Demographic characteristics were comparable between groups. After the intervention, pain levels decreased significantly in the intervention group, with 40% reporting mild pain and 53.3% moderate pain, compared to the control group, where 66.7% reported moderate pain and 33.3% severe pain. All participants in the intervention group achieved good sleep quality, while no improvements were observed in the control group. Between-group differences were statistically significant ( $p < 0.05$ ).

**Conclusion:** PMR effectively reduces pain and improves sleep quality in lung cancer patients undergoing chemotherapy. This study provides new evidence on the application of PMR in supportive care for lung cancer patients in Indonesia.

**Keywords:** Progressive Muscle Relaxation; Autogenic Training; Lung Neoplasms; Pain; Sleep Quality.

**Implications for Practice:**

- PMR is a simple, low-cost, and feasible intervention that can be integrated into routine nursing care, particularly in resource-limited or low- and middle-income settings.
- It empowers patients to self-manage pain and sleep disturbances, reducing dependence on medications and supporting holistic care.
- Incorporating PMR training into nursing practice and education can enhance symptom management and improve quality of life for cancer patients.

## Introduction

Lung cancer is one of the most prevalent and deadly types of cancer worldwide, including in Indonesia. According to the World Cancer Research ([Fund, 2023](#)) lung cancer ranks first in global cancer-related mortality, with 2.5 million new cases and 1.8 million deaths annually. GLOBOCAN data reports that between 2018 and 2022, Indonesia recorded 38,904 new cases of lung cancer, representing 9.5% of total cancer cases, second only to breast cancer ([Ferlay et al., 2024](#)). In South Kalimantan alone, 180 new lung cancer cases were reported in 2023 ([Data Kalsel, 2024](#)).

Patients undergoing chemotherapy for lung cancer frequently experience chronic pain and sleep disturbances as common treatment-related side effects. Pain may result from tumor progression or chemotherapy-induced neuropathy, while sleep disturbances are often exacerbated by psychological stress and medication side effects. The coexistence of pain and poor sleep significantly reduces patients' quality of life, hinders recovery, and increases the risk of anxiety and depression ([Duan & et al., 2022](#)).

Current management strategies rely primarily on pharmacological interventions, such as opioids, non-steroidal anti-inflammatory drugs (NSAIDs), and sedatives. However, these treatments carry risks, including dependency, gastrointestinal problems, and cognitive impairment ([Mestdagh et al., 2023](#); [O'Regan & et al., 2025](#)). Non-pharmacological interventions, such as music therapy, acupuncture, and breathing relaxation techniques, have been explored, but findings are inconsistent, and few studies have addressed both pain and sleep disturbances in lung cancer patients ([Gündogdu & Koçasli, 2023](#); [Li et al., 2025](#)).

Progressive Muscle Relaxation (PMR) is a relaxation technique involving systematic

tensing and releasing of specific muscle groups to reduce muscle tension and stress responses. Previous research has shown that PMR can reduce pain and anxiety in breast cancer patients and individuals with chronic pain ([Kartika et al., 2022](#); [Pambudiarto & et al., 2024](#)).

Nevertheless, evidence regarding the effectiveness of PMR in lung cancer patients undergoing chemotherapy particularly in Indonesia remains scarce.

This study was guided by the biopsychosocial model, which emphasizes the interaction between biological symptoms (pain), psychological responses (stress, anxiety), and social functioning (quality of life). By applying this framework, PMR is expected to alleviate pain and improve sleep through stress reduction and relaxation mechanisms. Therefore, this study aimed to examine the effectiveness of Progressive Muscle Relaxation (PMR) in reducing pain and improving sleep quality among lung cancer patients undergoing chemotherapy in Indonesia.

## Methods

### Study Design

This study employed a quasi-experimental design with a pretest-posttest control group format. The intervention group received Progressive Muscle Relaxation (PMR) therapy over a 14-day period, while the control group received standard care without PMR. Pain intensity and sleep quality were measured at baseline (pretest) and after the intervention (posttest) in both groups.

### Participants

The study population comprised 150 lung cancer patients undergoing chemotherapy at RSUD Ulin Banjarmasin, Indonesia. Participants were recruited using purposive sampling based on specific inclusion and exclusion criteria. Eligible participants were adults aged 18 years or

older who were undergoing chemotherapy, experiencing chronic pain with a Visual Analog Scale (VAS) score of 4 or higher, and reporting sleep disturbances as indicated by a Pittsburgh Sleep Quality Index (PSQI) score greater than 5. In addition, participants were required to express willingness to participate and provide written informed consent. Patients were excluded if they had severe comorbid conditions that could affect pain or sleep, were currently using high doses of analgesics or sleep medications, or had cognitive or mental impairments that could interfere with their participation. Based on these criteria, a total of 60 participants were selected and evenly assigned to the intervention group (n = 30) and the control group (n = 30). The sample size was determined using Slovin's formula to ensure adequate representativeness and statistical power.

### Instruments

This study employed two standardized instruments: the Visual Analog Scale (VAS) and the Pittsburgh Sleep Quality Index (PSQI), and Observation Sheet for PMR monitoring

#### *Visual Analog Scale (VAS)*

The original instrument, Visual Analog Scale (VAS), was described by (Hawker et al., 2011) who highlighted its application alongside other established pain measures. The VAS is designed as a self-report questionnaire using a 0–10 numeric scale. Respondents are required to mark their pain intensity on a 10-cm line, with 0 representing no pain and 10 representing the worst imaginable pain. Higher scores indicate greater pain intensity. Since this instrument is standardized and publicly available, specific permission for use is not required. Furthermore, recent research by (Huber & Stamer, 2025) expanded the VAS measurement approach by incorporating

uncertainty intervals within a simulation framework, contributing to improved precision and clinical interpretation. These findings support the continued use of VAS in both research and clinical practice.

#### *Pittsburgh Sleep Quality Index (PSQI)*

Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989), a self-report questionnaire comprising 19 items across seven components: subjective sleep quality, sleep latency, duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Each component is scored 0–3, yielding a global score from 0 to 21, with higher scores indicating poorer sleep quality. The PSQI demonstrates robust psychometric properties, including confirmed content, construct, criterion validity, and high reliability (Cronbach's alpha 0.72–0.83; test-retest >0.85). In this study, the PSQI was specifically applied to lung cancer patients undergoing chemotherapy to evaluate treatment-related sleep disturbances, including those caused by pain, fatigue, and psychological stress (Carpi, 2025). Permission for use of the PSQI was obtained in accordance with instrument licensing requirements.

#### *Observation Sheet*

An observation sheet was used to document patient responses during PMR sessions, including physiological indicators such as pulse rate, blood pressure, and respiration rate. Lower scores on these measures indicated greater relaxation. Data were collected at baseline (H1), daily during the 14 PMR sessions, and after the intervention (H14).

### Intervention

The intervention group received daily 30-minute Progressive Muscle Relaxation (PMR) sessions for 14 consecutive days in a

quiet. Each session began with a 5-minute physiological assessment, followed by 1 minute of initial relaxation and 2–3 deep breaths to prepare the patient. Core PMR exercises lasted 18 minutes, involving 15 muscle groups (hands, fingers, biceps, shoulders, forehead, eyes, jaw, lips, neck, chest, abdomen, thighs, and feet). Each muscle group was contracted for 5–10 seconds and relaxed for 20–30 seconds, averaging  $\pm 1$  minute 10 seconds per movement. Sessions concluded with 1 minute of final relaxation, 2–3 deep breaths, patient feedback, and a 5-minute post-session physiological assessment. The control group received routine care without PMR during the same period. All intervention sessions were monitored by trained research assistants to ensure adherence and safety.

### Data Collection

Data were collected at RSUD Banjarmasin between March and Agustus 2025. Pain and sleep quality assessments were conducted baseline (pretest) and after (posttest) the intervention period. Structured interviews were used to administer the VAS and PSQI. Demographic and clinical data were obtained from medical records. Research assistants assisted in supervising PMR sessions, recording observations, and ensuring intervention fidelity.

### Data Analysis

Data were analyzed using SPSS version 21. Descriptive statistics were used to summarize participant characteristics. The Wilcoxon signed-rank test was applied to compare pretest and posttest scores within groups. Between group comparisons were conducted using mean differences. Effect sizes and 95% confidence intervals (CIs) were calculated to provide estimates of clinical significance. Statistical significance was set at  $p < 0.05$ .

### Ethical Considerations

The study received approval from the Ethics Committee of RSUD Ulin Banjarmasin (Approval No. 84/VII-Reg. Riset RSUDU/25). All participants provided written informed consent before enrollment. Confidentiality was maintained throughout the study, and participants were informed of their right to withdraw at any time without consequences.

### Results

The respondents in this study ranged in age from 19 to  $\geq 60$  years, with the majority in the 19–44 age group. The intervention group consisted of 23 males and 7 females, while the control group included 28 males and 2 females. Most participants had completed senior high school, representing 66.7% in the intervention group and 93.3% in the control group, as presented in **Table 1**.

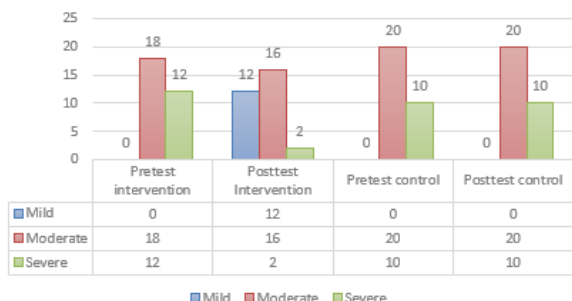
**Table 1.** Demographic Characteristics of Respondents

No	Characteristics	n (%)
1	Age	
	19–44 years	24 (40)
	45–59 years	19 (31,6)
	$\geq 60$ years	17 (28,4)
	Total	60 (100)
2	Gender	
	Male	51 (85)
	Female	9 (15)
	Total	60 (100)
3	Education	
	Junior High School	2 (3,3)
	Senior High School	48 (80)
	Bachelor’s Degree (S1)	10 (16,7)
	Total	60 (100)

The effectiveness of Progressive Muscle Relaxation (PMR) on pain showed that, before the intervention, most participants experienced moderate pain, while some reported severe pain. After 14 days of PMR, the intervention group demonstrated a significant improvement, with more



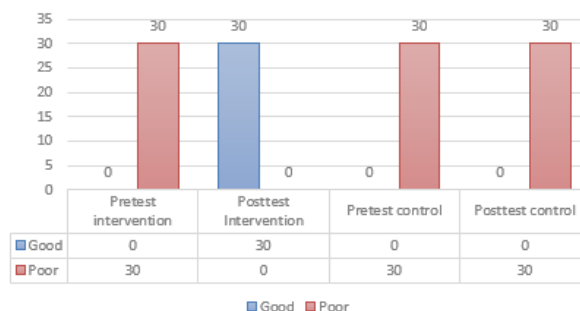
participants reporting mild pain and fewer experiencing severe pain. In contrast, the control group showed minimal change (Figure 1).



**Figure 1.** Distribution of Respondents Based on Pain Scale in Intervention and Control Groups (Pretest and Posttest)

Furthermore, the findings revealed that the intervention was also highly effective in improving sleep quality. At baseline, all participants in both groups reported poor sleep quality. After the intervention, every participant in the intervention group transitioned from poor to good sleep

quality, while the control group remained unchanged (Figure 2).



**Figure 2.** Distribution of Respondents Based on sleep Quality in Intervention and Control Groups (Pretest and Posttest)

Statistical differences indicate PMR effectiveness in reducing pain and improving sleep quality in the intervention group. Regarding sleep quality, all participants initially reported poor sleep. After the intervention, all participants in the intervention group achieved good sleep quality, whereas the control group showed no improvement as presented in Table 2.

**Table 2.** Comparison of Mean Pain and Sleep Quality Scores Between Intervention and Control Groups (Pretest and Posttest)

Variable	Intervention (Pretest)	Intervention (Posttest)	Control (Pretest)	Control (Posttest)
Pain score	7.5 ± SD	3.5 ± SD	7.2 ± SD	7.2 ± SD
Sleep quality	7.9 ± SD	3.2 ± SD	7.3 ± SD	7.3 ± SD

The findings of this study demonstrate that Progressive Muscle Relaxation (PMR) is effective in improving clinical outcomes among lung cancer patients undergoing chemotherapy. The intervention group showed a significant reduction in pain scores, decreasing from a mean of 7.5 to 3.5, and a marked improvement in sleep quality, from 7.9 to 3.2. In contrast, the control group showed no meaningful changes in either variable. Statistical analysis using the

Wilcoxon signed-rank test confirmed these results, indicating that PMR significantly reduced pain levels and enhanced sleep quality (p < 0.05). Overall, PMR can be considered an effective complementary intervention to improve pain management and sleep quality in this patient population.

### Discussion

The findings of this study demonstrate that Progressive Muscle Relaxation (PMR)

effectively reduces pain and improves sleep quality among lung cancer patients undergoing chemotherapy. In the intervention group, most patients reported mild to moderate pain after the intervention, while the control group remained predominantly in the moderate to severe pain category. Furthermore, all patients in the intervention group experienced improved sleep quality, categorized as good, whereas no improvement was observed in the control group.

These results are consistent with previous studies. (Sari et al., 2024) reported that PMR significantly improved sleep quality among cancer patients undergoing chemotherapy, with notable reductions in the global PSQI score and its subdimensions, including sleep latency, duration, subjective sleep quality, sleep efficiency, disturbances, and daytime dysfunction ( $p < 0.001$ ). Similarly, (Setyaningrum et al., 2023) found that regular PMR practice improved sleep patterns, reduced pain, and enhanced comfort in lung cancer patients receiving chemotherapy. Meta-analyses have also supported the effectiveness of PMR in reducing depression, anxiety, and fatigue, while improving sleep quality and overall quality of life among cancer patients (Li et al., 2023; Ozdemir et al., 2024; Zhang et al., 2024)

This study strengthens the evidence that PMR is a safe and effective nonpharmacological intervention for managing treatment-related symptoms in cancer patients. The mechanism of PMR involves reducing muscle tension, enhancing peripheral blood flow, and activating the parasympathetic nervous system, thereby decreasing pain perception and promoting relaxation (Anshasi et al., 2023; Kirca & Kutlurkan, 2021; Loh et al., 2022). Furthermore, PMR addresses cancer-related sleep disturbances, which

are often triggered by pain, fatigue, anxiety, and chemotherapy side effects (Sulistyawati et al., 2021; Tan et al., 2022). By promoting both physical and psychological relaxation, PMR supports more restorative sleep. In addition, PMR may enhance patients' self-efficacy in managing symptoms and reduce stress and anxiety (Kirca & Kutlurkan, 2021; Tan et al., 2022) Thus, PMR may serve as a complementary strategy that reduces reliance on pharmacological agents such as opioids and benzodiazepines, minimizing the risks of side effects, tolerance, or long-term complications (Mestdagh et al., 2023; O'Regan & et al., 2025)

Despite these promising findings, this study has limitations. The sample size was small and limited to a single center, which may affect generalizability. Self-reported measures like the pain scale and sleep quality assessments may introduce subjective bias. Additionally, the absence of objective sleep measures and long-term follow-up limits the ability to fully evaluate the sustained effects of PMR. Future studies with larger, multicenter samples and more objective assessment tools are recommended to validate and expand these findings.

Overall, this study provides new evidence on the application of PMR in lung cancer patients undergoing chemotherapy in Indonesia. The results highlight PMR as a simple, safe, and cost-effective nonpharmacological strategy that can be integrated into clinical practice to reduce pain, improve sleep quality, and support holistic patient care.

### Implications and limitations

This study highlights the effectiveness of Progressive Muscle Relaxation (PMR) as a simple, low-cost, and feasible intervention to reduce pain and improve sleep quality among lung cancer patients undergoing chemotherapy, particularly in low- and middle-income or resource-limited settings

such as Indonesia. PMR can be integrated into routine nursing care to enhance symptom management and promote patient self-efficacy while reducing reliance on pharmacological treatments. However, this study has several limitations, including a single-center design, relatively small sample size, and self-reported instruments, which may introduce bias and limit generalizability. The short intervention period and absence of objective physiological assessments also restrict the evaluation of long-term effects. Therefore, future research should employ larger, multicenter samples, objective sleep and pain measurements, and extended follow-up to validate and expand the applicability of PMR in diverse clinical contexts.

### Relevance to For Practice

The demonstrated reduction in pain and improvement in sleep quality confirm the value of Progressive Muscle Relaxation (PMR) as a supportive intervention in oncology and palliative care. PMR offers healthcare professionals a safe, low-cost, and nonpharmacological option to complement pharmacological treatment and optimize symptom management. Its integration into routine nursing care can empower patients with self-management skills, reduce reliance on medications, and promote overall comfort. Given its simplicity and absence of adverse effects, PMR can also be incorporated into nursing education, staff training, and institutional guidelines, thereby supporting evidence-based and patient-centered care.

### Conclusion

This study examined the effectiveness of Progressive Muscle Relaxation (PMR) in reducing pain and improving sleep quality in lung cancer patients undergoing chemotherapy. The results confirmed that PMR significantly lowered pain intensity

and enhanced sleep quality in the intervention group compared to the control group. These findings support the use of PMR as a complementary, nonpharmacological intervention in clinical practice, particularly in oncology and palliative care settings.

It is recommended that PMR be incorporated into routine nursing care to empower patients in managing pain and sleep disturbances, thereby reducing dependency on pharmacological agents. Future research should involve larger, multicenter trials, objective measures of sleep and physiological parameters, and long-term follow-up to strengthen evidence and broaden applicability in diverse clinical contexts.

### Funding

This research was funded by a grant from the Ministry of Education, Science, and Technology (Grant Number: 132/C3/DT.05.00/PL/2025). The funding body had no involvement in the study design, data collection, data analysis, interpretation of findings, or manuscript preparation.

### CrediT Authorship Contributions Statement

**Mira** : Conceptualization, Supervision, Writing - Original Draft

**Izma Daud** : Software, Methodology, Validation, Formal Analysis - Review & Editing

**Laiya Ruwaida** : Investigation, Project Administration, Original Draft

**Mahmud** : Investigation, Data Curation, Resources

**Mahrida Dwi Ariyani** : Investigation, Writing - Review & Editing, Visualization

## Conflicts Of Interest

The authors declare that have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

## Acknowledgments

The authors would like to express their sincere gratitude to all parties who have contributed to the successful execution of this research. Special thanks are extended to the Head of the Research and Innovation Institute at Universitas Muhammadiyah Banjarmasin for comprehensive support and the provision of facilities throughout the research period. This study was funded by a grant from the Ministry of Education, Culture, Research, and Technology (Grant Number: 132/C3/DT.05.00/PL/2025). The authors also wish to acknowledge the research team, field technical staff, and all individuals who assisted in data collection and the overall implementation of the research activities. This publication represents part of the findings derived from the research funded by the aforementioned grant. The invaluable contributions of all mentioned parties have been instrumental in ensuring the smooth execution and successful completion of this study.

## Supplementary Materials

Supplementary File S1: Materials contains detailed information on the PMR intervention procedure, as well as the PSQI and VAS questionnaires

## References

Anshasi, H., Saleh, M., Abdalrahim, M. S., & Shamieh, O. (2023). The effectiveness of progressive muscle relaxation technique in reducing cancer-related pain among palliative care patients: A randomized controlled trial. *British Journal of Pain*.

<https://doi.org/10.1177/20494637231190191>

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new psychiatric practice and research instrument. *Psychiatry Research*, 28(2), 193–213.

[https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)

Carpi, M. (2025). The Pittsburgh Sleep Quality Index: a brief review. *Occupational Medicine*, 75(1), 14–15.

Data Kalsel. (2024). Data kesehatan.

Duan, L., & et al. (2022). Symptoms and experiences of frailty in lung cancer patients with chemotherapy: A mixed-method approach. *Frontiers in Oncology*, 12, 1019006.

<https://doi.org/10.3389/fonc.2022.1019006>

Ferlay, J., Ervik, M., Lam, F., Laversanne, M., Colombet, M., Mery, L., & et al. (2024). *Global Cancer Observatory: Cancer Today*.

Fund, W. C. R. (2023). Lung cancer statistics. Gündogdu, F., & Koçaslı, S. (2023). The effects of pranayama or deep breathing exercises on fatigue and sleep quality in women receiving radiation therapy for breast cancer. *Oncology Nursing Forum*, 50(5), 509–520.

<https://doi.org/10.1188/23.ONF.509-520>

Hawker, G. A., Mian, S., Kendzerska, T., & French, M. (2011). Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF. Arthritis Care & Research, 63(S11), S240–S252.

<https://doi.org/10.1002/acr.20543>



- Huber, M., & Stamer, U. (2025). Pain assessment on a numerical scale with uncertainty intervals: a proof-of-concept simulation study. *Frontiers in Pain Research*, 6, 1555185.
- Kartika, D. E., Sabri, Y. S., & Gusty, R. P. (2022). Pengaruh Progressive Muscle Relaxation (PMR) dalam menurunkan skala nyeri pada pasien kanker paru yang mendapatkan pengobatan kemoterapi. *Jurnal Kesehatan Komunitas*, 8(1), 27–31. <https://doi.org/10.25311/keskom.Vol8.Iss1.1094>
- Kirca, K., & Kutluturkan, S. (2021). The effect of progressive relaxation exercises on treatment-related symptoms and self-efficacy in patients with lung cancer receiving chemotherapy. *Complementary Therapies in Clinical Practice*, 45, 101488. <https://doi.org/10.1016/j.ctcp.2021.101488>
- Li, Y., Li, X., Zhang, Y., & Wang, L. (2023). The efficacy of progressive muscle relaxation training on cancer-related fatigue and quality of life in patients with cancer: A systematic review and meta-analysis of randomized controlled studies. *Journal of Clinical Nursing*, 32(1–2), e1–e12. <https://doi.org/10.1111/jocn.16476>
- Li, Y., Zhang, W., Chen, Y., Huang, X., Zhou, Y., Wang, J., & et al. (2025). The effect of music therapy on anxiety, depression, pain and sleep quality of lung cancer patients: a systematic review and meta-analysis. *Supportive Care in Cancer*, 33(3), 169. <https://doi.org/10.1007/s00520-025-09213-2>
- Loh, E. W., Shih, H. F., Lin, C. K., & Huang, T. W. (2022). Effect of progressive muscle relaxation on postoperative pain, fatigue, and vital signs in patients with head and neck cancers: A randomized controlled trial. *Patient Education and Counseling*, 105, 2151–2157. <https://doi.org/10.1016/j.pec.2022.03.012>
- Mestdagh, F., Steyaert, A., & Lavand'homme, P. (2023). Cancer pain management: a narrative review of current concepts, strategies, and techniques. *Current Oncology*, 30(7), 6838–6858. <https://doi.org/10.3390/curroncol30070500>
- O'Regan, A., & et al. (2025). Opioids and benzodiazepines in oncology: Perspectives on coprescribing and mitigating risks. *Journal of Geriatric Oncology*, 16(2), 102172. <https://doi.org/10.1016/j.jgo.2024.102172>
- Ozdemir, S., Ovayolu, O., & Ovayolu, N. (2024). The effect of progressive muscle relaxation exercises on dyspnea, pain, and sleep quality in lung cancer patients. *European Journal of Oncology Nursing*, 66, 102383. <https://doi.org/10.1016/j.ejon.2024.102383>
- Pambudiarto, A. A., & et al. (2024). Evidence based nursing: Penerapan intervensi Progressive Muscle Relaxation untuk meningkatkan kualitas tidur pada pasien hemodialisa di RSUD Ir. Soekarno Sukoharjo. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM)*, 7(5), 2276–2287. <https://doi.org/10.33024/jkpm.v7i5.14588>
- Sari, E., Gündogdu, F., & Semerci, R. (2024). The Effect of Progressive Muscle Relaxation Exercises on Sleep Quality in Cancer Patients Undergoing Chemotherapy: A Randomized Controlled Study. *Seminars in Oncology Nursing*, 40(2), 151620. <https://doi.org/10.1016/j.soncn.2024.151620>

- Setyaningrum, W., Widodo, A., & Andayani, T. (2023). Pengaruh relaksasi otot progresif terhadap kualitas tidur pasien kanker yang menjalani kemoterapi di RS Telogorejo. *Antigen Jurnal Kesehatan*, 1(1), 45–53. <https://jurnal.stikeskesosi.ac.id/index.php/Antigen/article/download/55/57>
- Sulistiyawati, E., Allenidekania, A., & Gayatri, D. (2021). Effect of progressive muscle relaxation on sleep quality and side effects of chemotherapy in children with cancer: Randomized clinical trial. *Open Access Macedonian Journal of Medical Sciences*, 9, 300–308. <https://doi.org/10.3889/oamjms.2021.6368>
- Tan, L., Fang, P., Cui, J., Yu, H., & Yu, L. (2022). Effects of progressive muscle relaxation on health-related outcomes in cancer patients: A systematic review and meta-analysis of randomized controlled trials. *Complementary Therapies in Clinical Practice*, 49, 101676. <https://doi.org/10.1016/j.ctcp.2022.101676>
- Zhang, Y., Wang, L., Chen, Y., & Li, J. (2024). Effectiveness of progressive muscle relaxation in cancer patients: A systematic review and meta-analysis. *Complementary Therapies in Clinical Practice*, 52, 101814. <https://doi.org/10.1016/j.ctcp.2023.101814>