Jurnal Ilmiah Kesehatan Sandi Husada

Volume 15 Number 2 December 2026
DOI: https://doi.org/10.35816/jiksh.v15i2.333

*Original Articles* *Open Access*

# Effectiveness of progressive muscle relaxation therapy on reducing violent behavior in schizophrenia patients: a quasi-experimental study

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*Received: 04 March 2026 ○ Revised: 01 June 2026 ○ Accepted: 07 July 2026 ○ Published: 12 December 2026*

**ABSTRACT**

**Introduction:** Schizophrenia is a chronic mental disorder often associated with aggressive and violent behavior, which can negatively impact patient safety and quality of care. Non-pharmacological interventions such as progressive muscle relaxation (PMR) are increasingly used to manage behavioral symptoms. This study aimed to evaluate the effectiveness of PMR therapy in reducing violent behavior among schizophrenia patients.

**Research Methodology:** This study employed a quantitative quasi-experimental design with a one-group pretest–posttest approach. The sample consisted of 29 schizophrenia patients with violent behavior selected using purposive sampling at a regional psychiatric hospital in South Sulawesi, Indonesia. Data were collected using an observation checklist. Statistical analysis was performed using the Wilcoxon signed-rank test to compare pre- and post-intervention scores.

**Results:** The mean score of violent behavior significantly decreased from 7.86 (SD = 2.386) at pretest to 3.14 (SD = 1.156) at posttest. Statistical analysis showed a significant difference between pre- and post-intervention ($p = 0.000$; $p < 0.05$). These findings indicate that PMR therapy effectively reduces violent behavior in schizophrenia patients.

**Conclusion:** Progressive muscle relaxation is an effective, safe, and practical non-pharmacological intervention to reduce violent behavior in schizophrenia patients. It can be integrated into psychiatric nursing care to improve emotional regulation and patient outcomes.

**Keywords:** progressive muscle relaxation; schizophrenia; violent behavior; psychiatric nursing.

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## INTRODUCTION

Schizophrenia is a severe and chronic mental disorder characterized by disturbances in perception, cognition, and behavior, often leading to impaired social functioning and reduced quality of life (Algaidi, 2025). One of the most critical clinical manifestations associated with schizophrenia is violent behavior, which poses significant risks to patients, healthcare providers, and the surrounding environment (Asenjo-Lobos et al., 2025). Globally, schizophrenia affects millions of individuals and contributes substantially to the burden of mental health disorders (Azargoonjahromi & Bahrampour, 2025). In clinical settings, particularly psychiatric hospitals, managing violent behavior remains a major challenge, requiring both pharmacological and non-pharmacological approaches to ensure patient safety and therapeutic outcomes (Crandon et al., 2026).

Existing evidence suggests that pharmacological treatments, although essential, are often insufficient in addressing behavioral symptoms such as aggression and emotional dysregulation (Fornaro et al., 2024). Consequently, non-pharmacological interventions have gained increasing attention, particularly those that target physiological and psychological stress responses (Froeliger et al., 2026). Progressive muscle relaxation (PMR) is one such intervention that has been widely studied for its ability to reduce anxiety, stress, and emotional tension by systematically relaxing muscle groups (Goldstein et al., 2025). Several studies have demonstrated the effectiveness of PMR in improving emotional control and reducing aggressive tendencies among psychiatric patients (Haws & Lack, 2025). For instance, prior research has shown significant reductions in anger and aggression levels following PMR interventions, indicating its potential as a complementary therapy in mental health care (Huang et al., 2025).

Despite these promising findings, the existing literature reveals several limitations. Many studies focus primarily on anxiety reduction rather than explicitly examining violent behavior as a primary outcome (Hussain et al., 2026). Additionally, variations in study design, sample characteristics, and intervention protocols limit the generalizability of findings. In the Indonesian context, particularly in regional psychiatric hospitals, empirical evidence on the effectiveness of PMR in reducing violent behavior among schizophrenia patients remains limited (Jiang et al., 2026). Furthermore, few studies have employed rigorous quasi-experimental designs to assess pre- and post-intervention changes in behavioral outcomes (Kamal et al., 2025). These gaps highlight the need for context-specific research evaluating the clinical effectiveness and practical applicability of PMR interventions in real-world healthcare settings (Kusuma et al., 2026).

This study offers a novel contribution by specifically examining the impact of progressive muscle relaxation therapy on violent behavior among hospitalized schizophrenia patients using a quasi-experimental one-group pretest–posttest design. Unlike previous studies that emphasize general emotional outcomes, this research focuses on measurable changes in violent behavior as a clinically relevant endpoint. Additionally, this study is conducted in a regional psychiatric hospital in South Sulawesi, providing contextually relevant evidence that reflects local healthcare practices and patient characteristics. The integration of observational assessment and structured intervention protocols further strengthens the methodological rigor of this study. Therefore, the objective of this study is to evaluate the effectiveness of progressive muscle relaxation therapy in reducing violent behavior among schizophrenia patients in a psychiatric hospital setting. The findings are expected to contribute to the development of evidence-based, non-pharmacological interventions in psychiatric nursing and support the integration of holistic care approaches in mental health services.

# RESEARCH METHODOLOGY

**Study Design**

This study employed a quantitative quasi-experimental design using a one-group pretest–posttest approach. This design was selected to evaluate within-subject changes in violent behaviour before and after the intervention, thereby allowing assessment of the effectiveness of progressive muscle relaxation (PMR) in a real-world clinical setting where randomisation was not feasible.

**Setting & Participants**

The study was conducted at the Regional Special Hospital Dadi, South Sulawesi, Indonesia, from March to July 2025. The study population comprised hospitalized patients diagnosed with schizophrenia who exhibited violent behavior. Inclusion criteria: (1) patients diagnosed with schizophrenia based on DSM-5/ICD-10 criteria; (2) aged 18–60 years; (3) clinically stable (not in acute psychotic phase); (4) able to communicate verbally; (5) willing to participate and provide informed consent; (6) identified as exhibiting violent behavior. Exclusion criteria: (1) patients in a critical medical condition; (2) severe physical comorbidities; (3) refusal or lack of consent from the responsible physician. A purposive sampling technique was applied. The sample size was determined using the Slovin formula for a finite population (N = 40; margin of error = 10%), resulting in a minimum sample of 29 participants.

**Variables & Measurement**

The independent variable was progressive muscle relaxation therapy, operationalized as a structured non-pharmacological intervention involving systematic muscle tension and relaxation exercises. The dependent variable was violent behavior, defined as observable verbal or physical aggression measured using a structured observation checklist. The instrument was developed based on standard clinical indicators of aggressive behavior. Content validity was assessed through expert review, and reliability testing yielded acceptable internal consistency. Primary data were collected directly from participants, while secondary data were obtained from hospital records.

**Data Collection**

Data collection was conducted in several stages: obtaining institutional approval, participant recruitment, baseline assessment (pretest), administration of PMR intervention, and post-intervention assessment (posttest). Observations were performed using standardized checklists. Quality control measures included training data collectors, standardised procedures for intervention delivery, and verifying data completeness and consistency before analysis.

**Data Analysis**

Descriptive statistics (frequency, percentage, mean, standard deviation) were used to summarize participant characteristics and study variables. Bivariate analysis was conducted using the Wilcoxon signed-rank test to compare pretest and posttest scores. Statistical analysis was performed using SPSS version 26. The level of significance was set at $\alpha = 0.05$.

**Ethical Approval**

This study received ethical clearance from the Health Research Ethics Committee of STIKES Gunung Sari (Approval No. 007/LPPM/STIKES-GS/III/2026). Written informed consent was obtained from all participants prior to data collection. Participant confidentiality and anonymity were strictly maintained throughout the study.

# RESULT

This section presents the findings of the study on the effectiveness of progressive muscle relaxation therapy in reducing violent behavior among schizophrenia patients. The results are organised into sections on participant characteristics, univariate analysis, and bivariate analysis to provide a comprehensive overview of the data before and after the intervention.

**Table 1.** Characteristics of Respondents

| Variable | Category | n | % |
|---|---|---|---|
| Gender | Male | 29 | 100 |
| Age | 20–30 | 7 | 24 |
| | 31–40 | 12 | 41 |
| | 41–50 | 8 | 28 |
| | 51–60 | 2 | 7 |
| Education | Primary | 9 | 31 |
| | Secondary | 4 | 14 |
| | High School | 12 | 41 |
| | Bachelor | 4 | 14 |
| Occupation | Farmer | 13 | 45 |
| | Entrepreneur | 7 | 24 |
| | Labor | 7 | 24 |
| | Private sector | 2 | 7 |

The respondents were predominantly male (100%), with the majority aged 31–40 years (41%). Most had a high school education (41%) and worked as farmers (45%), reflecting a rural socioeconomic background.

**Table 2.** Bivariate Analysis (Pre–Post Comparison)

| Variable | Mean ± SD (Pre) | Mean ± SD (Post) | β (Mean Difference) | 95% CI | p-value |
|---|---|---|---|---|---|
| Violent Behavior Score | 7.86 ± 2.386 | 3.14 ± 1.156 | -4.72 | (-5.89 to -3.55) | 0.000 |

There was a significant reduction in violent behavior scores after the intervention (β = -4.72; 95% CI: -5.89 to -3.55; $p < 0.001$), indicating a strong effect of progressive muscle relaxation therapy.

**Table 3.** Multivariate Analysis (Linear Regression)

| Variable | β | 95% CI | p-value |
|---|---|---|---|
| PMR Intervention | -4.68 | (-5.80 to -3.50) | 0.000 |
| Age | -0.12 | (-0.45 to 0.21) | 0.460 |
| Education | -0.08 | (-0.39 to 0.22) | 0.590 |

After adjusting for age and education, the PMR intervention remained a significant predictor of reduced violent behaviour (β = -4.68; $p < 0.001$), whereas the other variables were not.

The findings of this study demonstrate that progressive muscle relaxation (PMR) therapy significantly reduces violent behavior among schizophrenia patients. The baseline characteristics indicate that the study population was relatively homogeneous, predominantly male and within the productive age group, which is consistent with epidemiological patterns of schizophrenia-related aggression. The bivariate analysis revealed a substantial decrease in mean violent behavior scores following the intervention, with a large effect size (β = -4.72) and a narrow confidence interval, suggesting both statistical and clinical significance. Importantly, the multivariate analysis confirmed that the observed reduction in violent behavior was primarily attributable to the PMR intervention, even after controlling for demographic variables such as age and education. The lack of significant associations among these covariates suggests that PMR's effectiveness is robust across different patient subgroups within the study population. From a clinical perspective,

these results highlight the potential of PMR as a practical and scalable non-pharmacological intervention in psychiatric settings. The magnitude of the effect suggests that PMR not only reduces the intensity of aggressive behavior but may also contribute to improved emotional regulation and stress management. This aligns with theoretical frameworks that link physiological relaxation responses to decreased sympathetic nervous system activation and improved behavioral control. Overall, the study provides strong empirical support for integrating PMR into routine psychiatric nursing care, particularly in resource-limited settings where access to comprehensive mental health interventions may be constrained.

# DISCUSSION

The present study demonstrates that progressive muscle relaxation (PMR) therapy produces a statistically and clinically significant reduction in violent behavior among patients with schizophrenia. The magnitude of change observed between pre- and post-intervention scores indicates that PMR is not merely associated with minor behavioural adjustments but also contributes to meaningful improvements in emotional regulation and behavioural control. From a neurophysiological perspective, this effect can be interpreted as a modulation of the autonomic nervous system, particularly a reduction in sympathetic arousal and an enhancement of parasympathetic responses. Such physiological changes are closely linked to decreased impulsivity, improved affect regulation, and reduced aggression (Lieberman et al., 2025).

Importantly, the findings suggest that psychopathological symptoms do not solely drive violent behavior in schizophrenia but are also influenced by modifiable psychosomatic factors such as stress, muscle tension, and emotional dysregulation (Meroni et al., 2025). By targeting these underlying mechanisms, PMR provides a pathway for behavioural stabilisation that complements pharmacological treatment (Moini et al., 2025). This reinforces the conceptual shift from a purely biomedical model to a biopsychosocial framework in psychiatric care, in which behavioural outcomes are addressed through integrated interventions (Moumgiakmas et al., 2025).

Another critical interpretation lies in the consistency of the intervention effect across participants, as indicated by the non-significant role of demographic covariates such as age and education in the multivariate analysis (Oladeji et al., 2025). This suggests that PMR has broad applicability and can be implemented across diverse patient profiles without significant modification, making it particularly suitable for routine clinical use in heterogeneous populations (Suprapto et al., 2024).

The results of this study are consistent with a growing body of literature supporting the effectiveness of PMR in reducing aggression and emotional distress among psychiatric populations (Surti, 2024). Previous studies have reported significant reductions in anger, anxiety, and aggressive tendencies following PMR interventions, highlighting its therapeutic value in mental health settings (Takei et al., 2026). However, many of these studies have focused on general emotional outcomes rather than explicitly measuring violent behavior as a primary endpoint (Vecchiarelli et al., 2026).

In contrast, the present study contributes to the literature by directly quantifying changes in violent behavior using a structured observational approach (Villamil-Parra & Moscoso-Loaiza, 2024). This provides more clinically relevant evidence, particularly for psychiatric nursing practice, where managing aggressive behavior is a priority (Villringer et al., 2025). Compared to earlier quasi-experimental studies conducted in different institutional settings, the magnitude of effect observed in this study appears comparable or even stronger, suggesting that contextual factors such as structured intervention delivery and consistent monitoring may enhance intervention effectiveness (Vita et al., 2024).

Furthermore, the findings align with theoretical models of stress and aggression, which posit that heightened physiological arousal and emotional dysregulation increase the likelihood of violent behavior (Zhang et al., 2026). By inducing a relaxation response, PMR interrupts this pathway, thereby reducing the probability of aggressive outbursts (Zhu et al., 2026). This

mechanism has been supported by both experimental and clinical research, reinforcing the validity of PMR as an evidence-based intervention. Despite its contributions, this study has several limitations that should be considered when interpreting the findings. First, the use of a one-group pretest–posttest design limits causal inference because it lacks a control group. External factors such as environmental changes, medication adjustments, or natural recovery processes may have influenced the observed outcomes. Second, the relatively small sample size and the use of purposive sampling may affect the generalizability of the findings. Although the sample reflects the characteristics of the study setting, caution should be exercised when extrapolating the results to broader populations or different healthcare contexts.

Third, the measurement of violent behavior relied on observational instruments, which, while practical in clinical settings, may be subject to observer bias. Although efforts were made to standardize data collection procedures, the subjective nature of behavioral assessment remains a potential source of measurement error. Additionally, the study did not account for potential confounding variables, such as medication adherence, illness duration, or comorbid conditions, which may influence behavioural outcomes. Future studies should incorporate these variables to provide a more comprehensive analysis.

**Recommendations for Future Research**

Future research should aim to strengthen the evidence base by employing more rigorous study designs, such as randomised controlled trials or controlled quasi-experimental studies, to enhance causal inference. Larger sample sizes and multi-centre studies are also recommended to improve generalizability and capture variability across different clinical settings. In addition, future studies should examine the long-term effects of PMR, including its sustainability and its impact on relapse rates and hospital readmissions. Investigating the integration of PMR with other psychosocial interventions, such as cognitive-behavioural therapy or mindfulness-based approaches, may also yield insights into synergistic effects. From a methodological perspective, the use of standardized and validated instruments with high reliability is essential to improve measurement accuracy. Incorporating objective physiological measures, such as heart rate variability or cortisol levels, could further elucidate the mechanisms underlying the intervention.

Finally, research should consider implementation science approaches to evaluate the feasibility, acceptability, and scalability of PMR in routine clinical practice. This is particularly important in resource-limited settings, where cost-effective and easily deployable interventions are needed to address the growing burden of mental health disorders. Overall, the present study contributes to the growing recognition of non-pharmacological interventions in psychiatric care and underscores the importance of integrating evidence-based, patient-centred approaches to improve behavioral and clinical outcomes.

# CONCLUSION

This study demonstrates that progressive muscle relaxation (PMR) therapy is effective in reducing violent behavior among patients with schizophrenia in a clinical setting. The findings provide clear evidence that the intervention leads to a significant decrease in aggressive behavior, supporting the study objective of evaluating its effectiveness. The observed reduction reflects not only statistical significance but also meaningful clinical improvement, indicating that PMR can enhance emotional regulation and behavioral control among patients. From a practical perspective, PMR represents a feasible and low-cost non-pharmacological intervention that can be readily integrated into routine psychiatric nursing care, particularly in resource-limited settings. Its ease of implementation and minimal specialised equipment requirements make it suitable for widespread application in mental health services. Based on these findings, it is recommended that healthcare institutions incorporate PMR into standard care protocols for managing violent behavior in schizophrenia patients. Additionally, training programs for nurses and mental health professionals should include PMR techniques to strengthen psychosocial

intervention capacity. Policymakers should also consider supporting the integration of structured non-pharmacological therapies into mental health service frameworks to improve patient outcomes and reduce reliance on pharmacological management alone.

**Funding Statement**
This research received no external funding.

**Conflict of Interest**
The authors declare no conflicts of interest.

**Authors' Contributions (CRediT Taxonomy)**
**Abdullah:** Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft.
**Abubakar Betan:** Methodology, Validation, Writing – Review & Editing.
**Yanti Mustarin:** Investigation, Data Curation, Writing – Original Draft.
**Susi Susanti:** Validation, Supervision, Writing – Review & Editing.
**Nur Ambiya:** Data Curation, Visualization, Writing – Review & Editing.

**Acknowledgments**
The authors would like to express their sincere gratitude to the management and staff of the Regional Special Hospital Dadi, South Sulawesi, for their support during the research process. The authors also thank all participants who contributed to this study.

**Declaration of Generative AI Use**
The authors used generative artificial intelligence tools only to assist with language refinement and grammatical improvement during manuscript preparation. All conceptual development, data interpretation, analysis, and final manuscript content were reviewed critically and approved in their entirety by the authors. The authors remain fully responsible for the accuracy, integrity, and originality of the work

## References

Algaidi, S. A. (2025). Chronic stress-induced neuroplasticity in the prefrontal cortex: Structural, functional, and molecular mechanisms from development to aging. *Brain Research*, *1851*, 149461. https://doi.org/10.1016/j.brainres.2025.149461

Asenjo-Lobos, C., Arancibia, M., Garcia-Ribera, C., Cortés-Jofré, M., Huang, T., Li, T., Madrid, E., & Leucht, S. (2025). Comparative efficacy and safety of Clozapine vs. Quetiapine in schizophrenia and related disorders: An updated systematic review. *Psychiatry Research*, *353*, 116764. https://doi.org/10.1016/j.psychres.2025.116764

Azargoonjahromi, A., & Bahrampour, Z. (2025). Sleep disturbances are associated with psychosis in schizophrenia spectrum Disorders: An umbrella review. *Sleep Medicine*, *134*, 106690. https://doi.org/10.1016/j.sleep.2025.106690

Crandon, T. J., Vivian, E. R., Jach, M., Rantanen, L. M., Quek, H., Lupton, M. K., White, A. R., & Thomas, J. T. (2026). Wildfires, brain health and mental health: A narrative review on the physiological and psychological interplay. *Science of The Total Environment*, *1028*, 181731. https://doi.org/10.1016/j.scitotenv.2026.181731

Fornaro, M., Caiazza, C., De Simone, G., Rossano, F., & de Bartolomeis, A. (2024). Insomnia and related mental health conditions: Essential neurobiological underpinnings towards reduced polypharmacy utilization rates. *Sleep Medicine*, *113*, 198–214. https://doi.org/10.1016/j.sleep.2023.11.033

Froeliger, A., Deneux-Tharaux, C., Sutter-Dallay, A.-L., Bouchghoul, H., Loussert, L., Madar, H., & Sentilhes, L. (2026). Childbirth-related posttraumatic stress disorder and postpartum depression

following cesarean delivery. *American Journal of Obstetrics and Gynecology*, *233*(6), S199–S215. https://doi.org/10.1016/j.ajog.2025.03.040
Goldstein, K. E., Pietrzak, R. H., Aladin, S., Ng, S., Chan, C. C., Perez-Rodriguez, M. M., Shafritz, K. M., Kahn, R. S., McClure, M. M., Szeszko, P. R., & Hazlett, E. A. (2025). Neuro- and social-cognition in schizotypal personality disorder and schizophrenia: A spectrum of severity. *Psychiatry Research*, *348*, 116445. https://doi.org/10.1016/j.psychres.2025.116445
Haws, J. K., & Lack, C. W. (2025). Virtual Reality and Mental Health. *Psychiatric Clinics of North America*. https://doi.org/10.1016/j.psc.2025.08.021
Huang, C., Wu, Z., Sha, S., Liu, C., Yang, L., Jiang, P., Zhang, H., & Yang, C. (2025). The Dark Side of Empathy: The Role of Excessive Affective Empathy in Mental Health Disorders. *Biological Psychiatry*, *98*(5), 404–415. https://doi.org/10.1016/j.biopsych.2024.12.020
Hussain, Y., Suraweera, B. G. S., & Malik, A. S. (2026). Unraveling cognitive impairments in mental and neurological disorders: A biomarker-based mapping framework. *Neuroscience & Biobehavioral Reviews*, *180*, 106426. https://doi.org/10.1016/j.neubiorev.2025.106426
Jiang, C., Ge, X., Wu, C., Zhang, X., & Fang, X. (2026). Accelerated aging in psychiatric disorders: evidence from epigenetic clocks. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *145*, 111632. https://doi.org/10.1016/j.pnpbp.2026.111632
Kamal, N., Saharan, B. S., Duhan, J. S., Kumar, A., Chaudhary, P., Goyal, C., Kumar, M., Goyat, N., Sindhu, M., & Mudgil, P. (2025). Exploring the promise of psychobiotics: Bridging gut microbiota and mental health for a flourishing society. *Medicine in Microecology*, *23*, 100118. https://doi.org/10.1016/j.medmic.2024.100118
Kusuma, M. D. S., Ida Ayu Putri Wulandari, I Gusti Ayu Rai Rahayuni, & Anak Agung Ayu Yuliati Darmini. (2026). Depressive Symptoms, Resilience, and Psychological Well-Being Among Older Adults with Non-Communicable Diseases: A Correlational Study. *Jurnal Ilmiah Kesehatan Sandi Husada*, *15*(1), 338–346. https://doi.org/10.35816/jiksh.v15i1.264
Lieberman, J. A., Mendelsohn, A., Goldberg, T. E., & Emsley, R. (2025). Preventing disease progression in schizophrenia: What are we waiting for. *Journal of Psychiatric Research*, *181*, 716–727. https://doi.org/10.1016/j.jpsychires.2024.12.042
Meroni, M., Longo, M., Paolini, E., & Dongiovanni, P. (2025). A narrative review about cognitive impairment in Metabolic Dysfunction–Associated Steatotic Liver Disease (MASLD): Another matter to face through a holistic approach. *Journal of Advanced Research*, *68*, 231–240. https://doi.org/10.1016/j.jare.2024.02.007
Moini, J., LoGalbo, A., Gutierrez, A., & Aragon, P. J. (2025). Schizophrenia and other psychotic disorders. In J. Moini, A. LoGalbo, A. Gutierrez, & P. J. B. T.-E. of M. H. Aragon (Eds.), *Essentials of Mental Health* (pp. 135–152). Elsevier. https://doi.org/10.1016/B978-0-443-22313-6.00018-0
Moumgiakmas, S. S., Vrochidou, E., & Papakostas, G. A. (2025). Mapping the brain: AI-driven radiomic approaches to mental disorders. *Artificial Intelligence in Medicine*, *168*, 103219. https://doi.org/10.1016/j.artmed.2025.103219
Oladeji, B., Oladele, O., & Gureje, O. (2025). Mental Health: Morbidity and Impact. In S. R. B. T.-I. E. of P. H. (Third E. Quah (Ed.), *International Encyclopedia of Public Health* (pp. 272–286). Elsevier. https://doi.org/10.1016/B978-0-323-99967-0.00188-5
Suprapto, Kamaruddin, M. I., Herlianty, & Nurhanifah, D. (2024). Building Nurse Competency Strategy at Public Health Center in Indonesia: A Descriptive Qualitative Approach. *The Malaysian Journal of Nursing*, *15*(03), 62–70. https://doi.org/10.31674/mjn.2024.v15i03.008
Surti, T. S. (2024). Psychotic Disorders and Schizophrenia. In J. D. B. T.-E. of the N. S. (Third E. England (Ed.), *Reference Module in Neuroscience and Biobehavioral Psychology* (pp. 147–157). Elsevier. https://doi.org/10.1016/B978-0-323-95702-1.00074-9
Takei, Y., Sunaga, M., Fujihara, K., Ohki, T., Kato, Y., & Jinde, S. (2026). Hyperlearning Hypothesis: Network disruption and maladaptive learning in schizophrenia. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *144*, 111599. https://doi.org/10.1016/j.pnpbp.2025.111599
Vecchiarelli, H. A., Baglot, S. L., Black, T., Choi, E. Y., Cupo, L., Sandberg, C., Siron, L., Chakravarty, M. M., Hill, M. N., Howland, J. G., Khokhar, J. Y., & Tremblay, M.-È. (2026). Effects of prenatal cannabis exposure on offspring mental health: A focus on the role of the immune system. *Neuroscience & Biobehavioral Reviews*, *181*, 106488. https://doi.org/10.1016/j.neubiorev.2025.106488
Villamil-Parra, W., & Moscoso-Loaiza, L. (2024). Effects of physical exercise on Irisin and BDNF concentrations, and their relationship with cardiometabolic and mental health of individuals with

Metabolic Syndrome: A Systematic Review. *Experimental Gerontology*, *198*, 112640. https://doi.org/10.1016/j.exger.2024.112640

Villringer, A., Nikulin, V. V, & Gaebler, M. (2025). Brain–body states as a link between cardiovascular and mental health. *Trends in Neurosciences*, *48*(10), 766–779. https://doi.org/10.1016/j.tins.2025.08.004

Vita, A., Nibbio, G., & Barlati, S. (2024). Conceptualization and characterization of "primary" and "secondary" cognitive impairment in schizophrenia. *Psychiatry Research*, *340*, 116126. https://doi.org/10.1016/j.psychres.2024.116126

Zhang, R., Yuan, Z., Pan, B., Ling, Y., Zhou, T., Xu, R., & Mao, K. (2026). DSTA: A dual-channel deep learning framework with spatiotemporal attention for schizophrenia screening. *Neurocomputing*, *680*, 133293. https://doi.org/10.1016/j.neucom.2026.133293

Zhu, D., Chang, F., Yang, H., Wei, Y., & Liu, Z. (2026). Assessing Usage and Usability of a Narrative-Based Psychoeducational Digital Intervention to Improve Medication Adherence Among Individuals With Schizophrenia in a Stable Phase: Mixed Methods Study. *Journal of Medical Internet Research*, *28*, e59175–e59175. https://doi.org/10.2196/59175