Innovation in Applied Nursing Informatics
G. Strudwick et al. (Eds.)

doi:10.3233/SHTI240109

Applications of Artificial Intelligence in Psychiatric Nursing: A Scope Review

Huanhuan LI[1,#] Guibing ZHU [2,#] Yan ZHONG[3] Zhuoqiu ZHANG[1] Shuiying LI[1] Jialin LIU[4*1]

[1] *Mental Health Center, West China Hospital, Sichuan University/West China School of Nursing, Sichuan University, Sichuan, China,*
[2] *Shenzhen Institute for Advanced Study, University of Electronic Science and Technology of China, Sichuan, China*
[3] *West China Hospital Of Stomatology, Sichuan, China*
[4] *Department of Medical Informatics, West China School of Medicine, Sichuan University, Sichuan, China*

Abstract. Rapid advances in artificial intelligence (AI) have reshaped healthcare, including psychiatric nursing, to address the limitations of traditional approaches and meet escalating mental health challenges. A scoping review analyzed 48 articles examining the application of AI in psychiatric nursing across different technologies and topics, noting trends in publications and countries involved. The articles covered different aspects of mental health using AI technologies such as machine learning and robotics, and primarily explored AI applications in mental health, specifically dementia, autism and schizophrenia. These studies highlighted the role of AI in personalized care plans, symptom monitoring and risk assessment. AI is promising, but faces challenges such as data bias and ethical concerns. Future research needs to focus on long-term studies, diverse populations, patient interaction and personalized treatments for practical integration into psychiatric nursing.

Keywords. artificial intelligence, psychiatry, nursing

1. Introduction

The rapid advancement of artificial intelligence (AI) in mental health, offers new ways to diagnose and treat mental illness, transforming nursing practice and patient care [1-3]. Traditional psychiatric nursing often relies on subjective clinical experience and standard guidelines, and struggles to meet individual needs amid growing challenges such as increasing patient numbers, limited resources and higher treatment costs. AI offers hope by providing data-driven precision in diagnosis, personalised treatments and improved care, harnessing its potential in areas ranging from language processing to risk identification. Despite these opportunities, the application of AI in psychiatric nursing faces challenges and lacks significant engagement from psychiatric nurses [1].This review aims to explore various applications of AI in psychiatric nursing to improve practice among professionals, policy makers and researchers.

[1] [#]H. LI and G. ZHU contributed equally to this work. *Corresponding Author: J. LIU, Corresponding email: Dljl8@163.com.

2. Methods

We conducted a scoping review to explore the use of AI in psychiatric nursing, following methodological guidelines[6,7] and PRISMA-ScR reporting recommendations[8]. Our research aimed to identify studies that addressed the impact of AI in psychiatric nursing, using inclusion criteria that included AI in psychiatric nursing, while excluding inaccessible, duplicate or non-English documents. We conducted a thorough literature search in six databases using a comprehensive search strategy. We then selected relevant studies and systematically reported our search and selection processes and summarized the findings from the data collected.

3. Results

3.1 Search and selection process

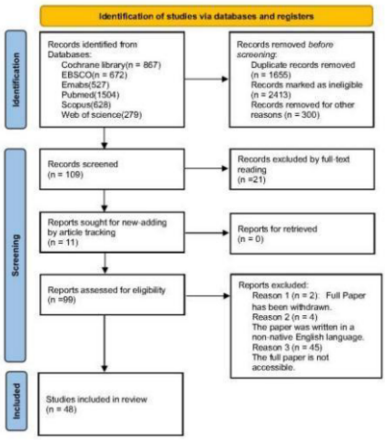

Figure 1 Search and selection process

Fig. 1 shows the search and selection process. Citation tracking yielded 4488 studies via database and hand searching until Oct. 2023. Finally, 48 studies were included.

3.2 Study characteristics

The review selected 48 articles spanning from 2014 to 2023, showing a steady annual increase in publications. In 2023, there were 17 publications [1,9-22], while only one article was released in 2014 [23]. These articles represent research from 19 countries, a focus on China with 15 articles [9,13,14,16,20,24-32], followed by South Korea with 5 articles [15,33-36].

3.3 Scope of AI Applications in Mental Health

Within the field of psychiatric disorders, applications of AI are being extensively explored across a variety of diseases. Currently, the research predominantly focuses on dementia[4,5,11,19,27,28,35,37-44], autism spectrum disorder[24,29,45],

schizophrenia[32,34,46]. Other areas like suicide[15,33], anxiety and depression[14], alcohol disorders[47], mental health staff[21, 48] have relatively fewer studies exploring AI applications.

3.4 AI Technologies in Psychiatric Nursing

The reviewed papers cover a range of AI technologies in psychiatric nursing, including machine learning, natural language processing [4,9,10,18,24,31,36], deep learning [24], and image processing[24] and so on. These studies explore AI applications from general usage to specific areas such as monitoring, clinical decision support [26], and various AI methods. Additionally, the papers explore robotics [5,11,19,27,37,39,43], wearable technology [39,41], and virtual reality, which was a major focus of several papers on the application of AI in psychiatric nursing. [10,14,17,20,28,29,31,34,35,40,47,48,50].

3.5 Aspects of AI in Psychiatric Nursing

In psychiatric nursing, AI applications have begun to penetrate various facets and are beginning to make an impact. These applications are still evolving and are being explored in areas such as 1) Personalized Care [26,30,52]: Care plans tailored to patient data. 2) Symptom Monitoring [22,41,42,49]: Tracking emotional changes using speech/text analysis, facial recognition, and behavioral patterns. 3) Risk Assessment [9,15,32,33,42,51,52]: Identifying suicide risk and potential violent behavior for early intervention. 4) Improving Patient Outcomes [11,24,29,35,38,39,43,50]: Enhancing life aspects for psychiatric patients through AI integration. 5) Nursing Education [13,17,28,34,40,48]: Using AI, such as virtual reality for teaching and improving clinical judgment. 6) Clinical Management [16,53]: Improving nursing documentation through speech recognition. 7) Emotional Support [12,35,37]: Providing continuous support via AI tools such as chatbots and virtual reality. 8) Relapse Management [36,46]: Predicting likelihood of relapse for early intervention. 9) Ethical Considerations [5]: Addressing concerns about the use of AI in maintaining patient autonomy and balancing caregiver needs.

4. Discussion

4.1 Difficulties and Challenges in Applying AI in Psychiatric Nursing

The application of AI in psychiatric nursing faces a number of complex challenges. A significant barrier is the collection of diverse and representative mental health data which is crucial to avoid biased or insufficient datasets that could compromise the accuracy of AI models. The lack of transparency in AI decision-making processes, and the need for more interpretable explanations, poses a challenge to building trust between healthcare providers and patients. Concerns about data privacy, especially with regard to sensitive patient information, and fears that AI will replace human care further exacerbate these challenges. Issues related to the reliability of algorithms and their adaptability to different patient needs also require attention. Ethical considerations, including protecting the confidentiality of patient data and ensuring the

transparency of AI-influenced decisions, are critical to the use of AI in psychiatric nursing. Collaboration between technologists, ethicists and healthcare providers is essential to develop comprehensive ethical guidelines and address these challenges to effectively integrate AI into psychiatric nursing.

4.2 Future Directions and Prospects

Despite the significant advances that AI has made in the treatment of various mental disorders, its application in psychiatric nursing requires ongoing research and development. Several areas require further investigation, such as assessing the long-term effects and effectiveness of AI in psychiatric rehabilitation nursing. Comprehensive longitudinal studies are essential to determine the durability and effectiveness of AI applications in this area. Moreover, the generalisability of AI models across different cultures, backgrounds and individual cases requires extensive research with diverse populations to ensure the universality and inclusivity of the technology. Additionally, the effectiveness of AI in interacting with patients and its acceptance by patients requires further research to ensure its effective integration with human care. Furthermore, the potential of AI in early intervention and prevention of mental disorders needs to be further explored to improve the effectiveness of care and reduce risks to patients. Finally, more research is needed into the role of AI in formulating and adapting personalized treatment plans to better meet the individual needs of different patients. Further research is needed into the accuracy and reliability of AI in identifying and monitoring specific psychological symptoms (such as depression), and how AI can be integrated with existing psychiatric treatments (such as psychotherapy) to optimize overall treatment outcomes. In-depth research is also needed into the practicality and effectiveness of AI in crisis intervention and the management of urgent mental health situations.

5. Conclusions

AI has been applied to various aspects of psychiatric nursing with significant success. Evidence suggests that it can play an important role in improving patient outcomes, disease management and training for nursing staff. At the same time, challenges and difficulties in applying AI continue to emerge. The future of AI in psychiatric nursing warrants further exploration and research.

References

[1] Wilson RL, et al. Artificial intelligence: An eye cast towards the mental health nursing horizon. Int J Ment Health Nurs. 2023 Jun;32(3):938-44. https://doi.org/10.1111/inm.13121

[2] Kleebayoon A, et al. Artificial intelligence and mental health nursing care plans. J Psychiatr Ment Health Nurs. 2023 Sep 19. https://doi.org/10.1111/jpm.12982

[3] Higgins O, et al. Artificial intelligence (AI) and machine learning (ML) based decision support systems in mental health: An integrative review. Int J Ment Health Nurs. 2023 Aug;32(4):966-78. https://doi.org/10.1111/inm.13114

[4] David L, et al. Nursing procedures for advanced dementia: Traditional techniques versus autonomous robotic applications (Review). Exp Ther Med. 2022 Feb;23(2):124. https://doi.org/10.3892/etm.2021.11047

[5] Koh WQ, et al. The ethics of pet robots in dementia care settings: Care professionals' and organisational leaders' ethical intuitions. Front Psychiatry. 2023 Jan 23;14:1052889. https://doi.org/10.3389/fpsyt.2023.1052889
[6] Arksey H, et al. Scoping studies: towards a methodological framework. International journal of social research methodology. 2005 Feb 1;8(1):19-32. https://doi.org/10.1080/1364557032000119616
[7] Levac D, et al. Scoping studies: advancing the methodology. Implementation science. 2010 Dec;5:1-9. https://doi.org/10.1186/1748-5908-5-69
[8] Tricco AC, et al. PRISMA-ScR: Checklist and Explanation. Ann Intern Med. 2018 Oct 2;169(7):467-473.
[9] Hu YH, et al. An analysis of Chinese nursing electronic medical records to predict violence in psychiatric inpatients using text mining and machine learning techniques. PLoS One. 2023 Jun 7;18(6):e0286347. https://doi.org/10.1371/journal.pone.0286347
[10] Asiri HM, et al. A scoping review of different monitoring-technology devices in caring for older adults with cognitive impairment. Front Public Health. 2023 Jun 15;11:1144636. https://doi.org/10.3389/fpubh.2023.1144636
[11] Bevilacqua R, et al. Social robotics to support older people with dementia: a study protocol with Paro seal robot in an Italian Alzheimer's day center. Front Public Health. 2023 Jun 21;11:1141460. https://doi.org/10.3389/fpubh.2023.1141460
[12] Higgins O, Wilson RL. Commercial determinants and therapeutic chatbots: A mental health nursing perspective. Int J Ment Health Nurs. 2023 Dec;32(6):1509-1511. https://doi.org/10.1111/inm.13199
[13] Ho KF, et al. Comparison of nursing diagnostic accuracy when aided by Knowledge-Based Clinical Decision Support Systems with Clinical Diagnostic Validity and Bayesian Decision Models for psychiatric care plan formulation among nursing students: a quasi-experimental study. BMC Nurs. 2023 Apr 27;22(1):142. https://doi.org/10.1186/s12912-023-01292-y
[14] Hu Y, et al. Virtual Reality in Clinical Nursing Practice Over the Past 10 Years: Umbrella Review of Meta-Analyses. JMIR Serious Games. 2023 Nov 23;11:e52022. https://doi.org/10.2196/52022
[15] Kim J, et al. Identifying the suicidal ideation risk group among older adults in rural areas: Developing a predictive model using machine learning methods. J Adv Nurs. 2023 Feb;79(2):641-651. https://doi.org/10.1111/jan.15549
[16] Lee TY, et al. Machine-learning-based speech recognition system for nursing documentation - A pilot study. Int J Med Inform. 2023 Oct;178:105213. https://doi.org/10.1016/j.ijmedinf.2023.105213
[17] Moyer JE. Virtual Reality Simulation Applications in Pre-Licensure Psychiatric Nursing Curricula: An Integrative Review. Issues Ment Health Nurs. 2023 Oct;44(10):984-1001. https://doi.org/10.1080/01612840.2023.2243330
[18] Nashwan AJ, et al. Harnessing Artificial Intelligence: Strategies for Mental Health Nurses in Optimizing Psychiatric Patient Care. Issues Ment Health Nurs. 2023 Oct;44(10):1020-1034. https://doi.org/10.1080/01612840.2023.2263579
[19] Rashid NLA, et al. The effectiveness of a therapeutic robot, 'Paro', on behavioural and psychological symptoms, medication use, total sleep time and sociability in older adults with dementia: A systematic review and meta-analysis. Int J Nurs Stud. 2023 Sep;145:104530. https://doi.org/10.1016/j.ijnurstu.2023.104530
[20] Wang S, et al. Effect of virtual reality technology as intervention for people with kinesiophobia: A meta-analysis of randomised controlled trials. J Clin Nurs. 2023 Jul;32(13-14):3074-3086. https://doi.org/10.1111/jocn.16397
[21] Woodnutt S, Allen C, Snowden J, Flynn M, Hall S, Libberton P, Purvis F. Could artificial intelligence write mental health nursing care plans?. Journal of Psychiatric and Mental Health Nursing. 2024 Feb;31(1):79-86. https://doi.org/10.1111/jpm.12965
[22] Zhou Y, et al. Developing a machine learning model for detecting depression, anxiety, and apathy in older adults with mild cognitive impairment using speech and facial expressions: A cross-sectional observational study. Int J Nurs Stud. 2023 Oct;146:104562. https://doi.org/10.1016/j.ijnurstu.2023.104562
[23] Tomar D, et al. An emotion detection system based on multi least squares twin support vector machine. Advances in Artificial Intelligence. 2015 Jan 1;2014:8-8. https://doi.org/10.1155/2014/282659
[24] Ortiz Castellanos AE, et al. Deep Mobile Linguistic Therapy for Patients with ASD. Int J Environ Res Public Health. 2022 Oct 7;19(19):12857. https://doi.org/10.3390/ijerph191912857
[25] Hu YH, et al. An analysis of Chinese nursing electronic medical records to predict violence in psychiatric inpatients using text mining and machine learning techniques. PLoS One. 2023 Jun 7;18(6):e0286347. https://doi.org/10.1371/journal.pone.0286347
[26] Ho KF, et al. Design and evaluation of a knowledge-based clinical decision support system for the psychiatric nursing process. Comput Methods Programs Biomed. 2021 Aug;207:106128. https://doi.org/10.2196/preprints.12889

[27] Saragih ID, et al. Effects of robotic care interventions for dementia care: A systematic review and meta-analysis randomised controlled trials. J Clin Nurs. 2021 Nov;30(21-22):3139-3152. https://doi.org/10.1111/jocn.15856
[28] Xie Z, et al. Using Virtual Reality in the Care of Older Adults With Dementia: A Randomized Controlled Trial. J Gerontol Nurs. 2023 Nov;49(11):25-32. https://doi.org/10.3928/00989134-20231011-01
[29] Zhao J, et al. Virtual reality technology enhances the cognitive and social communication of children with autism spectrum disorder. Front Public Health. 2022 Oct 6;10:1029392. https://doi.org/10.3389/fpubh.2022.1029392
[30] Chen X, et al. The Application of Convolutional Neural Network Model in Diagnosis and Nursing of MR Imaging in Alzheimer's Disease. Interdiscip Sci. 2022 Mar;14(1):34-44. https://doi.org/10.1007/s12539-021-00450-7
[31] YANG F, et al. The Application of Artificial Intelligence in the Mental Diseases; proceedings of the ACM International Conference Proceeding Series, F, 2020 [C]. Association for Computing Machinery.
[32] Yu T, et al. The Prediction and Influential Factors of Violence in Male Schizophrenia Patients With Machine Learning Algorithms. Front Psychiatry. 2022 Mar 11;13:799899. https://doi.org/10.3389/fpsyt.2022.799899
[33] Kim HK, et al. Decision Tree Identified Risk Groups with High Suicidal Ideation in South Korea: A Population-Based Study. Public Health Nurs. 2016 Mar-Apr;33(2):99-106. https://doi.org/10.1111/phn.12219
[34] Lee Y, et al. Usability of mental illness simulation involving scenarios with patients with schizophrenia via immersive virtual reality: A mixed methods study. PloS one. 2020 Sep 16;15(9):e0238437. https://doi.org/10.1371/journal.pone.0238437
[35] Kim JH, et al. Developing a virtual reality for people with dementia in nursing homes based on their psychological needs: a feasibility study. BMC Geriatr. 2021 Mar 7;21(1):167. https://doi.org/10.1186/s12877-021-02125-w
[36] Lee DY, et al. Psychosis Relapse Prediction Leveraging Electronic Health Records Data and Natural Language Processing Enrichment Methods. Front Psychiatry. 2022 Apr 5;13:844442. https://doi.org/10.3389/fpsyt.2022.844442
[37] Bemelmans R, et al. Effectiveness of Robot Paro in Intramural Psychogeriatric Care: A Multicenter Quasi-Experimental Study. J Am Med Dir Assoc. 2015 Nov 1;16(11):946-50. https://doi.org/10.1016/j.jamda.2015.05.007
[38] Jøranson N, et al. Effects on Symptoms of Agitation and Depression in Persons With Dementia Participating in Robot-Assisted Activity: A Cluster RCT. J Am Med Dir Assoc. 2015 Oct 1;16(10):867-73. https://doi.org/10.1016/j.jamda.2015.05.002
[39] Moyle W, et al. Effect of a robotic seal on the motor activity and sleep patterns of older people with dementia, as measured by wearable technology: A cluster-randomised controlled trial. Maturitas. 2018 Apr;110:10-17. https://doi.org/10.1016/j.maturitas.2018.01.007
[40] Hirt J, Beer T. Use and impact of virtual reality simulation in dementia care education: A scoping review. Nurse Educ Today. 2020 Jan;84:104207. https://doi.org/10.1016/j.nedt.2019.104207
[41] Wang A, et al. Wearable multimodal sensors for the detection of behavioral and psychological symptoms of dementia using personalized machine learning models. Amst. 2022 Apr 27;14(1):e12305. https://doi.org/10.1002/dad2.12305
[42] Pu L, et al. Feasibility study protocol of the PainChek app to assess the efficacy of a social robot intervention for people with dementia. J Adv Nurs. 2022 Feb;78(2):587-594. https://doi.org/10.1111/jan.15106
[43] Zuschnegg J, et al. Humanoid socially assistive robots in dementia care: a qualitative study about expectations of caregivers and dementia trainers. Aging Ment Health. 2022 Jun;26(6):1270-1280. https://doi.org/10.1080/13607863.2021.1913476
[44] Pu L, et al. Feasibility study protocol of the PainChek app to assess the efficacy of a social robot intervention for people with dementia. J Adv Nurs. 2022 Feb;78(2):587-594. https://doi.org/10.1111/jan.15106
[45] Ghosh T, et al. Artificial intelligence and internet of things in screening and management of autism spectrum disorder. Sustainable Cities and Society. 2021 Nov 1;74:103189. https://doi.org/10.1016/j.scs.2021.103189
[46] Zhao Q, Yuan S. Magnetic Resonance Imaging (MRI) Based on Machine Learning Algorithms for the Diagnosis in Efficacy of Dexmedetomidine along with Modified Electroconvulsive Therapy Nursing on First Episode Schizophrenia. Scientific Programming. 2021 Nov 29;2021:1-9. https://doi.org/10.1155/2021/1897571
[47] Lebiecka Z, et al. Is Virtual Reality Cue Exposure a Promising Adjunctive Treatment for Alcohol Use Disorder? J Clin Med. 2021 Jul 1;10(13):2972. https://doi.org/10.3390/jcm10132972

[48] Riches S, et al. Virtual reality-based training for mental health staff: a novel approach to increase empathy, compassion, and subjective understanding of service user experience. Adv Simul (Lond). 2022 Jul 19;7(1):19. https://doi.org/10.1186/s41077-022-00217-0
[49] Barrera A, et al. Introducing artificial intelligence in acute psychiatric inpatient care: qualitative study of its use to conduct nursing observations. Evid Based Ment Health. 2020 Feb;23(1):34-38. https://doi.org/10.1136/ebmental-2019-300136
[50] Brander M, et al. Virtual Reality Human-Human Interface to Deliver Psychotherapy to People Experiencing Auditory Verbal Hallucinations: Development and Usability Study. JMIR Serious Games. 2021 Jun 1;9(2):e26820. https://doi.org/10.2196/26820
[51] Suchting R, et al. A data science approach to predicting patient aggressive events in a psychiatric hospital. Psychiatry Res. 2018 Oct;268:217-222. https://doi.org/10.1016/j.psychres.2018.07.004
[52] Neumann M, Klatt T. Identifying Predictors of Inpatient Verbal Aggression in a Forensic Psychiatric Setting Using a Tree-based Modeling Approach. J Interpers Violence. 2022 Sep ;37(17-18): NP16351-NP16376. https://doi.org/10.1177/08862605211021972
[53] Kosters J, et al. Soundscape Awareness Intervention Reduced Neuropsychiatric Symptoms in Nursing Home Residents With Dementia: A Cluster-Randomized Trial With MoSART. J Am Med Dir Assoc. 2023 Feb;24(2):192-198.e5. https://doi.org/10.1016/j.jamda.2022.11.010