

continuing education systems should be strengthened by integrating pharmaceutical knowledge, medication safety standards, and communication skills into routine training programs, while enhancing practical competence through simulation-based training and interprofessional discussions.

On this basis, a structured competency assessment and supervision mechanism should be established to enable ongoing evaluation of nurses' abilities in identifying medication deviations, utilizing clinical decision-support tools, and participating in therapeutic decision-making. This would help form a supportive closed-loop framework encompassing training, practice, assessment, and supervision. Meanwhile, healthcare institutions should reinforce institutional support by advancing integrated electronic medical record systems and clinical decision-support platforms, while strengthening collaboration among physicians, nurses, and pharmacists. Health management authorities should also encourage nurses' participation in policy formulation and quality improvement initiatives to ensure that medication safety measures are aligned with the practical needs of frontline clinical practice.

Acknowledgments

The authors extend sincere thanks to two anonymous peer reviewers for their feedback on the manuscript.

Conflict of Interest Disclosure

The authors affirm that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

References

- Alanazi A., Guhani M., Althobity S., Alharthi M., Alotaibi S., and Ghamdi F., 2024, The role of health education among nurses in promoting medication adherence: strategies and outcomes, *Journal of Healthcare Sciences*, 4(12): 1024-1030.
<https://doi.org/10.52533/johs.2024.41251>
- Alruwaili M., Alwallah S., AlRuwaili F., Asmari M., AlRowily R., Alghamedi F., Alenazi E., Alanazi A., Alshammari W., and Alghamedi N., 2024, The role of nursing in managing chronic illness: a review of patient outcomes and quality of life, *Journal of Ecohumanism*, 3(7): 4681.
<https://doi.org/10.62754/joe.v3i7.4681>
- Aly N., El-Shanawany S., Ghanem M., Elbiaa M., Mohamed H., and Lotfy W., 2023, Medication safety climate: managing high-alert medication administration and errors among nurses in intensive and critical care units, *Egyptian Nursing Journal*, 20(2): 228-236.
https://doi.org/10.4103/enj.enj_16_23
- Berardinelli D., Conti A., Hasnaoui A., Casabona E., Martin B., Campagna S., and Dimonte V., 2024, Nurse-led interventions for improving medication adherence in chronic diseases: a systematic review, *Healthcare*, 12(23): 2337.
<https://doi.org/10.3390/healthcare12232337>
- Bibi S., Saira .., Ihsan A., Nisa N., Begum H., Parveen N., Rehman A., and Khan S., 2025, Knowledge regarding the administration and regulation of high alert medications among nurses in tertiary care hospitals Bannu KPK, *Pakistan Journal of Health Sciences*, 6(4): 221-226.
<https://doi.org/10.54393/pjhs.v6i4.2828>
- Chan J.H., Walker S., Lim A., and Stokes E., 2025, Exploring an introduction to electronic medical record-based assessment of medication orders among novice pharmacy students, *American Journal of Pharmaceutical Education*, 89(9): 101477.
<https://doi.org/10.1016/j.ajpe.2025.101477>
- Chien T.C.R., Weng S.E., and Hsu W.T., 2025, Improving medication adherence in heart failure through pharmacist-led patient education: protocol for a mechanism-based study of information motivation and behavioral skills, *Patient Preference and Adherence*, 19: 1855-1868.
<https://doi.org/10.2147/ppa.s527419>
- Chiu Y., 2024, Automated medication verification system (AMVS): system based on edge detection and CNN classification drug on embedded systems, *Heliyon*, 10: e30486.
<https://doi.org/10.1016/j.heliyon.2024.e30486>
- Guo J., 2025, Nurses' chronic disease management competencies and patient adherence to long-term treatment plans, *Health Medicine and Therapeutics*, 1(1): 62-74.
<https://doi.org/10.63313/hmt.9008>
- Højgaard H., Høgh A., Lindholt J., Frederiksen K., and Dahl M., 2025, Effect of nurse-led telephone follow-up to optimize adherence to preventive medication after screen-detected cardiovascular disease: a randomized controlled trial, *European Journal of Cardiovascular Nursing*, 24(5): 748-759.
<https://doi.org/10.1093/eurjcn/zvaf047>
- Jandaghian-Bidgoli M., Jamalnia S., Pashmforosh M., Shaterian N., Darabiyan P., and Rafi A., 2025, Personalized nursing as the missing link of providing care: a systematic review, *BMC Nursing*, 24(1): 239.
<https://doi.org/10.1186/s12912-025-02855-x>
- Kanene N., Waldron K., Vest M., and Eckel S., 2025, Developing an autoverification framework for medication orders at UNC Health, *American Journal Health-System Pharmacists*, 82(22): 1256-1264.
<https://doi.org/10.1093/ajhp/zxaf081>