The Regional Tribune (TRT) | ISSN (Online): 3006-8428 | DOI: 10.55737/trt/v-i.226

Impact of AI-assisted Medication Dosing on Adherence, Cognition, and Treatment Perception in Elderly Patients

Abiha Zainab [1*] **Qurat-ul-Ain Zia** [2] **Walija Maryum** [3] **Hunaina Nadeem** [4] **Fiza Iman** [5]

[1] M.Phil. Scholar, Saulat Institute of Pharmaceutical Sciences, Quaid-i-Azam University, Islamabad, Pakistan.
Email: abihazani29@gmail.com

[2] BS Graduate, Saulat Institute of Pharmaceutical Sciences, Quaid-I-Azam University, Islamabad, Pakistan.
Email: quratulainzia159@gmail.com

[3] BS Graduate, Saulat Institute of Pharmaceutical Sciences, Quaid-I-Azam University, Islamabad, Pakistan.
Email: walijamaryum@gmail.com

[4] BS Graduate, Saulat Institute of Pharmaceutical Sciences, Quaid-I-Azam University, Islamabad, Pakistan.
Email: hunainanadeem875@gmail.com

[5] M.Phil. Scholar, National Institute of Psychology, Quaid-I-Azam University, Islamabad, Pakistan.
Email: imanfiza092@gmail.com

ABSTRACT: The focus of this study is to evaluate the effectiveness of an AI-assisted medication dosing system in improving medication compliance, cognitive function related to medication management, and treatment perception among elderly patients. 80 elderly patients undergo a quantitative, quasi-experimental pretest–posttest design, who received AI-guided dosing recommendations with clinician oversight for 12 weeks. Morisky Medication Adherence Scale (MMAS-8) is used to assess medication adherence, cognitive performance using the Mini-Mental State Examination (MMSE), and Structured Technology Acceptance Questionnaire is used for treatment perception. Pre- and post-intervention scores were compared by using paired sample t-tests and Pearson's correlation analysis inspects relationships among study variables. The results showed a substantial increase in compliance and therapeutic adherence (pre-intervention mean = 5.42 ± 1.21; post-intervention mean = 7.13 ± 0.96; t = 8.74, p < 0.001), cognitive function (pre-intervention mean = 24.18 ± 2.64; post-intervention mean = 26.03 ± 2.31; t = 6.11, p < 0.001), and treatment evaluation (pre-intervention mean = 3.01 ± 0.54; post-intervention mean = 4.21 ± 0.47; t = 10.38, p < 0.001). Important positive interrelations were observed between adherence and cognitive performance (r = 0.58, p < 0.001), adherence and treatment perspective (r = 0.66, p < 0.001), and cognitive function and treatment performances (r = 0.49, p < 0.001). The conclusion illustrated that AI-assisted medication dosing significantly enhances adherence, cognitive ability for medication management, and patient acceptance, supporting its amalgamation into geriatric pharmacotherapy to enhance its clinical efficacy.

KEYWORDS: Medication Adherence, Cognitive Performance, Medication Management, AI-Assisted Medication, Elderly Patients

Pages: 300 – 309
Volume: 5
Issue: 1 (2026)

Corresponding Author
Abiha Zainab
✉ abihazani29@gmail.com

Cite this Article: Zainab, A., Zia, Q., Maryum, W., Nadeem, H. & Iman, F. (2026). Impact of AI-assisted Medication Dosing on Adherence, Cognition, and Treatment Perception in Elderly Patients. *The Regional Tribune, 5*(1), 300-309. https://doi.org/10.55737/trt/v-i.226

Introduction

Aging Population and Polypharmacy

The world's fastest demographic groups include those over the age of 60, as global population is aging at an exceptional rate. The World Health Organization vaccinated that by 2050, there will be over 2.1 billion people over the age of 60 (World Health Organization, 2018). This demographic shift is followed by an increase in the frequency of chronic, especially non communicable diseases such as hypertension, diabetes mellitus, cardiovascular problems, and neurodegenerative disorders, which often demand long-term pharmaceutical treatment.

Polypharmacy defined as the simultaneous use of five or more medications has become popular among older people (Maher et al., 2014). Use of multiple medications may be beneficial in some cases, although polypharmacy is frequently linked with negative outcomes such as drug-drug interactions, non-adherence of medication, an increased risk of falls, hospitalizations, and cognitive impairment (Gnjidic et al. 2012). Age-related physiological changes, such as compromised renal clearance, changed hepatic metabolism, and imbalances in body composition, enhance this population's sensitivity to precarious medication responses.

Besides low physiological resilience, geriatric patients often encounter issues related to a convoluted dosing schedule, thus causing confusion, lack of adherence, and lack of quality of life (Khezarian et al., 2020). The impaired mental ability and sensory capacity as are common in advancing age complicate administration of drugs since the likelihood of drug errors and unintentional use rises.

Challenges in Medication Adherence Among Elderly Patients

Medication adherence is a significant challenge for elderly individuals, which leads to poor treatment results, frequent hospitalizations, and more healthcare expenditures. Medication adherence is defined by the World Health Organization (WHO) as the extent to which a person's behavior matches agreed-upon instructions from a healthcare professional. Older people have low adherence rates, which indicates that over half of all senior patients do not take their prescriptions as recommended (Sabaté, 2003).

Two major factors for poor adherence among elderly people are Polypharmacy and regimen complexity. As the geriatric patients suffer from more chronic diseases which demands the administration of several drugs with varied dose regimens. Convoluted routine raises the risk of confusion, dosage mistakes, and purposeful or accidental noncompliance (Maher et al., 2014; Khezrian et al., 2020). Studies shows that low adherence level will increase the number of drugs (Gnjidic et al., 2012).

Cognitive impairment is another important factor contributing to drug nonadherence in the elderly people. Memory, executive function, and lack of attention because of ageing might hinder an individual's capacity to understand, remember, and follow prescription properly (Campbell et al., 2012). Even minor cognitive loss leads to missing doses, inappropriate scheduling, and unintentional overdose, especially in the absence of career help. Adverse drug responses (ADRs) lead to low adherence. As ADRs are more occur in elderly patients due to aging-related pharmacokinetics and pharmacodynamics changes. Side effects commonly cause individuals to deliberately stop medication or change their drugs without consulting their healthcare professionals (Maher et al., 2014). Fear of possible damage has a hazardous impact on patients' judgements of pharmaceutical need.

Depression, anxiety, limited patients' knowledge, and a lack of social support all contribute to adherence behavior. Older people in which depression is widespread, have been linked to poor drug adherence across several chronic disease states (DiMatteo et al., 2000). And the inability to understand purpose of treatment and advantages limits desire to adhere, especially in asymptomatic illnesses like hypertension or hyperlipidemia (Osterberg and Blaschke, 2005).

Factors which are linked with the healthcare system, such as non-patient -centered care, minimal follow-up, and patchy care, increase adherence problems. Elderly patients frequently account inadequate counselling about drug use, potential adverse effects, and treatment objectives, which leads to distrust and withdraw from therapy (Nieuwlaat et al., 2014). These complex problems emphasis the need for patient-centered, digital therapies to enhance adherence in geriatric populations.

Cognitive Decline and Its Impact on Drug Therapy Outcomes

Cognitive decline is a common process of growing age, and it is characterized by memory lapses, social deficits in attention, decreased executive motion and decreased rate of information processing. Such cognitive changes have been described as ranging between moderate cognitive impairment (MCI) and more in-depth impairments that include dementia and significantly affect medication therapy outcomes in the elderly. A cognitive dysfunction will cause the individual to have difficulty in understanding the instructions given in the prescription, dose schedules, and adherence to the prescription, lowering the effectiveness of therapeutic treatment (Campbell et al., 2012).

Among the most thoughtless consequences of cognitive impairments, medication nonadherence may be driven accidentally by lapse of memory or misunderstanding of dosage regimens. Research has revealed that frail aged patients with impaired cognition are significantly more apt to neglect doses, receive misleading doses or duplicate medications leading to poor disease control and higher chance of adverse drug events (ADEs). These were common in patients whose prescription schemes are complicated or those with polypharmacy.

Cognitive impairment increases the chances of error in medication and extreme reaction to drugs. Declines in cognitive control due to age would potentially impact decision making abilities and problem solving skills wherein a patient may not be able to respond appropriately to side effects or drug issues. And patients with cognitive impairment might not be able to effectively convey their symptoms to medical care workers, thereby delaying the identification of medication toxicity or treatment failure.

Cognitive impairment has been linked to the variation in the pharmacodynamics performance, especially in drugs that act on the central nervous system. Older adults with cognitive impairment might be highly vulnerable to psychoactive drugs, anticholinergics and sedatives, which contribute to deteriorated brain functions and status, creating a vicious circle of poor drug treatment outcomes. This reciprocal link emphasizes the importance of guarded drug selection and dosing in the elderly people.

In addition to clinical outcomes, cognitive impairments decrease treatment perception and self-efficacy. Patients characterized by reduced cognition often do not trust themselves to follow medication regimen alone, which can be a cause of anxiety, reliance on vocations or premeditated ending of therapy. Altogether, these features show that cognitive decline is a major predictor of low drug therapy outcomes in older patients, and individualized, cognitive adaptive drug management techniques are important to be promoted.

Limitations of Conventional Dosing Strategies

Clinical dosage procedures are basically guided by standardized recommendations after analyzing the population-level data. These techniques are simple and widely applicable, but they often become contraindicated due to considerable variance among geriatrics. Physiological changes associated with age, like compromised renal and hepatic function, altered body composition, insensitivity of receptors, cause changes in pharmacokinetics and pharmacodynamics. Due to this reason fixed-dose regimens become ineffective in elderly patients (Mangoni & Jackson, 2004).

The traditional dosing basically works on the approach of trial-and-error adjustments which is a major drawback, where dosage adjustments are implemented only after therapeutic failure or the occurrence of adverse drug reactions. This leads to medication related toxicity in the geriatrics because of compromised systems, leading to adverse effects due to polypharmacy and comorbidities (Maher et al., 2014). In addition, frail elderly patients are frequently underrepresented or excluded from clinical trials, limiting the general and practical relevance of standard dosing recommendations for the geriatric populations (Herrera et al., 2010).

Conventional dosing strategies mostly increases the treatment complexity, which can negatively affect medication adherence and cognitive burden. Medication administration of multiple daily doses, varied intake schedules, and subsequent dose adjustments can complicate medication management, especially for patients with cognitive impairment (Insel et al., 2006). Besides the documented effect on adherence and therapeutic success, traditional dosing systems infrequently integrate patient-reported outcomes such as perceptions of treatment effectiveness and efficacy (Osterberg & Blaschke, 2005).

Emergence of Artificial Intelligence in Personalized Medicine

Artificial intelligence (AI) has become an important tool in the healthcare field, particularly in the field of individualized medicine. Technologies such as machine learning (ML), deep learning, and clinical decision support systems are able to process vast and complicated data sets to identify patterns that mainstream analytical methods can't process (Topol, 2019). In pharmacotherapy, AI enables the development of individualized dose optimization according to patient-specific factors including age, renal function, genetic profile, medication history and comorbid conditions.

Unlike conventional dosing algorithms, AI-based models are able to make adaptations and continual update of their predictions as regards to the reactions of the patient. The result of these adaptations is a real-time dose adjustment and eases such as the early detection of possible adverse drug reactions (Sutton et al., 2020). These strategies have manifested significant ability in measuring the dosages for noxious medications, such as anticoagulants, anti-diabetic agents, and psychotropic drugs—where limited therapeutic ranges of drugs and high variability between the patients give rise to substantial challenges (Serrano et al., 2024). Apart from pharmacokinetic excellence, AI-based customized models also address to the behavioral and cognitive side of healthcare. By rationalizing the medication regimens, projecting adherence patterns, and generating patient-centered recommendations, AI systems can also lower the cognitive strain and enhance the treatment insight among the elderly patients (Nieuwlaat et al., 2014). On the top, combining AI models and techniques with computerized health tools including electronic health records, mobile health applications, and wearable devices permits the dynamic monitoring and increase patient engagement in therapeutic management.

Rationale and Research Gap

The increasing incidence of polypharmacy, age-associated cognitive impairment of different bodily systems, and insufficient medication compliance among the aged patients give rise to notable challenges in geriatric pharmacotherapy. While customary dosing techniques and adherence-support interventions have been widely studied and accepted, they are basically made on the population recommendations and backdated dose adjustments. So, these approaches have restricted ability to respond to the new emerging and individualized needs of aged patients (Maher et al., 2014; Mangoni & Jackson, 2004). Although the recent modulations in the artificial intelligence (AI) have shown significant abilities in the areas such as drug discovery, pharmacokinetic modeling, and dosage management, their blending into the routine clinical care for geriatric populations stays insufficient (Serrano et al., 2024).

Most of the present writings on the AI applications in healthcare field mostly focus on the improvements in the diagnostic accuracy, disease prediction, and operational efficiency. While less attention has been given to the patient-centered outcomes that includes medication compliance, rational strain, and treatment perception (Topol, 2019). Research on the AI-supported dosing models shows that they basically concentrate on the pharmacokinetic parameters or clinical biomarkers, often neglecting the behavioral and cognitive factors that significantly affect the therapeutic results in the geriatric patients (Sutton et al., 2020). This thing needs attention mainly in the already established relationship between the cognitive capacity, regimen complexity, and adherence behaviors among the older adults (Campbell et al., 2012).

Moreover, aged individuals have been discriminated in the clinical trials conventionally, which reduces the generalizability of the proof that supports innovative dosing technologies (Herrera et al., 2010). There remains a notable shortage of the empirical studies that examines whether AI-assisted dosing can optimize drug therapy and reduce cognitive load simultaneously, thereby improving adherence and patient perceptions about the treatment. Emphasis on this research gap is important to facilitate the precise medicine frameworks which are not only clinically effective but also rationally manageable and behaviorally sustainable for the geriatric populations.

Objectives

1. To quantitatively analyze the effect of AI-assisted medication dosing on medication adherence in geriatric patients.
2. To evaluate the differences in cognitive performance related to medication management.
1. To determine the patient's perception and acceptance of treatment of AI-assisted dosing system.

Hypotheses

H1: There is no significant difference in medication adherence between elderly patients receiving AI-assisted dosing and those receiving conventional dosing methods.

H2: AI-assisted dosing does not significantly affect cognitive performance associated to medication management in the geriatric patients.

H3: There is no significant difference in the treatment perception and acceptance between An assisted and conventional dosing groups.

Methodology

Study Design

This study basically based on a quantitative, quasi-experimental pretest–posttest design to calculate the impact of AI-assisted medication dosing on medication adherence, cognitive performance, and treatment perception among the geriatric patients. Results were measured before and after the intervention, enabling the assessment of changes attributable to the AI-assisted dosing system.

Study Sample

The study sample consisted of 80 geriatric patients aged 65 years and above, who were receiving long-term pharmacological treatment for chronic conditions such as hypertension, diabetes mellitus, dyslipidemia, and cardiovascular diseases. Eligible criteria require participants who were on two or more long-term medications and clinically stable for at least three months prior to enrollment in the study.

AI-Assisted Dosing Intervention

Participants received medication dosing recommendations generated by AI models under the supervision of healthcare professionals. This system provides the dose modifications and reminders according to the data collected from the patients.

Instruments

Medication Adherence Scale (MAS): Morisky et al. (2008) have proposed an 8-item Morisky Medication Adherence Scale (MMAS-8) to study the level of medication adherence among patients. The scale composed of eight questions that evaluate specific behaviors which are related to medication-related patterns, such as forgetting doses, negligence, and giving up on medication when feeling better or worse. All of the items are rated on the basis of a dichotomy (Yes or No), with an exception as the last items score a 5-point Likert Scale (Never to Always). The total score is 0-8 with a score less than 6 indicating low adherence, 6-7 indicating medium adherence, and 8 indicating high adherence. The scale has demonstrated sufficient levels of internal consistency (Cronbach 2 = 0.625-0.83).

Mini-Mental State Examination (MMSE): The Mini-Mental State Examination (MMSE) is a standardized 11-item tool introduced by Folstein et al. (1975) to examine cognitive function across five sectors: orientation, registration, attention and calculation, recall, and language. The total score ranges from 0 to 30, with higher scores showing high cognitive properties; scores of 23 or less shows cognitive impairment. The MMSE takes 5–10 minutes to administer and is most commonly used in clinical and research settings due to its high reliability and authenticity.

Structured Technology Acceptance Questionnaire: The Structured Technology Acceptance Questionnaire, which was adapted based on the Technology Acceptance Model (TAM) by Davis (1989), focuses on the levels of familiarity and approval of the AI-assisted medication dosing system by the participants in response to critical constructs like perceived effectiveness, ease of use, trust, attitude toward the use, and willingness to use in future. Questions are checked on a 5-point Likert scale with higher scores representing the increased acceptance and the more favorable treatment awareness. The tool is applied in a broad scope and has proven to be reliable and authentic in health technology studies.

Procedure

After obtaining the moral sanction, aged patients were selected from walk-in centers during their regular follow ups. A written consent form was taken from all of them. Their basic information was collected including demographic details. They were assessed using the Morisky Medication Adherence Scale (MMAS-8), the Mini-Mental State Examination (MMSE), and the Structured Technology Acceptance Questionnaire.

After this, an Ai-based medication dosing system was introduced in this. This system provided personalized dose suggestions and reminders by keeping patients clinical conditions in mind. All these recommendations were checked by the certified clinical. All the participants were properly trained to use the system. They were monitored properly for a period of over 12 weeks.

At the end of this intervention phase, changes in medication adherence, cognitive performance, and treatment perception were assessed using the same tools privacy and secrecy were maintained throughout the research and patients were also give. The right to withdraw any time.

Results

The data obtained from the analysis of 80 patients to evaluate the effectiveness of the AI-assisted medication dosing system on medication adherence, cognitive performance related to medication management, and treatment perception is explained in this section. This data is analyzed using SPSS version 26. To summarize participants' demographic information and to compare medication adherence, cognitive performance, and technology acceptance scores before and after the intervention descriptive statistics were used. To identify differences between pre and post-intervention results, t-tests and Pearson's correlation interventions were used. These tests were also used to examine the relationships among medication adherence, cognition, and treatment perception.

Table 1

Correlation Between Adherence, Cognition, and Treatment Perception

Variables	r-value	p-value
Adherence & Cognitive Performance	0.58	0.001
Adherence & Treatment Perception	0.66	0.002
Cognitive Performance & Perception	0.49	0.001

Pearson correlation analysis revealed significant positive relationships among study variables:

Table 2

Effect of AI-Assisted Dosing on Medication Adherence

Phase	Mean ± SD	t-value	p-value
Pre-intervention	5.42 ± 1.21		
Post-intervention	7.13 ± 0.96	8.74	<0.001

A paired-sample t-test indicated a significant increase in adherence scores after the intervention ($t = 8.74$, $p < 0.001$).

Table 3

Effect of AI-Assisted Dosing on Cognitive Performance

Phase	Mean ± SD	t-value	p-value
Pre-intervention	24.18 ± 2.64		
Post-intervention	26.03 ± 2.31	6.11	<0.001

The paired t-test revealed a significant improvement in MMSE scores post-intervention ($t = 6.11$, $p < 0.001$).

Table 4

Treatment Perception and Acceptance

Phase	Mean ± SD	t-value	p-value
Pre-intervention	3.01 ± 0.54		
Post-intervention	4.21 ± 0.47	10.38	<0.001

A paired-sample t-test indicated a significant improvement in treatment perception and acceptance following the AI-assisted dosing intervention ($t = 10.38$, $p < 0.001$).

Discussion

This study explains the impact of AI-assisted medicine dosage on older patients' medication adherence, cognitive performance, and treatment perception. The results showed betterment in three dimensions. The results support the use of AI-assisted treatments in older pharmacotherapy.

From table 1, it is concluded that there is positive relationship between adherence, treatment perception and cognitive performance. It indicates an interdependent connection in which adherence of AI tools can be promoted by better cognition and positive perception. It shows that drug adherence outcomes are influenced by patient involvement and faith in technology (Topol, 2019) . These findings support the influence of AI therapies to enhances clinical outcomes. It also promotes self-management in older patients.

MMAS-8 adherence scores in scale 2 have increased statistically significantly. According to earlier studies (Morisky et al., 2008), adherence in older persons can be improved by personalized, technology-assisted strategies that simplify complicated prescriptions. According to Maher et al., (2014), polypharmacy and adherence issues which are usually faced by older patients can be lessen by AI-assisted dosing. AI can actively enhance the behavior of medication if proper data of patient and real time coaching is provided.

Table 3 shows that the MMSE scores significantly improved. It suggests that increased cognitive function is linked to drug management. The AI systems provide streamlined instructions, timely reminders, and optimized dose regimens, this effect can be explained by a decrease in cognitive burden. Earlier research has shown that decreasing the cognitive demands of complex drug regimens might improve older persons' functional results and adherence (Khezrian et al., 2020). These findings state that simply decreasing the mental strain of managing many medications, AI-assisted dosage may indirectly improve cognition.

The table 4 shows the increase in scores on the Technology Acceptance Questionnaire. It suggests that participants who participated in the acceptance of the AI-assisted dosing method were more favorable. This is consistent with research on digital health, which shows that trust, perceived value, and accessibility of use are essential factors which influence adoption among older persons (Serrano et al., 2024). Acceptance of AI in healthcare can increase adherence and overall treatment efficacy by improving interaction with interventions.

Limitations

Some limitations are revealed in the study. Limitations include the inability to feature the effect of intervention because the trial is nonrandomized, and the non-randomized trial does not have a control group. The sample size was small, and it might have affected generalizability. A single center was the head of this study. Moreover, no long-term compliance and medical outcomes were observed after the 12 weeks. The future research needs to concentrate on randomized controlled trials, involving larger more heterogeneous populations and check-in durations to uncover the sustainability of such effects.

Conclusion

The overall aim of the study was to evaluate the effectiveness of AI-based dose adman schedule to enhance adherence to medication, brain processing in terms of drug administration It further reports perception and consent to treatment among old patients who undergo long-term pharmacotherapy. The AI system reduces mental load as well as maximizes the engagement of the patient through the provision of the individual dosage, reminders, and convenient medication regimes with medical supervision. These positive relationships between adherence and cognitive reaction and awareness of medicine prove the interdependent nature of technology approval and cognitive assistance to maximise the pharmacotherapy outcomes. These outcomes show the impact of AI-assisted dosing systems into elderly care to increase the medication management reducing risks related with polypharmacy and encourage patient-centered treatment. Further studies are needed to be conducted on random studies and i.e. of longer check-in to prove continuous adoption and longer duration.

References

Campbell, N. L., Boustani, M. A., Skopelja, E. N., Gao, S., Unverzagt, F. W., Murray, M. D., & Callahan, C. M. (2012). Medication adherence in older adults with cognitive impairment: A systematic evidence-based review. *The American Journal of Geriatric Pharmacotherapy, 10*(3), 165–177. https://doi.org/10.1016/j.amjopharm.2012.04.004

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

DiMatteo, M. R., Lepper, H. S., & Croghan, T. W. (2000). Depression is a risk factor for noncompliance with medical treatment. *Archives of Internal Medicine, 160*(14), 2101–2107. https://doi.org/10.1001/archinte.160.14.2101

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189–198. https://doi.org/10.1016/0022-3956(75)90026-6

Gnjidic, D., Hilmer, S. N., Blyth, F. M., Naganathan, V., Waite, L., Seibel, M. J., Handelsman, D. J., Cumming, R. G., & Le Couteur, D. G. (2012). Polypharmacy cutoff and outcomes: Five or more medicines were used to identify community-dwelling older men at risk of different adverse outcomes. *Journal of Clinical Epidemiology, 65*(9), 989–995. https://doi.org/10.1016/j.jclinepi.2012.02.018

Herrera, A. P., Snipes, S. A., King, D. W., Torres-Vigil, I., Goldberg, D. S., & Weinberg, A. D. (2010). Disparate inclusion of older adults in clinical trials: Priorities and opportunities for policy and practice change. *American Journal of Public Health, 100*(Suppl 1), S105–S112. https://doi.org/10.2105/AJPH.2009.162982

Insel, K. C., Morrow, D. G., Brewer, B. B., & Figueredo, A. J. (2006). Executive function, working memory, and medication adherence among older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 61*(2), P102–P107. https://doi.org/10.1093/geronb/61.2.P102

Khezrian, M., McNeil, C. J., Murray, A. D., & Myint, P. K. (2020). An overview of prevalence, determinants and health outcomes of polypharmacy. *Therapeutic Advances in Drug Safety, 11*, 1–10. https://doi.org/10.1177/2042098620933741

Maher, R. L., Hanlon, J., & Hajjar, E. R. (2014). Clinical consequences of polypharmacy in elderly. *Expert Opinion on Drug Safety, 13*(1), 57–65. https://doi.org/10.1517/14740338.2013.827660

Mangoni, A. A., & Jackson, S. H. D. (2004). Age-related changes in pharmacokinetics and pharmacodynamics: Basic principles and practical applications. *British Journal of Clinical Pharmacology, 57*(1), 6–14. https://doi.org/10.1046/j.1365-2125.2003.02007.x

Morisky, D. E., Ang, A., Krousel-Wood, M., & Ward, H. J. (2008). Predictive validity of a medication adherence measure for hypertension control. *Journal of Clinical Hypertension, 10*(5), 348–354. https://doi.org/10.1111/j.1751-7176.2008.07572.x

Nieuwlaat, R., Wilczynski, N., Navarro, T., Hobson, N., Jeffery, R., Keepanasseril, A., … Haynes, R. B. (2014). Interventions for enhancing medication adherence. *Cochrane Database of Systematic Reviews*, (11), CD000011. https://doi.org/10.1002/14651858.CD000011

Osterberg, L., & Blaschke, T. (2005). Adherence to medication. *The New England Journal of Medicine, 353*(5), 487–497. https://doi.org/10.1056/NEJMra050100

Sabaté, E. (Ed.). (2003). *Adherence to long-term therapies: evidence for action*. World health organization.

Serrano, D. R., Luciano, F. C., Anaya, B. J., Ongoren, B., Kara, A., Molina, G., Ramirez, B. I., Sánchez-Guirales, S. A., Simon, J. A., Tomietto, G., Rapti, C., Ruiz, H. K., Rawat, S., Kumar, D., & Lalatsa, A. (2024).

Artificial intelligence (AI) applications in drug discovery and drug delivery: Revolutionizing personalized medicine. *Pharmaceutics, 16*(10), 1328. https://doi.org/10.3390/pharmaceutics16101328

Sutton, R. T., Pincock, D., Baumgart, D. C., Sadowski, D. C., Fedorak, R. N., & Kroeker, K. I. (2020). An overview of clinical decision support systems: Benefits, risks, and strategies for success. *Journal of Biomedical Informatics, 109*, 103466. https://doi.org/10.1016/j.jbi.2020.103466

Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine, 25*(1), 44–56. https://doi.org/10.1038/s41591-018-0300-7

World Health Organization. (2003). *Adherence to long-term therapies: Evidence for action*. WHO.

World Health Organization. (2018). *Ageing and health*. WHO. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health