



Evaluating Pharmacist Interventions and Commonly Used Medications in the Geriatric Ward of a Teaching Hospital: A Retrospective Analysis

Khaled Obaid Hammad Albathali ¹, Abdullah Nazal Mohammed Alharbi ¹, Abdulrazaq Ahmed Hattab Alanazi ², Mamdouh Saud Dahi Alfadhli ¹, Ahmad Khalaf Ramadan Alanazi ², Naif Sulaiman Alharbi ²

1-Pharmacy Technician

2-Pharmacist

Abstract:

Objective: The prevalence of diseases increases with aging, leading to complex medication regimens among the elderly population. This study aimed to classify drug-related problems (DRPs), pharmacist interventions, and frequently prescribed medications concerning potential DRPs in patients admitted to the geriatric ward of a teaching hospital in Turkey.

Methods: Retrospective analysis of pharmacist medication review reports for 200 orders of 91 patients (mean age: 80.33 ± 0.46) was conducted.

Results: A total of 1,632 medications were assessed, with 329 interventions proposed for possible DRPs in 156 orders. Polypharmacy (≥ 5 drugs, mean: 8.17 ± 0.23) correlated with higher DRP occurrence (1.66 ± 0.11 vs. 1.04 ± 0.15 , $P < 0.05$). Adverse drug events were identified in 71.31% of cases, primarily due to drug interactions (40.12%). Only 22 potentially inappropriate medications were prescribed. Common interventions included therapy monitoring (31.0%), discontinuation (20.06%), and dosage adjustment (13.98%), with an 85.41% acceptance rate by geriatricians. Most frequently prescribed drugs targeted the nervous system, alimentary tract, metabolism, and cardiovascular system. Pharmacists identified 23 drugs with inappropriate pharmaceutical forms.

Conclusion: The study underscores the underutilization of clinical pharmacy services in Turkey's geriatric care. Collaboration between geriatricians and pharmacists is crucial, as evidenced by high acceptance rates of pharmacist interventions addressing various DRPs and medication classes in interdisciplinary geriatric teams.

Keywords: pharmaceutical care, clinical pharmacy, elderly, medication review, polypharmacy, potentially inappropriate medication

Introduction:

The global phenomenon of population aging, as outlined in the United Nations' World Population Prospects report, forecasts a significant increase in the number of older individuals worldwide, reaching an estimated 2.1 billion by 2050. Specifically, projections indicate a rising life expectancy at birth, expected to reach 82.5 years by 2050 and 89.1 years by 2100. With aging populations, there's a corresponding rise in the prevalence of diseases and geriatric syndromes, leading to more complex medication regimens and increased drug use among the elderly. This trend contributes to a higher risk of drug-related problems (DRPs), potentially inappropriate medication use (PIMs), and increased hospitalizations, particularly due to polypharmacy. (Cortejoso et al., 2016)

DRPs are defined as events or circumstances related to drug therapy that interfere with desired health outcomes. These issues not only impact clinical outcomes but also escalate health expenditure, posing an economic burden. Extensive research has demonstrated that pharmacists play a crucial role in resolving and preventing DRPs across various healthcare settings, including outpatient clinics, inpatient care, nursing homes, and palliative care environments. Studies focusing on inpatient care, especially among geriatric patients, have highlighted the benefits of integrating pharmacists into interdisciplinary healthcare teams, leading to improved outcomes, reduced drug-related readmissions, and decreased mortality rates. (Mangin et al., 2018)

Pharmaceutical care, characterized by pharmacists' contributions to optimizing medication use and enhancing health outcomes, forms the cornerstone of clinical pharmacy practice. Recent developments in pharmacy education and healthcare legislation reflect a growing recognition of pharmaceutical care. However, the implementation of clinical pharmacy services remains relatively nascent, emphasizing the need to establish standardized protocols for ward-based pharmacy services and enhance the quality and efficiency of care delivery. (Shim et al., 2018)

This study aims to define and categorize DRPs and pharmacist interventions within the geriatric ward of a teaching hospital in Turkey. Additionally, it seeks to identify frequently prescribed medications and pharmaceutical forms relevant to potential DRPs in this population, thereby contributing to the understanding and improvement of pharmaceutical care practices in geriatric healthcare settings. (Brahma et al., 2013)

Patients and Methods:

Settings and Data Collection:

The study took place within the acute geriatric ward of a government-run tertiary university hospital in Turkey, housing 1,800 beds. Patients aged 65 and above, admitted to the hospital's outpatient geriatric clinic or emergency department with acute geriatric conditions, were hospitalized. Referrals from smaller district hospitals were also accepted. Patient care was managed by an interdisciplinary team comprising geriatricians, nurses, and dietitians, ensuring comprehensive medical attention and discharge planning.

Two licensed pharmacists from the Department of Clinical Pharmacy at the Ege University's Faculty of Pharmacy began participating in weekly interdisciplinary geriatric rounds in December 2017. A routine medication review service was initiated, conducted once a week thereafter. Pharmacists evaluated medication orders, medication history, and clinical data (e.g., vitals, biochemical markers) to identify potential drug-related problems (DRPs). They prepared reports detailing possible DRPs and proposed interventions for each order, which were reviewed and discussed with a geriatrician during the weekly interdisciplinary rounds. Pharmacists noted the acceptance status of proposed interventions.

In the medication review process, pharmacists utilized software-based, guideline-based, or knowledge-based approaches to assess the latest medication orders for DRPs. They analyzed drug-drug interactions, food-drug interactions, disease-drug interactions, and intravenous incompatibilities using RxMediaPharma® Interactive Drug Database. Pharmacists also evaluated potentially inappropriate medication use in geriatric patients based on Beers criteria, STOPP criteria, and START criteria, supported by clinical practice guidelines for specific diseases when necessary.

Data Analysis:

Retrospective analysis involved examining pharmacist reports for 200 medication orders of 91 patients. The data were classified according to Pharmaceutical Care Network Europe's (PCNE) definitions and DRP classifications (PCNE Classification V 8.02). Standardized terms recommended by PCNE were utilized to facilitate result comparison across European studies. The classification included problem type, cause of the problem, proposed interventions, and acceptance status for the proposed interventions. The detailed classification of data with subcategories and frequencies is presented in Table S1, noting that one DRP may lead to multiple proposed interventions and have multiple causes.

Definitions:

Problem:

A problem refers to an expected or unexpected event or circumstance that is, or might be, incorrect in drug therapy. This study encompasses both manifest and potential problems, while technical issues (e.g., logistical or computer errors) are delineated separately.

Cause:

The cause is defined as the action or lack of action that leads to the occurrence of a potential or actual problem in drug therapy.

Intervention:

An intervention comprises proposed measures by the pharmacist to address the cause of the problem, aimed at preventing or resolving the issue. These proposed actions are intended to enhance and/or maintain patients' health and well-being.

Acceptance:

Acceptance signifies the evaluation of pharmacist intervention proposals by physicians, indicating the status of acceptance or rejection.

Statistical Analysis:

Data normality was assessed using the Kolmogorov–Smirnov test. Continuous data were described using mean $\pm$ standard error of the mean, while categorical data were presented as frequencies. Correlation between the number of DRPs and total medications per order was evaluated using Pearson's correlation test. Student's t-test was used to analyze the number of DRPs in orders based on age, gender, and the presence or absence of renal impairment and polypharmacy. Statistical analysis was performed using SPSS version 25.0, with a significance level set at $P < 0.05$.

Ethical Considerations:

This study received approval from the Ethics Committee for Clinical Research of the Faculty of Medicine at Ege University (Date: October 2, 2018; No: 18-10/4). Written informed consent was obtained from all patients or their substitute decision makers for their participation in the study.

Results:

The analysis encompassed pharmacists' reports on 200 medication orders involving 91 patients. Among these patients, 55 were hospitalized for two to six consecutive weeks, while seven were readmitted two to three times within six months post-discharge.

Pharmacists identified 329 possible DRPs in 156 orders, while no problems were detected in 44 orders. Analysis showed no significant differences in the number of medications and DRPs per order across various age groups, genders, or in the absence or presence of renal impairment. However, a weak positive correlation was noted between the total number of drugs used and the number of DRPs per order. Polypharmacy (five or more drugs) was observed in 175 (87.5%) orders, correlating with a higher number of DRPs.

Pharmacists proposed 329 interventions, with 282 (85.71%) interventions proposed directly to prescribers and 47 (14.28%) interventions discussed or informed to prescribers. The most frequent intervention was monitoring, followed by drug discontinuation and dosage adjustments.

Physicians accepted 85.41% ($n=281$) of pharmacist interventions, with 67.78% fully implemented, 12.16% partially implemented, and 3.65% not implemented. The acceptance status for 3.04% interventions was unknown, and 11.55% were rejected, mainly due to feasibility concerns or other reasons.

The study involved 1,632 medications, categorized per WHO–Anatomical Therapeutic Chemical (ATC) classification. The most ordered drugs belonged to ATC groups N (nervous system), A (alimentary tract and metabolism), C (cardiovascular system), B (blood and blood-forming organs), and J (anti-infectives for systemic use).

The most frequently prescribed medications were pantoprazole, enteral nutrition products, enoxaparin, furosemide, metoprolol, sertraline, quetiapine, insulin glargine, acetylsalicylic acid (ASA), and parenteral nutrition. The study also evaluated potential drug interactions related to these medications.

Only 22 potentially inappropriate medications (PIMs) were prescribed, identified by Beers criteria, STOPP/START criteria, or clinical practice guidelines. Adverse events were possible in 20 cases, mainly due to inappropriate drug combinations or high dosages. Pharmacist intervention proposals were accepted in most instances (86.36%) for addressing PIMs.

Additionally, pharmacist evaluations highlighted 23 instances of inappropriate drug formulations, primarily related to patient difficulties in swallowing or inappropriate administration routes. These issues were addressed through pharmacist interventions or hospital system corrections.

Discussion:

This study highlights the valuable contribution of pharmacists within interdisciplinary geriatric teams in Turkey. Pharmacists proposed numerous interventions for a wide range of DRPs, spanning different drug classes and forms.

The aging population often requires multiple medications due to increased chronic diseases and geriatric syndromes. Patients in this study were prescribed an average of 8.17 medications, aligning with previous reports. Polypharmacy, prevalent in 87.5% of orders, correlated with a higher incidence of DRPs. (Suggett et al., 2016)

Notably, age did not directly impact DRPs, consistent with findings that age alone does not significantly affect adverse drug events (ADEs). Polypharmacy, however, remains a significant risk factor for DRPs. (Gammie et al., 2017)

Drug interactions were a prominent cause of DRPs, emphasizing the need for vigilant medication reviews. Pharmacists focused on monitoring drug therapy, discontinuing drugs, and adjusting dosages or instructions, reflecting efforts to simplify therapy amid complex medication regimens. (Abunahlah et al., 2018)

The high acceptance rate of pharmacist interventions (85.4%) indicates a positive collaboration between pharmacists and physicians. Interventions commonly included monitoring drug therapy and adjusting drug use, aligning with other studies focused on simplifying therapy for patients on multiple medications. (Bosnak et al., 2018)

The most frequently ordered drugs belonged to categories affecting the nervous, alimentary, cardiovascular, and blood systems. Notably, medications like pantoprazole and quetiapine raised concerns due to potential drug interactions and adverse effects, highlighting the importance of pharmacist intervention in optimizing medication regimens. (Korcegez et al., 2017)

Potentially inappropriate prescribing was relatively low in this study, possibly due to specialized geriatric care. Pharmacists' high acceptance rates for resolving inappropriate prescriptions underscore their role in ensuring safe and effective medication use. (Wilson et al., 2011)

Swallowing difficulties and inappropriate drug formulations were identified as areas needing attention, emphasizing the importance of tailoring pharmaceutical forms to meet patients' needs, especially in the elderly population. (Van der Linden et al., 2018)

Standardized classification systems like PCNE facilitate documenting clinical pharmacy activities, promoting data sharing and comparison across healthcare settings. This study underscores the critical role of pharmacists in geriatric care and the importance of ongoing collaboration within interdisciplinary teams for optimal patient outcomes. (LA U et al., 2018)

Limitations:

This study has several limitations that should be considered. First, pharmacist interventions were evaluated retrospectively, and DRPs were defined prior to ward rounds, potentially missing actual (manifest) problems. The lack of follow-up evaluations limited the assessment of intervention outcomes. Additionally, the study was conducted in one hospital, resulting in a relatively small sample size and potentially limiting

the generalizability of the findings. Future research could benefit from assessing frequently encountered DRPs in patient subgroups with follow-up outcome evaluations.

Conclusion:

Despite its limitations, this study underscores the critical role of clinical pharmacy services in geriatric care. Pharmacists play a crucial role in addressing ADEs and drug interactions, which are common issues in geriatric patients. Interventions such as monitoring drug therapy, discontinuing drugs, and adjusting dosages are frequently needed and contribute to improving patient care.

Awareness of pharmaceutical form choices can also enhance patient safety by reducing the need to split or crush oral solid medications. Polypharmacy is a challenge in geriatric care but can be managed effectively through the collaboration of pharmacists with geriatric specialists and other healthcare professionals.

The study highlights the potential for advanced collaboration among healthcare professionals in interdisciplinary geriatric teams in Turkey. Pharmacists' recommendations for addressing various DRPs have been well-received by physicians, indicating the value of pharmacist involvement in patient care. This study provides insights that can inform the development of standard operating models for optimizing healthcare resources in Turkey's healthcare system.

References

1. United Nations World Population Prospects. The 2017 revision. Key findings and advance tables. 2017. Available from: https://esa.un.org/unpd/wpp/publications/files/wpp2017_keyfindings.pdf. Accessed January 5, 2019.
2. Cortejoso L, Dietz RA, Hofmann G, Gosch M, Sattler A. Impact of pharmacist interventions in older patients: a prospective study in a tertiary hospital in Germany. *Clin Interv Aging*. 2016;11:1343–1350. doi:10.2147/CIA.S109048
3. Gallagher P, Barry P, O'Mahony D. Inappropriate prescribing in the elderly. *J Clin Pharm Ther*. 2007;32(2):113–121. doi:10.1111/j.1365-2710.2007.00793.x
4. Mangin D, Bahat G, Golomb BA, et al. International Group for Reducing Inappropriate Medication Use & Polypharmacy (IGRIMUP): position statement and 10 recommendations for action. *Drugs Aging*. 2018;35(7):575–587. doi:10.1007/s40266-018-0554-2
5. Shim YW, Chua SS, Wong HC, Alwi S. Collaborative intervention between pharmacists and physicians on elderly patients: a randomized controlled trial. *Ther Clin Risk Manag*. 2018;14:1115–1125. doi:10.2147/TCRM.S146218
6. Brahma DK, Wahlang JB, Marak MD, Ch Sangma M. Adverse drug reactions in the elderly. *J Pharmacol Pharmacother*. 2013;4(2):91–94. doi:10.4103/0976-500X.110872
7. Suggett E, Marriott J. Risk factors associated with the requirement for pharmaceutical intervention in the hospital setting: a systematic review of the literature. *Drugs Real World Outcomes*. 2016;3(3): 241–263. doi:10.1007/s40801-016-0083-4
8. Pharmaceutical Care Network Europe Foundation. The PCNE classification V 8.02, 2018. Available from: <https://www.ismp.org/sites/default/files/attachments/2018-10/highAlert2018new-Oct2018-v1.pdf>. Accessed January 5, 2019.
9. Gammie T, Vogler S, Babar ZU. Economic evaluation of hospital and community pharmacy services. *Ann Pharmacother*. 2017;51(1):54–65. doi:10.1177/1060028016667741
10. Westerlund T, Marklund B. Assessment of the clinical and economic outcomes of pharmacy interventions in drug-related problems. *J Clin Pharm Ther*. 2009;34(3):319–327. doi:10.1111/j.1365-2710.2008.01017.x
11. Abunahlah N, Elawaisi A, Velibeyoglu FM, Sancar M. Drug related problems identified by clinical pharmacist at the Internal Medicine Ward in Turkey. *Int J Clin Pharm*. 2018;40(2):360–367. doi:10.1007/s11096-017-0585-5
12. Apikoglu-Rabus S, Yesilyaprak G, Izzettin FV. Drug-related problems and pharmacist interventions in a cohort of patients with asthma and chronic obstructive pulmonary disease. *Respir Med*. 2016;120:109–115. doi:10.1016/j.rmed.2016.10.006

13. Bosnak AS, Birand N, Diker O, Abdi A, Basgut B. The role of the pharmacist in the multidisciplinary approach to the prevention and resolution of drug-related problems in cancer chemotherapy. *J Oncol Pharm Pract.* 2018. doi:10.1177/1078155218786048
14. Demirkan K, Bayraktar-Ekincioglu A, Gulhan-Halil M, Abbasoglu O. Assessment of drug administration via feeding tube and the knowledge of health-care professionals in a university hospital. *Eur J Clin Nutr.* 2017;71(2):164–168. doi:10.1038/ejcn.2016.147
15. Halvorsen KH, Ruths S, Granas AG, Viktil KK. Multidisciplinary intervention to identify and resolve drug-related problems in Norwegian nursing homes. *Scand J Prim Health Care.* 2010;28(2):82–88. doi:10.3109/02813431003765455
16. Korcegez EI, Sancar M, Demirkan K. Effect of a pharmacist-led program on improving outcomes in patients with type 2 diabetes mellitus from northern cyprus: a randomized controlled trial. *J Manag Care Spec Pharm.* 2017;23(5):573–582. doi:10.18553/jmcp.2017.23.5.573
17. Spinewine A, Dhillon S, Mallet L, Tulkens PM, Wilmotte L, Swine C. Implementation of ward-based clinical pharmacy services in Belgium—description of the impact on a geriatric unit. *Ann Pharmacother.* 2006;40(4):720–728. doi:10.1345/aph.1G515
18. Wilson S, Wahler R, Brown J, Doloresco F, Monte SV. Impact of pharmacist intervention on clinical outcomes in the palliative care setting. *Am J Hosp Palliat Care.* 2011;28(5):316–320. doi:10.1177/1049909110391080
19. Selcuk A, Sancar M, Okuyan B, Demirtunc R, Izzettin FV. The potential role of clinical pharmacists in elderly patients during hospital admission. *Pharmazie.* 2015;70(8):559–562.
20. Somers A, Robays H, De Paepe P, Van Maele G, Perehudoff K, Petrovic M. Evaluation of clinical pharmacist recommendations in the geriatric ward of a Belgian university hospital. *Clin Interv Aging.* 2013;8:703–709. doi:10.2147/CIA.S42162
21. Van der Linden L, Hias J, Dreessen L, et al. Medication review versus usual care to improve drug therapies in older inpatients not admitted to geriatric wards: a quasi-experimental study (RASP-IGCT). *BMC Geriatr.* 2018;18(1):155. doi:10.1186/s12877-018-0843-y
22. LA U, Arun M, Ege M, et al. Media Pharma İnteraktif İlaç Bilgi Kaynağı 2018. In: Ustunes L, editor GEMAŞ Genel Mühendislik Mekanik Sanayi ve Ticaret A.Ş. İzmir, Turkey; 2018.
23. American Geriatrics Society 2015 Beers Criteria Update Expert Panel. American Geriatrics Society 2015 updated Beers criteria for potentially inappropriate medication use in older adults. *J Am Geriatr Soc.* 2015;63(11):2227–2246. doi:10.1111/jgs.13702
24. O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing.* 2015;44(2):213–218. doi:10.1093/ageing/afu145
25. Allemann SS, van Mil JW, Botermann L, Berger K, Griesse N, Hersberger KE. Pharmaceutical care: the PCNE definition 2013. *Int J Clin Pharm.* 2014;36(3):544–555. doi:10.1007/s11096-014-9933-x
26. van Mil JW, Westerlund LO, Hersberger KE, Schaefer MA. Drug-related problem classification systems. *Ann Pharmacother.* 2004;38(5):859–867. doi:10.1345/aph.1D182
27. Baijens LW, Clave P, Cras P, et al. European Society for Swallowing Disorders – European Union Geriatric Medicine Society white paper: oropharyngeal dysphagia as a geriatric syndrome. *Clin Interv Aging.* 2016;11:1403–1428. doi:10.2147/CIA.S107750
28. Bo M, Gibello M, Brunetti E, et al. Prevalence and predictors of inappropriate prescribing according to the screening tool of older people's prescriptions and screening tool to alert to right treatment version 2 criteria in older patients discharged from geriatric and internal medicine wards: a prospective observational multicenter study. *Geriatr Gerontol Int.* 2019;19(1):5–11.
29. Piau A, Huet Y, Gallini A, Andre L, Vellas B, Nourhashemi F. Optimization of drug therapy in elderly individuals admitted to a geriatric unit. *Clin Interv Aging.* 2017;12:1691–1696. doi:10.2147/CIA.S132309
30. Gurwitz JH, Avorn J. The ambiguous relation between aging and adverse drug reactions. *Ann Intern Med.* 1991;114(11):956–966.

31. Alhawassi TM, Krass I, Bajorek BV, Pont LG. A systematic review of the prevalence and risk factors for adverse drug reactions in the elderly in the acute care setting. Clin Interv Aging. 2014;9:2079–2086. doi:10.2147/CIA.S71178