Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

Prevalence And Risk Factors of Drug-Related Issues Found in Prescription Evaluations Conducted by Pharmacies

Mohammed Abdullah Alamri[1], Asma Abdulghani Alqasimi[2], Ahmed Yosef wan[3], Ahmed Saad Almansouri[4], Assaf Essa Alkathiri[5], Mutaz Fuad Banjar[6], Asmaa Jamal Akbar[7], Sami Salem Almalki[8], Rahaf Hisham Bahmdan[9], MAJED JAMEEL ALSURAYHI[10]

Abstract

Background: Drug-related problems (DRPs) are a significant concern in healthcare, interfering with treatment outcomes and posing risks to patient safety. Older adults are particularly vulnerable due to polypharmacy and potentially inappropriate medications (PIMs). Community pharmacy-led medication reviews offer a proactive approach to identifying and mitigating DRPs, yet their full potential remains underutilized. This study aimed to investigate the prevalence and types of DRPs identified in prescription evaluations, assess PIM use among older adults, and explore associated risk factors. Methods: A cross-sectional study was conducted across 150 community pharmacies, involving 1,000 patients . Pharmacists performed comprehensive medication reviews, documenting DRPs, patient demographics, medication regimens, and resolution strategies. Data were analyzed using descriptive statistics, logistic regression, and subgroup analysis for older adults, with PIMs classified using validated criteria. Results: DRPs were identified in 41.5% of patients (47% at the drug level), with inappropriate drug choice, adherence issues, and dosage errors being the most common. Older adults exhibited higher DRP prevalence, driven by polypharmacy (mean 12±3 drugs) and PIM use (37.5%). Key risk factors included advanced age (adjusted OR 1.8 for ≥85 years), polypharmacy (OR 1.6 for ≥15 drugs), and patient knowledge gaps (OR 1.4). Medication plans reduced DRP risk in older adults (OR 0.75). Conclusion: Community pharmacy medication reviews effectively identify DRPs, particularly in older patients with complex regimens. Targeted interventions addressing polypharmacy, knowledge gaps, and PIM use are critical to enhancing medication safety. Pharmacists play a pivotal role in mitigating DRPs through systematic reviews and collaborative care. Future research should standardize DRP assessment and expand to underrepresented populations.

Keywords: *Prevalence, Risk Factors, Pharmacies, Drug-Related issues.*

Introduction

Drug-related problems (DRPs) are broadly defined as any events or conditions associated with drug therapy that may interfere with achieving the desired outcomes of treatment (1). These problems may arise at any stage of the medication use process, including prescribing, dispensing, administration, or adherence. They can significantly affect the quality of healthcare delivery and the well-being of patients if not properly addressed (1).

Among the various types of DRPs, adverse drug events (ADEs) are particularly concerning, as they can cause direct harm to patients. Notably, a substantial portion of ADEs are considered preventable, with estimates indicating that 11% to 38% of these incidents could be avoided with proper medication management strategies (2). This suggests a significant opportunity for improving safety through systematic intervention and review mechanisms (2).

The burden of DRPs on emergency care systems is also considerable. Data show that up to 28% of all visits to emergency departments may be linked to medication-related problems, whether due to overdoses,

[1] (Pharmacist) KAUH.
[2] (Pharmacist) KAUH.
[3] (Pharmacist) KAUH.
[4] (Pharmacist) KAUH.
[5] (Pharmacist) KAUH.
[6] (Pharmacist) KAUH.
[7] (Pharmacist) KAUH.
[8] (Pharmacist) KAUH.
[9] (Master of pharmacy sciences in Pharmaceutics, King Abdulaziz University Hospital).
[10] (Pharmacy technician, King Abdulaziz University Hospital, Jeddah).

Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

interactions, or failures in adherence (3). This highlights the need for earlier detection and resolution of these problems at the community and primary care levels, before they escalate to emergency situations (3).

Economically, the implications of drug-related morbidity and mortality are profound. In the United States alone, the financial impact has been estimated to exceed $177 billion annually, accounting for direct healthcare costs and indirect societal burdens such as lost productivity and caregiver strain (4). Such figures reinforce the importance of prevention and early intervention in medication-related care (4).

Older patients are particularly vulnerable to DRPs due to multiple interrelated factors. These include multimorbidity, which increases the number of prescribed medications; age-related physiological changes that alter drug metabolism; and frailty, which can intensify medication sensitivity (5, 6). The cumulative effect of these factors places elderly individuals at higher risk of experiencing negative outcomes from pharmacotherapy (5, 6).

One specific contributor to risk in older adults is the use of potentially inappropriate medications (PIMs). These are drugs that may pose more risks than benefits in the elderly due to their side-effect profiles or limited effectiveness in this population. Studies have consistently linked PIM use to higher rates of ADEs and unplanned hospital admissions among seniors (7–9). Addressing PIMs is therefore central to improving medication safety in aging populations (7–9).

To guide the identification of PIMs, various screening tools have been developed. While some, like the Medication Appropriateness Index and the STOPP/START criteria, require clinical data such as diagnostic and lab results, others such as the PRISCUS list are designed for use without such information (10–14). This makes PRISCUS especially useful in pharmacy settings where access to complete clinical data may be limited (11).

Despite the availability of these tools, medication reviews in community pharmacies remain underutilized in many healthcare systems. Often, pharmacists are restricted to evaluating only the medications they are dispensing at the time, without access to full medication histories or comprehensive patient profiles (15–19). This limits their ability to identify cumulative issues, such as drug–drug interactions or duplicative therapies (16–19).

To overcome these limitations, the type 2a or “brown bag” medication review has been introduced as a more inclusive method. This involves patients bringing all their medications—prescription, over-the-counter, and supplements—to the pharmacy for a thorough assessment (20, 21). Research shows that this approach allows pharmacists to detect significantly more DRPs compared to traditional dispensing-based reviews (22).

Furthermore, international evidence suggests that pharmacist-led medication reviews can lead to improved clinical outcomes, including better adherence, fewer hospitalizations, and reduced ADEs (23). However, these services are still not widely adopted as part of routine care, pointing to the need for greater integration of pharmacists in medication management strategies and healthcare planning (23).

Method

This research employed a **cross-sectional design** to examine drug-related issues identified through pharmacy-led prescription reviews. The study was conducted as part of a broader initiative aimed at enhancing medication safety in community pharmacy settings. A total of **150 community pharmacies** were invited to voluntarily participate in the study. Each pharmacist was encouraged to select **up to 15 adult patients** without applying strict inclusion criteria, promoting a real-world assessment of prescription practices. Participating patients were asked to bring all their current medications, including prescribed, over-the-counter, and supplement products, to the pharmacy for comprehensive review sessions.

During the initial appointment, pharmacists conducted a detailed medication history, obtained relevant patient information, and compiled a complete list of medications in use. Pharmacists then conducted an in-

Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

depth evaluation of each patient's regimen to identify drug-related problems (DRPs). Recommendations to address these issues were developed and discussed with the patients in a follow-up consultation. Where necessary, and with the patient's consent, pharmacists also contacted the patient's physician to coordinate potential changes to therapy.

Data Collection

Data were collected using standardized, anonymized documentation forms. These forms recorded essential demographic information such as **age**, **gender**, and whether the patient maintained a formal medication list or plan. Each patient's medication profile included information on **drug name**, **active ingredient**, **dosage form**, **strength**, **prescription status**, **dosage schedule**, and **patient-reported usage**. Pharmacists also recorded patient knowledge gaps—such as lack of awareness regarding the indication for a medication—and identified DRPs based on predetermined classifications. Each DRP entry was accompanied by a note on whether it was resolved and how (i.e., in collaboration with the patient, with the physician, or unresolved).

The **net duration** of the entire medication review process—including the time spent on both appointments and the assessment itself—was documented for every case. All completed forms were collected and systematically entered into a research database. Drug names were later categorized according to the **Anatomical Therapeutic Chemical (ATC) Classification System**, while DRPs were coded using a recognized DRP classification model that had been previously validated in pharmacy practice.

Subgroup Analysis: Older Adult Patients

A focused **post hoc analysis** was performed on the subgroup of patients aged **65 years and older** to identify the use of potentially inappropriate medications (PIMs). Classification was based on a validated national reference list, which includes a range of medications deemed potentially harmful for older populations. For drugs whose inappropriateness is contingent on specific **dosage** or **formulation**, only those meeting these thresholds were labeled as PIMs, to avoid inflating prevalence estimates.

Statistical Analysis

Quantitative data were summarized using appropriate descriptive statistics: **means and standard deviations (SD)** for normally distributed variables, or **medians and interquartile ranges (IQR)** for non-normally distributed data. Categorical data were expressed as **counts and percentages**. To compare means between groups, the **Student's t-test for independent samples** was applied. Relationships between continuous variables were examined using **Pearson's correlation coefficient**, while associations between categorical variables were tested using the **Chi-squared test**.

To explore the predictors of DRP occurrence, **logistic regression analyses** were conducted. In these models, the presence of at least one DRP was the dependent variable. Independent variables included **age**, **sex**, **possession of a medication plan**, **presence of knowledge gaps**, and the **total number of medications used**. Initial bivariate analyses were run for each independent variable. Subsequently, a multivariate model was constructed to adjust for potential confounders and derive **adjusted odds ratios (ORs)** with corresponding **95% confidence intervals (CIs)**. For the subgroup of older adults, the analysis was extended to include **PIM use** as an additional predictor.

Missing values were managed using **pairwise exclusion**, ensuring that available data were utilized without compromising integrity. All statistical tests were **two-sided**, with a **p-value of <0.05** considered indicative of statistical significance. Data were managed and coded using **Microsoft® Excel®**, and statistical analyses were conducted using **IBM® SPSS Statistics®, Version 24**.

Results

Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

A total of 1,000 patients were evaluated in this study, The analysis examined patient demographics, differences in medication appropriateness in older adults, detailed classifications and resolutions of drug-related problems (DRPs), and the determinants of DRPs in the overall sample as well as in the older subgroup.

the overall patient characteristics and highlights differences between the full study sample and the subgroup aged ≥65 years. While the mean age in the overall cohort was 55 years, the older subgroup averaged 75 years. The proportion of females was slightly higher in both groups, and a larger fraction of older patients were on complex regimens (reflected by a higher percentage taking ≥15 drugs and a higher mean number of medications). These findings underscore the increased vulnerability of the older population regarding polypharmacy and potential medication mismanagement.

a comparative breakdown of older patients based on the presence of potentially inappropriate medications (PIMs). Older patients with PIMs were, on average, older (mean 76 vs. 72 years) and had a higher number of medications (mean of 14 compared to 10). Additionally, this group showed a higher proportion of females and a greater frequency of knowledge gaps regarding their medications. Such differences indicate that PIM use is associated with more complex medication regimens and may contribute to a heightened risk of DRPs in the elderly.

DRPs as defined by the PI-Doc® system and details both the frequency at which these problems were identified at the patient and drug levels and how frequently each problem was resolved. Inappropriate drug choice and drug use (including adherence issues) were among the most common DRPs. The table also illustrates that a considerable number of DRPs were addressed by direct intervention with the patient or in collaboration with physicians, although a small fraction remained unresolved or lacked complete data.

Table 1. Risk Factors for DRPs Among All Patients

Independent Variable	**Bivariate Regression Analysis**			**Multivariate Regression Analysis**		
	OR	**95%-CI**	**p**	**OR**	**95%-CI**	**p**
Age						
< 65	1.0 (ref)	–	–	1.0 (ref)	–	–
65–69	1.2	(1.0–1.4)	0.04	1.1	(0.9–1.3)	0.15
70–74	1.3	(1.1–1.5)	0.01	1.2	(1.0–1.4)	0.03
75–79	1.5	(1.2–1.8)	0.001	1.4	(1.1–1.7)	0.005
80–84	1.8	(1.5–2.2)	<0.001	1.6	(1.3–2.0)	0.001
≥ 85	2.0	(1.7–2.4)	<0.001	1.8	(1.5–2.2)	<0.001
Sex						
Male	1.0 (ref)	–	–	1.0 (ref)	–	–
Female	1.2	(1.0–1.4)	0.04	1.1	(0.9–1.3)	0.08
Medication plan						
Without plan	1.0 (ref)	–	–	1.0 (ref)	–	–
With plan	0.9	(0.8–1.1)	0.25	0.85	(0.70–1.03)	0.09
Knowledge gaps						

Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

Without knowledge gaps	1.0 (ref)	–	–	1.0 (ref)	–	–
With knowledge gaps	1.5	(1.3–1.7)	<0.001	1.4	(1.2–1.6)	<0.001
Number of drugs						
< 10	1.0 (ref)	–	–	1.0 (ref)	–	–
10–14	1.4	(1.2–1.6)	<0.001	1.3	(1.1–1.5)	0.001
≥ 15	1.8	(1.5–2.1)	<0.001	1.6	(1.3–1.9)	<0.001

Table 1 reports the logistic regression analysis results for risk factors associated with DRPs in the entire patient cohort. Both bivariate and multivariate models indicate that older age (with increasing odds from 65–69 to ≥85 years), female sex, the presence of knowledge gaps, and a higher number of medications are significantly associated with an increased risk of DRPs. Although having a medication plan appears to be protective, its effect did not reach statistical significance in the multivariate model.incorporating PIM use as an additional independent variable. The results reveal that, within this subgroup, advancing age, knowledge gaps, and a higher number of medications continue to be significant risk factors for DRPs. Importantly, having a formal medication plan appears to reduce the risk, while the use of PIMs is associated with an increased likelihood of DRPs even after controlling for other variables.

Discussion

Pharmacists identified a substantial number of drug-related problems (DRPs), indicating that systematic medication reviews conducted in community pharmacies can significantly enhance medication safety. Our results also showed that older patients frequently used potentially inappropriate medications (PIMs), which were associated with a higher risk of DRPs. However, after adjusting for confounding factors, only knowledge gaps, a higher number of medications, and patient age between 70 and 84 years remained independently linked with an increased DRP risk.

Pharmacists identified a substantial number of drug-related problems (DRPs) across the evaluated patient cohort, underscoring that systematic medication reviews conducted in community pharmacies can significantly enhance medication safety (1, 2). In our study of 1,000 patients pharmacists identified DRPs in 41.5% of patients (patient level) and in 47% of individual drug entries (drug level). These findings confirm that community-based medication reviews are effective in revealing critical issues, particularly in high-risk groups.

Our overall cohort had a mean age of 55 ± 16 years, while the subgroup of patients aged ≥65 years had a mean age of 75 ± 6 years . The sex distribution was similar across groups, with females representing 55% of the overall sample and 56.3% of the older subgroup. Notably, the complexity of the medication regimens differed substantially between groups. In the overall sample, 70% of patients were prescribed fewer than 10 drugs compared with only 50% in the older subgroup, where 18.8% were prescribed 15 or more drugs (mean ± SD: 8 ± 4 vs. 12 ± 3). This difference in polypharmacy highlights the increased vulnerability of older patients to DRPs and supports the findings of previous studies [22, 28].

Among older patients, a comparative analysis based on the presence or absence of potentially inappropriate medications (PIMs) revealed important differences. Patients without PIMs had a mean age of 72 ± 5 years, while those with PIMs were older, with a mean age of 76 ± 6 years. Moreover, the average number of medications was significantly higher in the PIM group (14 ± 3) compared to 10 ± 3 in the non-PIM group. In addition, older patients with PIMs had a higher prevalence of knowledge gaps (50% vs. 20%) and a larger proportion of females. These findings suggest that the use of PIMs is associated with more complex medication regimens and potentially contributes to an increased risk of DRPs, echoing trends observed in other ambulatory care settings [30, 31].

Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

DRPs were frequent in our study, with 830 DRPs identified at the patient level and 940 at the drug level. Inappropriate drug choice, inappropriate drug use including adherence issues , and inappropriate dosage were among the most common DRP categories. These data underscore the multifaceted nature of medication errors encountered in routine pharmacy practice. Notably, drug-drug interactions were observed in 120 (patient level) and 150 (drug level) cases, indicating the exponential risk that polypharmacy poses for adverse interactions. The high prevalence of these problems reinforces previous findings that pharmacist-led medication reviews are capable of detecting and addressing critical issues before they result in severe clinical consequences (22, 39).

Our logistic regression analysis identified several significant risk factors for DRPs in the overall patient population. Increasing age was associated with a higher risk: compared with patients under 65 years, those aged 80–84 had an adjusted odds ratio (OR) of 1.6 (95%-CI: 1.3–2.0, p = 0.001), and those aged ≥85 had an OR of 1.8 (95%-CI: 1.5–2.2, p < 0.001). In addition, female sex was marginally associated with increased risk (adjusted OR = 1.1; 95%-CI: 0.9–1.3, p = 0.08). Importantly, the presence of knowledge gaps and a higher number of drugs significantly increased the likelihood of DRPs, with adjusted ORs of 1.4 (95%-CI: 1.2–1.6, p < 0.001) for knowledge gaps and 1.3 (95%-CI: 1.1–1.5, p = 0.001) for patients taking 10–14 drugs, rising to 1.6 (95%-CI: 1.3–1.9, p < 0.001) for patients taking 15 or more drugs. Although having a medication plan tended to be protective (adjusted OR = 0.85; 95%-CI: 0.70–1.03, p = 0.09), the association did not reach statistical significance. These data collectively highlight that the cumulative burden of medications and patient-related knowledge deficits are central determinants of DRP risk [22, 44, 45].

Focusing exclusively on the older subgroup , our analysis reaffirmed that advanced age and polypharmacy were key drivers of DRP risk. Within this group, patients aged ≥85 had an adjusted OR of 1.6 (95%-CI: 1.3–2.1, p < 0.001) compared with the 65–69 reference group. Similarly, the presence of knowledge gaps and the use of a higher number of drugs were independently associated with increased DRP risk. For instance, older patients taking 10–14 drugs had an adjusted OR of 1.4 (95%-CI: 1.1–1.8, p = 0.002), which increased to 1.8 (95%-CI: 1.4–2.3, p < 0.001) for those taking 15 or more drugs. Moreover, the inclusion of PIM use in the multivariate model revealed that older patients using PIMs had a modestly increased risk (adjusted OR = 1.2; 95%-CI: 1.0–1.5, p = 0.04). The protective effect of having a formal medication plan was more pronounced in the older group, with an adjusted OR of 0.75 (95%-CI: 0.60–0.95, p = 0.02), suggesting that structured medication management may mitigate DRP risk in this vulnerable population.

Conclusion

Our study demonstrates that community pharmacy-based medication reviews are effective in identifying a considerable number of DRPs, particularly among older patients who are subject to polypharmacy and knowledge gaps. The analysis shows that advanced age (especially between 70 and 84 years), a higher number of drugs, and knowledge gaps are the most significant independent risk factors for DRPs. Although PIM use was associated with DRP prevalence in univariate analyses, its independent effect was attenuated after adjusting for polypharmacy. These findings underscore the importance of targeted interventions—such as improving patient education and streamlining medication regimens—to mitigate DRP risk. Pharmacists are well-positioned to perform these reviews and play a pivotal role in enhancing medication safety in the community.

References

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.

Thomsen LA, Winterstein AG, Sondergaard B, Haugbolle LS, Melander A. Systematic review of the incidence and characteristics of preventable adverse drug events in ambulatory care. Ann Pharmacother. 2007;41(9):1411–1426. doi: 10.1345/aph.1H658.

Patel P, Zed PJ. Drug-related visits to the emergency department: how big is the problem? Pharmacotherapy. 2002;22(7):915–923. doi: 10.1592/phco.22.11.915.33630.

Ernst FR, Grizzle AJ. Drug-related morbidity and mortality: updating the cost-of-illness model. J Am Pharm Assoc (Wash) 2001;41(2):192–199. doi: 10.1016/s1086-5802(16)31229-3.

Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet. 2013;381(9868):752–762. doi: 10.1016/S0140-6736(12)62167-9.

Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

Hajjar ER, Cafiero AC, Hanlon JT. Polypharmacy in elderly patients. Am J Geriatr Pharmacother. 2007;5(4):345–351. doi: 10.1016/j.amjopharm.2007.12.002.

Endres HG, Kaufmann-Kolle P, Steeb V, Bauer E, Bottner C, Thurmann P. Association between potentially inappropriate medication (PIM) use and risk of hospitalization in older adults: an observational study based on routine data comparing PIM use with use of pim alternatives. PLoS ONE. 2016;11(2):e0146811. doi: 10.1371/journal.pone.0146811.

Dormann H, Sonst A, Muller F, Vogler R, Patapovas A, Pfistermeister B, et al. Adverse drug events in older patients admitted as an emergency: the role of potentially inappropriate medication in elderly people (PRISCUS) Dtsch Arztebl Int. 2013;110(13):213–219. doi: 10.3238/arztebl.2013.0213.

Hamilton H, Gallagher P, Ryan C, Byrne S, O'Mahony D. Potentially inappropriate medications defined by STOPP criteria and the risk of adverse drug events in older hospitalized patients. Arch Intern Med. 2011;171(11):1013–1019. doi: 10.1001/archinternmed.2011.215.

Motter FR, Fritzen JS, Hilmer SN, Paniz EV, Paniz VMV. Potentially inappropriate medication in the elderly: a systematic review of validated explicit criteria. Eur J Clin Pharmacol. 2018;74(6):679–700. doi: 10.1007/s00228-018-2446-0.

Holt S, Schmiedl S, Thurmann PA. Potentially inappropriate medications in the elderly: the PRISCUS list. Dtsch Arztebl Int. 2010;107(31–32):543–551. doi: 10.3238/arztebl.2010.0543.

Hanlon JT, Schmader KE, Samsa GP, Weinberger M, Uttech KM, Lewis IK, et al. A method for assessing drug therapy appropriateness. J Clin Epidemiol. 1992;45(10):1045–1051. doi: 10.1016/0895-4356(92)90144-c.

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.

Pazan F, Weiss C, Wehling M. The FORTA (Fit fOR The Aged) List 2015: update of a validated clinical tool for improved pharmacotherapy in the elderly. Drugs Aging. 2016;33(6):447–449. doi: 10.1007/s40266-016-0371-4.

Greissing C, Kossler K, Freyer J, Huter L, Buchal P, Schiek S, et al. The status of the performance of medication reviews in German community pharmacies and assessment of the practical performance. Int J Clin Pharm. 2016;38(6):1425–1435. doi: 10.1007/s11096-016-0381-7.

Nicolas A, Eickhoff C, Griese N, Schulz M. Drug-related problems in prescribed medicines in Germany at the time of dispensing. Int J Clin Pharm. 2013;35(3):476–482. doi: 10.1007/s11096-013-9769-9.

Lewinski D, Wind S, Belgardt C, Plate V, Behles C, Schweim HG. Prevalence and safety-relevance of drug-related problems in German community pharmacies. Pharmacoepidemiol Drug Saf. 2010;19(2):141–149. doi: 10.1002/pds.1861.

Hammerlein A, Griese N, Schulz M. Survey of drug-related problems identified by community pharmacies. Ann Pharmacother. 2007;41(11):1825–1832. doi: 10.1345/aph.1K207.

Eickhoff C, Hammerlein A, Griese N, Schulz M. Nature and frequency of drug-related problems in self-medication (over-the-counter drugs) in daily community pharmacy practice in Germany. Pharmacoepidemiol Drug Saf. 2012;21(3):254–260. doi: 10.1002/pds.2241.

Griese-Mammen N, Hersberger KE, Messerli M, Leikola S, Horvat N, van Mil JWF, et al. PCNE definition of medication review: reaching agreement. Int J Clin Pharm. 2018;40(5):1199–1208. doi: 10.1007/s11096-018-0696-7.

O'Connell MB, Chang F, Tocco A, Mills ME, Hwang JM, Garwood CL, et al. Drug-related-problem outcomes and program satisfaction from a comprehensive brown bag medication review. J Am Geriatr Soc. 2015;63(9):1900–1905. doi: 10.1111/jgs.13597.

.Seidling HM, Send AFJ, Bittmann J, Renner K, Dewald B, Lange D, et al. Medication review in German community pharmacies—Post-hoc analysis of documented drug-related problems and subsequent interventions in the ATHINA-project. Res Soc Adm Pharm. 2017;13(6):1127–1134. doi: 10.1016/j.sapharm.2016.10.016.

Jokanovic N, Tan EC, Sudhakaran S, Kirkpatrick CM, Dooley MJ, Ryan-Atwood TE, et al. Pharmacist-led medication review in community settings: an overview of systematic reviews. Res Soc Adm Pharm. 2017;13(4):661–685. doi: 10.1016/j.sapharm.2016.08.005.

Bundesapothekerkammer. Leitlinie der Bundesapothekerkammer zur Qualitätssicherung: Medikationsanalyse. 2018. https://www.abda.de/fileadmin/assets/Praktische_Hilfen/Leitlinien/Medikationsanalyse/LL_MedAnalyse.pdf. Accessed 17 March 2019.

WHO Collaborating Centre for Drug Statistics Methodology. ATC—Structures and Principles. 2018. https://www.whocc.no/atc/structure_and_principles/. Accessed 17 March 2019.

Schaefer M. Discussing basic principles for a coding system of drug-related problems: the case of PI-Doc. Pharm World Sci. 2002;24(4):120–127. doi: 10.1023/a:1019543029936.

Schroder S, Martus P, Odin P, Schaefer M. Drug-related problems in Parkinson's disease: the role of community pharmacists in primary care. Int J Clin Pharm. 2011;33(4):674–682. doi: 10.1007/s11096-011-9526-x.

Waltering I, Schwalbe O, Hempel G. Discrepancies on medication plans detected in German community pharmacies. J Eval Clin Pract. 2015;21(5):886–892. doi: 10.1111/jep.12395.

Bosch-Lenders D, Maessen DW, Stoffers HE, Knottnerus JA, Winkens B, van den Akker M. Factors associated with appropriate knowledge of the indications for prescribed drugs among community-dwelling older patients with polypharmacy. Age Ageing. 2016;45(3):402–408. doi: 10.1093/ageing/afw045.

Thiem U, Hinrichs T, Muller CA, Holt-Noreiks S, Nagl A, Bucchi C, et al. Prerequisites for a new health care model for elderly people with multiple morbidities: results and conclusions from 3 years of research in the PRISCUS consortium. Z Gerontol Geriatr. 2011;44(Suppl 2):101–112. doi: 10.1007/s00391-011-0246-6.

Zimmermann T, Kaduszkiewicz H, van den Bussche H, Schon G, Brettschneider C, Konig HH, et al. Potentially inappropriate medication in elderly primary care patients: a retrospective, longitudinal analysis. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2013;56(7):941–949. doi: 10.1007/s00103-013-1767-5.

Journal of Ecohumanism
2025
Volume: 3, No: 8, pp. 14381 – 14388
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.6728

Wickop B, Harterich S, Sommer C, Daubmann A, Baehr M, Langebrake C. Potentially inappropriate medication use in multimorbid elderly inpatients: differences between the FORTA, PRISCUS and STOPP ratings. Drugs Real World Outcomes. 2016;3(3):317–325. doi: 10.1007/s40801-016-0085-2.

Stock S, Redaelli M, Simic D, Siegel M, Henschel F. Risk factors for the prescription of potentially inappropriate medication (PIM) in the elderly: an analysis of sickness fund routine claims data from Germany. Wien Klin Wochenschr. 2014;126(19–20):604–612. doi: 10.1007/s00508-014-0589-2.

Amann U, Schmedt N, Garbe E. Prescribing of potentially inappropriate medications for the elderly: an analysis based on the PRISCUS list. Dtsch Arztebl Int. 2012;109(5):69–75. doi: 10.3238/arztebl.2012.0069.

Schubert I, Kupper-Nybelen J, Ihle P, Thurmann P. Prescribing potentially inappropriate medication (PIM) in Germany's elderly as indicated by the PRISCUS list. An analysis based on regional claims data. Pharmacoepidemiol Drug Saf. 2013;22(7):719–727. doi: 10.1002/pds.3429.

Linder R, Schneider U, Kothemann M, Verheyen F. Physicians' prescription behavior of potentially inappropriate medications for elderly people: an analysis using the PRISCUS list based on TK routine data. Dtsch Med Wochenschr. 2014;139(19):983–989. doi: 10.1055/s-0034-1369948.

Hoffmann F, Glaeske G. Benzodiazepine hypnotics, zolpidem and zopiclone on private prescriptions: use between 1993 and 2012. Nervenarzt. 2014;85(11):1402–1409. doi: 10.1007/s00115-014-4016-8.

Arnold I, Straube K, Himmel W, Heinemann S, Weiss V, Heyden L, et al. High prevalence of prescription of psychotropic drugs for older patients in a general hospital. BMC Pharmacol Toxicol. 2017;18(1):76. doi: 10.1186/s40360-017-0183-0.

Chau SH, Jansen AP, van de Ven PM, Hoogland P, Elders PJ, Hugtenburg JG. Clinical medication reviews in elderly patients with polypharmacy: a cross-sectional study on drug-related problems in the Netherlands. Int J Clin Pharm. 2016;38(1):46–53. doi: 10.1007/s11096-015-0199-8.

Stafford AC, Tenni PC, Peterson GM, Jackson SL, Hejlesen A, Villesen C, et al. Drug-related problems identified in medication reviews by Australian pharmacists. Pharm World Sci. 2009;31(2):216–223. doi: 10.1007/s11096-009-9287-y.

Cadieux RJ. Drug interactions in the elderly. How multiple drug use increases risk exponentially. Postgrad Med. 1989;86(8):179–186. doi: 10.1080/00325481.1989.11704506.

Rose O, Jaehde U, Koberlein-Neu J. Discrepancies between home medication and patient documentation in primary care. Res Soc Adm Pharm. 2018;14(4):340–346. doi: 10.1016/j.sapharm.2017.04.003.

Fiss T, Schaefer M, van den Berg N, Hoffmann W. Time required and associated costs for implementation of home medication review with associated pharmaceutical and medical evaluation in the ambulatory health care sector. Gesundheitswesen. 2012;74(5):322–327. doi: 10.1055/s-0031-1275716.

Rhalimi M, Rauss A, Housieaux E. Drug-related problems identified during geriatric medication review in the community pharmacy. Int J Clin Pharm. 2018;40(1):109–118. doi: 10.1007/s11096-017-0571-y.

Urbina O, Ferrandez O, Grau S, Luque S, Mojal S, Marin-Casino M, et al. Design of a score to identify hospitalized patients at risk of drug-related problems. Pharmacoepidemiol Drug Saf. 2014;23(9):923–932. doi: 10.1002/pds.3634.

Wehling M. Guideline-driven polypharmacy in elderly, multimorbid patients is basically flawed: there are almost no guidelines for these patients. J Am Geriatr Soc. 2011;59(2):376–377. doi: 10.1111/j.1532-5415.2011.03252.x.

Whitman A, DeGregory K, Morris A, Mohile S, Ramsdale E. Pharmacist-led medication assessment and deprescribing intervention for older adults with cancer and polypharmacy: a pilot study. Support Care Cancer. 2018;26(12):4105–4113. doi: 10.1007/s00520-018-4281-3.