

Evaluating the Impact of Pharmacist-Driven Medication Reviews in Geriatric Inpatient Units: Reducing Polypharmacy and Preventing Adverse Drug Reactions

¹Shatha H. Abu jabah, ²Hadeel M. Alharbi, ³Sahar A. Alsuliami Alharbi

Pharmacist

Health Affairs of National Guard Hospital

Abstract

This study evaluates the effectiveness of pharmacist-driven medication reviews in reducing polypharmacy and preventing adverse drug reactions (ADRs) in geriatric inpatient units. Conducted in a large tertiary hospital over 12 months, the study involved 300 elderly patients who underwent regular medication reviews by clinical pharmacists. The findings revealed a significant reduction in the average number of medications per patient, from 9.2 to 6.8, and a decrease in ADR incidence from 21% to 11%. Additionally, hospital length of stay and 30-day readmission rates were significantly reduced. These results highlight the critical role of pharmacists in optimizing medication management for elderly patients, improving patient outcomes, and enhancing healthcare efficiency.

Keywords: Pharmacist-driven medication review, polypharmacy, adverse drug reactions, geriatric inpatient care, medication safety, elderly patients

Introduction

Polypharmacy, defined as the concurrent use of multiple medications, is a common and growing concern in geriatric populations. As the elderly often present with multiple chronic conditions, they are frequently prescribed a complex array of medications. While necessary to manage their health conditions, polypharmacy increases the risk of adverse drug reactions (ADRs), drug-drug interactions, and medication non-adherence, leading to significant morbidity and mortality (Maher et al., 2014). In geriatric inpatient settings, where patients are already vulnerable due to acute illnesses or frailty, the risks associated with polypharmacy are particularly pronounced.

Adverse drug reactions are a major contributor to hospitalizations and prolonged hospital stays among elderly patients. Studies have shown that the incidence of ADRs in hospitalized elderly patients can be as high as 35%, with many of these reactions being preventable (Onder et al., 2010). The complexity of managing multiple medications in the elderly underscores the need for regular and systematic medication reviews to identify potentially inappropriate medications (PIMs), reduce unnecessary drug use, and optimize therapeutic outcomes.

Pharmacists, with their specialized knowledge of pharmacotherapy, play a crucial role in addressing the challenges of polypharmacy and ADRs in geriatric patients. Pharmacist-driven medication reviews involve a thorough assessment of a patient's medication regimen, with the goal of identifying and resolving drug-related

problems, discontinuing unnecessary medications, and ensuring that the remaining therapies are safe, effective, and appropriate for the patient's condition (Lau et al., 2000). By actively participating in the care of geriatric patients, pharmacists can help reduce the burden of polypharmacy, prevent ADRs, and improve overall patient outcomes.

Despite the recognized importance of pharmacist involvement in medication management, there is a need for more research to quantify the impact of pharmacist-driven medication reviews in geriatric inpatient units. This study aims to evaluate the effectiveness of these reviews in reducing polypharmacy and preventing adverse drug reactions in elderly patients. By exploring the outcomes of regular pharmacist-led interventions, this research seeks to provide evidence-based recommendations for integrating pharmacists more fully into geriatric care teams.

Literature Review

Polypharmacy in the Elderly

Polypharmacy is a prevalent issue in geriatric populations, defined by the concurrent use of multiple medications, often five or more. While polypharmacy can be necessary for managing multiple chronic conditions, it also introduces significant risks, particularly in elderly patients who may have altered pharmacokinetics and pharmacodynamics (Maher et al., 2014). Studies indicate that polypharmacy increases the likelihood of adverse drug reactions (ADRs), drug-drug interactions, and medication non-adherence, which can lead to hospitalizations, increased healthcare costs, and decreased quality of life (Fried et al., 2014).

The risk of polypharmacy is compounded by the fact that elderly patients often receive care from multiple healthcare providers, leading to fragmented care and a higher probability of overlapping or contraindicated therapies. Research has shown that nearly 30% of hospital admissions in older adults are medication-related, with polypharmacy being a significant contributing factor (Gnjidic et al., 2012). As the population ages, addressing polypharmacy in the elderly has become a priority in clinical practice to prevent harm and optimize therapeutic outcomes.

Adverse Drug Reactions in Elderly Patients

Adverse drug reactions are a leading cause of morbidity and mortality among elderly patients, with a higher incidence reported in this demographic compared to younger populations. The altered physiology of aging, including changes in drug metabolism, renal function, and body composition, makes elderly patients more susceptible to ADRs, even at standard therapeutic doses (Onder et al., 2010). Commonly used medications in elderly patients, such as anticoagulants, antipsychotics, and antihypertensives, have been associated with a high risk of ADRs, particularly when combined with other drugs in polypharmacy regimens.

The consequences of ADRs in the elderly can be severe, leading to prolonged hospital stays, functional decline, and increased mortality. A study by Gurwitz et al. (2003) found that ADRs were responsible for up to 25% of hospitalizations in older adults, with many of these reactions deemed preventable. This highlights the need for proactive measures, such as regular medication reviews, to identify and mitigate the risk of ADRs in this vulnerable population.

The Role of Pharmacists in Medication Reviews

Pharmacists are uniquely positioned to address the challenges of polypharmacy and ADRs through comprehensive medication reviews. These reviews involve a systematic evaluation of a patient's medication regimen to identify potentially inappropriate medications (PIMs), assess drug-drug interactions, and recommend discontinuation or modification of therapies as needed (Hanlon et al., 1992). The American Geriatrics Society's Beers Criteria and the STOPP/START criteria are commonly used tools in these reviews to guide the identification of PIMs and optimize medication use in elderly patients (O'Mahony et al., 2015).

Research has demonstrated that pharmacist-driven medication reviews can significantly reduce the number of medications prescribed, decrease the incidence of ADRs, and improve overall patient outcomes. For example, a study by Kaur et al. (2009) found that pharmacist-led interventions in a geriatric unit reduced the average number of medications per patient and lowered the rate of potentially harmful drug interactions. Similarly, Christensen and Lundh (2016) reported that medication reviews conducted by pharmacists led to a 30% reduction in the risk of ADRs in elderly patients.

Effectiveness of Pharmacist-Driven Interventions in Geriatric Care

Numerous studies have highlighted the effectiveness of pharmacist-driven interventions in improving medication safety and efficacy in geriatric populations. A systematic review by Huiskes et al. (2017) found that pharmacist-led medication reviews significantly reduced polypharmacy and the risk of ADRs in elderly patients across various healthcare settings. These interventions were also associated with improvements in medication adherence, patient satisfaction, and overall quality of life.

In addition to reducing the number of medications and ADRs, pharmacist-driven interventions have been shown to decrease hospital readmission rates and shorten the length of hospital stays. For instance, a study by Gallagher et al. (2008) demonstrated that the implementation of pharmacist-led medication reviews in a geriatric inpatient unit resulted in a significant reduction in 30-day readmission rates and improved clinical outcomes for elderly patients.

Gaps in the Literature

While the existing literature provides strong evidence of the benefits of pharmacist-driven medication reviews in geriatric care, several gaps remain. Most studies have focused on specific interventions or patient populations, leaving a need for more comprehensive research that evaluates the long-term impact of these interventions across different healthcare settings. Additionally, there is limited research on the cost-effectiveness of pharmacist-led medication reviews, particularly in terms of their ability to reduce healthcare costs associated with polypharmacy and ADRs.

Another gap in the literature is the variability in the implementation of pharmacist-driven interventions. Different studies have employed various methods and criteria for conducting medication reviews, making it challenging to compare results and establish standardized protocols. Further research is needed to develop and validate best practices for pharmacist-driven medication reviews in geriatric care, ensuring that these interventions are consistently effective across diverse patient populations and settings.

The literature strongly supports the role of pharmacists in conducting medication reviews to reduce polypharmacy and prevent ADRs in elderly patients. Pharmacist-driven interventions have been shown to improve patient outcomes, reduce medication-related harm, and enhance the overall quality of care in geriatric populations. However, further research is needed to address the gaps in the literature, particularly concerning the long-term impact, cost-effectiveness, and standardization of these interventions. As the population continues to age, the importance of integrating pharmacists into geriatric care teams will only increase, making it essential to continue exploring and refining their role in medication management.

Methodology

Study Design

This study utilized a prospective cohort design to evaluate the effectiveness of pharmacist-driven medication reviews in reducing polypharmacy and preventing adverse drug reactions (ADRs) in elderly patients. The research was conducted over a 12-month period, from January 2019 to December 2019, in a large tertiary hospital with a dedicated geriatric inpatient unit.

Setting

The study was conducted in a large tertiary hospital located in an urban area, known for its comprehensive geriatric services. The hospital's geriatric inpatient unit is equipped with a multidisciplinary team that includes geriatricians, nurses, and clinical pharmacists, all specializing in the care of elderly patients. The hospital also has an integrated electronic health record (EHR) system that facilitated the collection and analysis of patient data for this study.

Population and Sample

The study population included elderly patients aged 65 years and older who were admitted to the geriatric inpatient unit during the study period. Patients were included if they were taking five or more medications at the time of admission, which is commonly defined as polypharmacy. Patients with a terminal illness or those receiving palliative care were excluded from the study.

A total of 300 patients were enrolled in the study, selected through consecutive sampling. The sample was representative of the diverse patient population typically seen in the hospital's geriatric unit, including those with multiple chronic conditions such as hypertension, diabetes, and cardiovascular disease.

Intervention

The intervention involved regular pharmacist-driven medication reviews, conducted at three key points during the patient's hospital stay: within 24 hours of admission, during the patient's stay (at least once every three days), and at discharge. The medication reviews were performed by clinical pharmacists who specialized in geriatric care and were integrated into the multidisciplinary team.

Components of the Pharmacist-Driven Medication Review:

1. **Comprehensive Medication History:** Pharmacists obtained a detailed medication history, including prescription drugs, over-the-counter medications, and supplements, to identify all current therapies.
2. **Assessment of Drug Appropriateness:** Pharmacists assessed each medication using tools such as the Beers Criteria and STOPP/START criteria to identify potentially inappropriate medications (PIMs) and recommend discontinuation or substitution where appropriate.
3. **Evaluation of Drug-Drug and Drug-Disease Interactions:** The reviews included an assessment of potential drug-drug and drug-disease interactions that could increase the risk of ADRs, with adjustments made as necessary.
4. **Dosage Optimization:** Pharmacists evaluated and adjusted dosages based on renal and hepatic function, as well as other age-related pharmacokinetic and pharmacodynamic considerations.
5. **Patient Education:** At discharge, pharmacists provided counseling on medication adherence, potential side effects, and the importance of follow-up care.

Data Collection

Data were collected prospectively through the hospital's EHR system. The data included patient demographics, clinical characteristics, the number and types of medications prescribed, and any changes made during the pharmacist-driven medication reviews. Information on adverse drug reactions was also collected, including the type, severity, and timing of ADRs in relation to medication changes.

The primary outcome measures were the reduction in the number of medications (an indicator of reduced polypharmacy) and the incidence of ADRs before and after the pharmacist-driven medication reviews. Secondary outcomes included hospital length of stay, readmission rates within 30 days, and patient satisfaction with medication management.

Data Analysis

Quantitative data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to summarize patient demographics, the prevalence of polypharmacy, and the frequency and types of pharmacist interventions. The effectiveness of the pharmacist-driven medication reviews was assessed by comparing the number of medications and the incidence of ADRs before and after the interventions using paired t-tests and chi-square tests, respectively.

A multivariate logistic regression analysis was conducted to identify factors associated with the likelihood of ADRs, controlling for potential confounders such as age, gender, comorbidities, and the initial number of medications. The regression model also assessed the impact of pharmacist interventions on reducing the risk of ADRs.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB) of the hospital. Informed consent was obtained from all patients or their legal guardians prior to their participation in the study. The study adhered to ethical guidelines for research involving human subjects, including the protection of patient confidentiality and the right to withdraw from the study at any time without affecting their standard of care.

Limitations

While this study provides valuable insights into the effectiveness of pharmacist-driven medication reviews in geriatric inpatient units, several limitations should be acknowledged. The study was conducted in a single tertiary hospital, which may limit the generalizability of the findings to other healthcare settings. Additionally, the relatively small sample size and the short follow-up period may not capture long-term outcomes of the interventions. Future research could benefit from a multicenter study design with a larger sample size and longer follow-up to validate these findings.

Findings

Patient Demographics and Clinical Characteristics

The study included a total of 300 elderly patients who were admitted to the geriatric inpatient unit during the 12-month study period. The demographic and clinical characteristics of the patients are summarized in Table 1. The mean age of the patients was 78.4 years (SD = 7.1), with a slightly higher proportion of females (56%). The most common comorbidities were hypertension (72%), type 2 diabetes (55%), and chronic kidney disease (30%).

Table 1. Patient Demographics and Clinical Characteristics

Characteristic	Value
Total Patients (n)	300
Age (mean \pm SD, years)	78.4 \pm 7.1
Gender (% female)	56%
Common Comorbidities (%)	
- Hypertension	72%
- Type 2 Diabetes	55%
- Chronic Kidney Disease	30%

Impact of Pharmacist-Driven Medication Reviews on Polypharmacy

One of the primary outcomes of the study was the reduction in the number of medications per patient, which served as an indicator of reduced polypharmacy. Before the pharmacist-driven medication reviews, the average number of medications per patient was 9.2 (SD = 2.3). After the reviews, the average number of medications was reduced to 6.8 (SD = 1.9), representing a statistically significant reduction ($p < 0.01$). The reduction in medication count is detailed in Table 2.

Table 2. Reduction in the Number of Medications Before and After Pharmacist-Driven Medication Reviews

Outcome	Pre-Intervention (n = 300)	Post-Intervention (n = 300)	p-value
Average Number of Medications	9.2 ±2.3	6.8 ±1.9	< 0.01

Statistically significant at $p < 0.01$.

Prevention of Adverse Drug Reactions (ADRs)

The incidence of adverse drug reactions (ADRs) was also assessed before and after the pharmacist-driven medication reviews. Prior to the intervention, 21% of patients experienced at least one ADR during their hospital stay. After the medication reviews, the incidence of ADRs decreased to 11%, representing a significant reduction ($p < 0.01$). The types of ADRs and their incidence rates before and after the intervention are shown in Table 3.

Table 3. Incidence of Adverse Drug Reactions Before and After Pharmacist-Driven Medication Reviews

Type of ADR	Pre-Intervention (%)	Post-Intervention (%)	p-value
Overall ADR Incidence	21%	11%	< 0.01
Gastrointestinal Disturbances	8%	4%	< 0.05*
Central Nervous System Effects	6%	3%	< 0.05*
Cardiovascular Events	7%	4%	< 0.05*

*Statistically significant at $p < 0.05$.

Statistically significant at $p < 0.01$.

Secondary Outcomes: Hospital Length of Stay and Readmission Rates

In addition to reducing polypharmacy and ADRs, the study evaluated the impact of pharmacist-driven medication reviews on hospital length of stay and 30-day readmission rates. The average hospital length of stay was reduced from 12.4 days (SD = 4.5) before the intervention to 10.7 days (SD = 4.1) after the intervention ($p < 0.05$). Similarly, the 30-day readmission rate decreased from 18% to 12% ($p < 0.05$), as shown in Table 4.

Table 4. Impact of Pharmacist-Driven Medication Reviews on Hospital Length of Stay and Readmission Rates

Outcome	Pre-Intervention (n = 300)	Post-Intervention (n = 300)	p-value
Average Length of Stay (days)	12.4 ±4.5	10.7 ±4.1	< 0.05*
30-Day Readmission Rate (%)	18%	12%	< 0.05*

*Statistically significant at $p < 0.05$.

Discussion

The findings of this study provide strong evidence supporting the effectiveness of pharmacist-driven medication reviews in reducing polypharmacy and preventing adverse drug reactions (ADRs) in geriatric inpatient units. These results underscore the critical role that pharmacists play in managing complex medication regimens in elderly patients, who are particularly vulnerable to the risks associated with polypharmacy and ADRs.

Reduction in Polypharmacy

One of the most significant outcomes of this study was the substantial reduction in the number of medications per patient following the pharmacist-driven medication reviews. The average number of medications decreased from 9.2 to 6.8, representing a significant reduction in polypharmacy ($p < 0.01$). This finding aligns with previous studies that have demonstrated the ability of pharmacists to identify and discontinue unnecessary medications, thus simplifying complex drug regimens and reducing the potential for drug-drug interactions (Kaur et al., 2009; Christensen & Lundh, 2016).

Polypharmacy is a well-known risk factor for ADRs, medication non-adherence, and diminished quality of life in elderly patients. By reducing the medication burden, pharmacists not only minimize the risks associated with polypharmacy but also enhance the overall therapeutic efficacy of the remaining medications. This reduction in polypharmacy is particularly important in the geriatric population, where physiological changes related to aging can exacerbate the effects of multiple medications (Maher et al., 2014).

Prevention of Adverse Drug Reactions

The study also found a significant reduction in the incidence of ADRs, from 21% before the intervention to 11% after ($p < 0.01$). The types of ADRs most notably reduced included gastrointestinal disturbances, central nervous system effects, and cardiovascular events. These findings suggest that pharmacist-driven medication reviews are highly effective in identifying and mitigating the risk factors that contribute to ADRs in elderly patients.

The reduction in ADRs observed in this study is consistent with existing literature, which highlights the role of pharmacists in improving medication safety through regular and thorough medication reviews (Onder et al., 2010). By assessing the appropriateness of each medication, adjusting doses, and identifying potential drug-drug interactions, pharmacists can prevent many ADRs that would otherwise contribute to patient morbidity and extended hospital stays.

Impact on Hospital Length of Stay and Readmission Rates

Beyond the direct effects on polypharmacy and ADRs, the study found that pharmacist-driven medication reviews were associated with a reduction in hospital length of stay and 30-day readmission rates. The average length of stay decreased by 1.7 days, and the 30-day readmission rate dropped from 18% to 12% ($p < 0.05$ for both outcomes). These findings suggest that optimizing medication regimens not only improves patient safety but also contributes to more efficient healthcare delivery.

Reducing hospital length of stay and readmission rates has significant implications for healthcare systems, particularly in terms of cost savings and resource allocation. Pharmacist-driven interventions that enhance medication management can lead to shorter hospital stays and lower readmission rates, thereby reducing the overall burden on healthcare facilities and improving patient throughput (Gallagher et al., 2008).

Implications for Clinical Practice

The results of this study have important implications for clinical practice in geriatric care. First, they highlight the necessity of incorporating regular pharmacist-driven medication reviews into the standard care protocol for elderly patients, particularly those with multiple chronic conditions and complex medication regimens. By systematically reviewing and optimizing medication use, pharmacists can play a pivotal role in improving patient outcomes and reducing the risks associated with polypharmacy and ADRs.

Second, the findings support the need for healthcare institutions to invest in the training and integration of clinical pharmacists within multidisciplinary geriatric care teams. Given the positive impact of pharmacist-driven interventions on patient outcomes, it is crucial that pharmacists are empowered to take an active role in medication management and are provided with the resources necessary to perform comprehensive medication reviews.

Limitations

While this study provides valuable insights into the benefits of pharmacist-driven medication reviews, several limitations should be acknowledged. The study was conducted in a single tertiary hospital, which may limit the generalizability of the findings to other healthcare settings. Additionally, the study's sample size, though sufficient to demonstrate significant effects, may not capture the full range of variability in patient responses to pharmacist interventions. Future research could benefit from a multicenter approach with a larger sample size and longer follow-up periods to validate and expand upon these findings.

Conclusion

In conclusion, this study demonstrates the significant impact of pharmacist-driven medication reviews on reducing polypharmacy and preventing adverse drug reactions in geriatric inpatient units. These interventions not only improve medication safety and patient outcomes but also contribute to more efficient use of healthcare resources by reducing hospital length of stay and readmission rates. As the population continues to age and the prevalence of polypharmacy increases, the role of pharmacists in managing complex medication regimens will become increasingly vital. Healthcare systems should prioritize the integration of pharmacist-driven medication reviews into geriatric care to enhance patient safety and optimize therapeutic outcomes.

References

1. Christensen, M., & Lundh, A. (2016). Medication review in hospitalised patients to reduce morbidity and mortality. *Cochrane Database of Systematic Reviews*, (2).
2. Fried, T. R., O'Leary, J., Towle, V., Goldstein, M. K., Trentalange, M., & Martin, D. K. (2014). Health outcomes associated with polypharmacy in community-dwelling older adults: a systematic review. *Journal of the American Geriatrics Society*, 62(12), 2261-2272.
3. Gallagher, P., Ryan, C., Byrne, S., Kennedy, J., & O Mahony, D. (2008). STOPP (screening tool of older person's prescriptions) and START (screening tool to alert doctors to right treatment). Consensus validation. *International journal of clinical pharmacology and therapeutics*, 46(2), 72.
4. Gnjidic, D., Hilmer, S. N., Blyth, F. M., Naganathan, V., Waite, L., Seibel, M. J., ... & 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.
5. Gurwitz, J. H., Field, T. S., Harrold, L. R., Rothschild, J., Debellis, K., Seger, A. C., ... & Bates, D. W. (2003). Incidence and preventability of adverse drug events among older persons in the ambulatory setting. *Jama*, 289(9), 1107-1116.
6. Hanlon, J. T., Schmader, K. E., Samsa, G. P., Weinberger, M., Uttech, K. M., Lewis, I. K., ... & Feussner, J. R. (1992). A method for assessing drug therapy appropriateness. *Journal of clinical epidemiology*, 45(10), 1045-1051.
7. Huiskes, V. J. B., Burger, D. M., Van Den Ende, C. H. M., & Van Den Bemt, B. J. F. (2017). Effectiveness of medication review: a systematic review and meta-analysis of randomized controlled trials. *BMC family practice*, 18, 1-15.
8. Kaur, S., Mitchell, G., Vitetta, L., & Roberts, M. S. (2009). Interventions that can reduce inappropriate prescribing in the elderly: a systematic review. *Drugs & aging*, 26, 1013-1028.
9. Maher, R. L., Hanlon, J., & Hajjar, E. R. (2014). Clinical consequences of polypharmacy in elderly. *Expert opinion on drug safety*, 13(1), 57-65.
10. O'Mahony, D., O'Sullivan, D., Byrne, S., O'Connor, M. N., Ryan, C., & Gallagher, P. (2014). STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age and ageing*, 44(2), 213-218.
11. Onder, G., Petrovic, M., Tangiisuran, B., Meinardi, M. C., Markito-Notenboom, W. P., Somers, A., ... & van der Cammen, T. J. (2010). Development and validation of a score to assess risk of adverse drug reactions among in-hospital patients 65 years or older: the GerontoNet ADR risk score. *Archives of internal medicine*, 170(13), 1142-1148.
12. Lau, H. S., Florax, C., Porsius, A. J., & De Boer, A. (2000). The completeness of medication histories in hospital medical records of patients admitted to general internal medicine wards. *British journal of clinical pharmacology*, 49(6), 597-603.