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Polypharmacy and Adverse Drug Reactions in Elderly Patients

Ibrahim Mohammed Mousa Haqawi, Yahya Mohammed Meshari Meshari , Alaa Mohammed Mohammed Absi, Ali Mohammed Tomaihi, Salman Ahmed Yahya Qarradi, Yahya Ahmad Atify, Nasser Yahya Dubayyi, Rawabi Mahroz Abdullah Gomeri, Aishah Ali Mohammed Harshan, Tariq Ali Jaber Al Malki

Sabya General Hospital, and Southern Medical Battalion

Abstract

Polypharmacy, which involves us of multiple medications is a growing concern in elderly populations worldwide. This practice is often clinically necessitated, but, on the other hand, the likelihood of adverse drug reactions (ADRs), drug-drug interactions, non-adherence to medications, and functional decline is quite high. ADRs rank among the most frequent causes of hospitalization, morbidity, and mortality in the elderly, whose changed pharmacokinetics and pharmacodynamics make them more susceptible. The paper discusses the complicated etiology of polypharmacy, the mechanisms and manifestations of ADRs in gerontology, and the discursive analysis of the deep clinical, economic, and humanistic implications. Moreover, it considers the overall mitigation strategies, with a heavy focus on deprescribing, technological assistance, the interdisciplinary care model, and systemic changes. The conclusion reiterates that polypharmacy and ADRs are not only a pharmacological problem but also a key requirement towards delivering the elderly with safe, effective, and person-centered care.

1. Introduction

One of the trends that characterize the healthcare of the 21st century is the demographic change in the global population towards an aging demographic. Old age leads to a greater load of chronic illnesses, including hypertension, diabetes mellitus, heart failure, chronic obstructive lung disease, osteoarthritis, and cognitive dysfunctions. Clinical management of these comorbid conditions, a condition referred to as multimorbidity, often results in the use of multiple medications—a condition often referred to as polypharmacy, which is normally considered the regular use of five or more drugs. Although this method may be mandatory and advantageous, it poses a significant risk, in the first place, of adverse drug reactions. ADRs, which are noxious and unintended reactions to a drug with normal doses, constitute a significant health issue for the population. They rank amongst the leading causes of hospitalization and mortality in the elderly and can be prevented and predicted to a large extent. Physiological aging processes such as decreased renal and hepatic functions, changes in body composition, and heightened end-organ sensitization are the fundamental factors that modify the manner in which older bodies process and react to drugs (McGettigan et al., 2024). When combined with the complicated dosage schedules, these changes form an ideal environment of therapeutic misfate. The effects are not just limited to damage to the lives of individual patients,

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but the costs are also immense both to the healthcare systems and to the caregivers themselves. This paper shall thoroughly discuss the causes and forces driving polypharmacy, the pathophysiology and manifestation of ADRs in the elderly, and the complex effects and solutions to this iatrogenic epidemic that need to be adopted to curb the occurrence of polypharmacy and thus enable safer and more rational drug administration to the aging population.

Multimorbidity, which is the presence of two or more chronic health conditions, is the main cause of polypharmacy among elderly patients. Clinical practice guidelines are usually centered on single diseases and not on the patient as a whole, and therefore there is a tendency to prescribe more than one drug without taking into account the cumulative effect of the drugs prescribed. Besides, older patients are regularly attended to by more than one healthcare provider, and this raises the probability of unnecessary repetitions of therapies and drug-drug interactions. Self-medication using over-the-counter medication, herbal supplements, and traditional medicine is also a contributor to polypharmacy, especially when such products are not reported to medical practitioners (Zazzara et al., 2021). Normal aging causes physiological alterations that are significant and influence the pharmacokinetics and pharmacodynamics. Slower gastric motility and changes in gastric pH can have an impact on drug absorption. The alterations in body structure, such as a decline in total body water and lean muscle mass and a rise in fat body mass, affect the drug distribution. More importantly, a diminished liver mass and hepatic blood flow slow down the drug metabolism, and a decreased renal functioning slows down the excretion of the drugs. The effects of the changes include longer half-lives of drugs and a higher tendency of toxicity even with normal doses, which increases the risk of developing ADRs in the elderly.

2. Etiology and Causes of Polypharmacy in the Elderly.

2.1 Clinical Drivers: Multimorbidity and Guideline-Centric Care.

The high rate of multimorbidity is the key stimulus of polypharmacy. The use of evidence-based clinical practice guidelines, however, is mostly specific to single disease states. Clinicians are prone to be tempted to use individual relevant guidelines when they encounter a patient who has got four or five chronic conditions, leading to a cumulative burden of medication (Sheikh-Taha & Asmar, 2021). This guideline-informed or disease-based polypharmacy exists when there is insufficient evidence on the effectiveness or safety of such complicated drug interactions in frail elderly people, where clinical trials are frequently omitted. This ad hoc system of prescribing does not incorporate the antagonistic risks, the accruing side-effect loads, and patient priorities that characterize geriatric care.

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2.2 Systemic and Prescriber-Related Factors.

Disjointed healthcare is a critical system force. Patients also visit more than one specialist who prescribes in their field without an overall view of the overall prescribed medications. Lack of a committed care coordinator, usually the primary care physician or geriatrician, results in duplication of therapy, incompatible medications, and a lack of simplicity opportunities (Oliveira et al., 2024). Moreover, there is an atmosphere of therapeutic inertia, in which drugs are prescribed but seldom monitored to be canceled (Mohamed et al., 2023). This is further aggravated by the prescribing cascade, where a symptom resulting as a side effect of a drug is mistakenly diagnosed as a new illness, thus resulting in the medication of another drug. Prescriptions are also increasing due to the use of defensive medicine, patient or family expectations of the pharmacological solution, and direct-to-consumer advertising.

2.3 The Issue Of Potentially Inappropriate Medications (PIMs).

Another important subgroup of polypharmacy is potentially inappropriate medications. PIMs are medications whose clinical usefulness is less in older adults than in other medications with lower risks of adverse effects. There are tools such as the American Geriatrics Society Beers Criteria(r) and the Screening Tool of Older Persons Prescriptions (STOPP) criteria that have been created to be able to identify these agents (Zitoun et al., 2022). Examples are long-acting benzodiazepines (e.g., diazepam), which are used to treat insomnia and increase the risk of falls and fractures; non-steroidal anti-inflammatory drugs (NSAIDs), which are used to treat chronic pain and increase the risk of gastrointestinal bleeding and kidney dysfunction; and strongly anticholinergic drugs (e.g., diphenhydramine, oxybutynin), which can result in confusion, constipation, and retention of urine. The continuous use of PIMs is a glaring symptom of inefficient prescribing and a direct cause of ADRs that can be prevented.

3. Pathophysiology and Manifestations of Adverse Drug Reactions in the Elderly

3.1 Age-Related Pharmacokinetic Changes

There is a considerable age effect on pharmacokinetics, which includes the processes of absorption, distribution, metabolism, and excretion. Although absorption is not much affected in the gastrointestinal tract, there is altered distribution since there is an increase in body fat and a decrease in total body water and lean mass. It causes an increase in the concentrations and half-lives of lipid-soluble drugs (e.g., diazepam) and an increase in the initial concentrations of water-soluble drugs (e.g., digoxin). There is a reduced metabolism, which is mainly through hepatic cytochrome P450 enzymes, and this is brought about by a reduction in liver mass and liver blood flow, which increases the effects of many drugs (Rochon et al., 2021). Above all, the renal excretion, as the index of glomerular filtration rate (GFR) decreases gradually with age, even without the manifested kidney disease. This decreases clearance of drugs excreted through the kidneys, like most antibiotics, direct oral anticoagulants (e.g.,

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dabigatran), and hypoglycemics (e.g., metformin), which results in drug accumulation and toxicity.

3.2 Pharmacodynamic Changes with Aging.

The pharmacodynamics, or the effect of a drug on the body, also changes. Seniors experience heightened sensitivity to some types of drugs at the usual concentrations. As an illustration, they are highly sensitive to anticoagulants such as warfarin, which raises the risk of bleeding; excessively sensitive to benzodiazepines and opioid sedatives and psychomotor actions; and they exaggerate hypotensive responses to blood pressure drugs. On the other hand, beta-adrenergic agonist sensitivity (e.g., in asthma) can be reduced. The impact of these changes is that the therapeutic window—the gap between the effective dose and the toxic dose of many drugs in the aged—reduces significantly.

3.3 Clinical Presentation: From Specific Toxicity to Geriatric Syndromes.

The manifestations of ADR in older patients are typically not typical textbook symptoms but non-specific functional decline or old-fashioned geriatric syndromes. Classic manifestations are

Cognitive Impairment: Delirium, confusion, and cognitive acceleration, which are usually associated with the use of anticholinergics, benzodiazepines, opioids, and H2-receptor antagonists (Nwadiugwu, 2021).

Falls and Instability: Medicated by the drugs that cause sedation, orthostatic hypotension (e.g., antihypertensives, diuretics), or extrapyramidal symptoms (e.g., antipsychotics).

Urinary Incontinence: This is usually made worse by the use of diuretics, sedatives, or anticholinergics.

Constipation: This is a common side effect of opioids, anticholinergics, and some calcium channel blockers.

This is what is known as diagnostic overshadowing, that is, the symptoms are ascribed to aging or dementia instead of medications and result in under-identification and continued promotion of the agent of cause. ADRs that are more acute and life-threatening are gastrointestinal bleeding (because of NSAIDs or anticoagulants), kidney failure (because of NSAIDs or some antibiotics), and extreme hypoglycemia (because of sulfonylureas or insulin).

The development of a multidisciplinary and patient-centered strategy is needed to address the problem of polypharmacy and the prevention of ADRs among elderly patients. Medication reviews need to be conducted regularly and should be done by physicians, nurses, pharmacists, and (where possible) caregivers. Such tools as Beers Criteria and STOPP/START guidelines are used to list potentially inappropriate drugs and to show safer options. Deprescribing—the planned effort towards reduction or abandonment of medications that are no longer

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beneficial—has become one of the most prominent measures in fading away polypharmacy with no adverse effects on patient outcomes or even improvement of them.

Nurses are crucial in the detection and treatment of risks associated with polypharmacy. By using detailed monitoring, nurses should be able to notice the indication of ADRs, evaluate the adherence to medication, and provide patients and their families with information on how to take medications properly. The patient education should aim at learning the purpose of every medication, the possible side effects, and maintaining open communication with healthcare providers before introducing new medications and supplements. Nurses also play a key role in promoting the idea of medication review whenever they make regular visits and change care.

4. Adverse Drug Reactions in Elderly Patients

A significant consequence of polypharmacy is adverse drug reactions that constitute a great proportion of morbidity and hospitalization in older adults. The typical adverse drug reactions are dizziness, falls, confusion, delirium, gastrointestinal bleeding, renal impairment, and electrolyte imbalances (Hoel et al., 2021). There are some specific classes of drugs with which serious ADRs in the elderly patients are strongly related, including benzodiazepines, anticholinergics, opioids, anticoagulants, and hypoglycemic agents. Such reactions may result in an impairment of functioning, loss of independence, and even death unless these are detected and addressed in time.

ADRs may have vague or typical symptoms in elderly patients, including fatigue, confusion, anorexia, or functional deterioration. These symptoms have the common misinterpretation of just being part of old age or a disease process, and the process is postponed to correct the diagnosis. This misunderstanding may lead to a prescribing cascade, with further drugs being prescribed to overcome the side effects of the present drugs. As an example, antipsychotics can be prescribed in case of delirium caused by medication, or laxatives can be introduced in case of constipation caused by opioids, which further increases the burden of medications and the risk of their adverse effects.

5. Consequences and Burden of Polypharmacy and ADRs

5.1 Clinical and Humanistic Impact on the Patient

The emotional burden on the subject is immense. In addition to the direct harm of an ADR, there is a close relationship between polypharmacy and impaired functional status, frailty, and decreased health-related quality of life (Thompson & McDonald, 2024). Medication non-adherence is caused by the cognitive strain of using a complicated regimen (intentionally because of a perceived lack of benefit or unintentionally because of confusion or physical inability). This may result in inadequate disease management, attacks, and additional hospitalization. There are psychological effects such as anxiety, depression, and loss of autonomy.

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5.2 Economic Healthcare Systems Burden.

It is unbelievable in terms of finances. There are costs associated with the medications themselves, treatments of ADRs (in terms of emergency visits, hospitalization, and intensive care, and the subsequent requirement of rehabilitation or long-term care). Among the elderly, problems associated with polypharmacy are the common causes of preventable hospitalizations. Staying at a hospital due to a single ADR can cost tens of thousands of dollars, and when summed up in a population, the cumulative cost is an enormous waste of healthcare systems that deprives other services that are vital.

5.3 Caregiver and Societal Burden.

Informal caregivers, who in most cases are relatives, have a big practical and emotional burden. The role involves the administration of complex medication regimens, prescription of medication, side effect surveillance, working with multiple providers, and financial aspects of medication prescriptions. This may also cause stress, burnout, and decreased work productivity of the caregivers, which is not limited to the formal healthcare sector. The loss of the functional abilities of an older person to their independence because of the drug use also changes the demand towards formal community support services or residential care. The adherence of patients to complex medication schedules is adversely influenced by age (especially when cognitive impairment, visual deficiency, or poor health literacy are involved), and these effects may be shown in older patients (Daunt et al., 2023). The frequent cases are missed doses, improper administration, and incidental overdosing, which may negatively affect the effectiveness of treatment or result in toxicity. Financial strain is also a cause of polypharmacy, as this condition forces some patients to be economical with drugs or even stop medical treatment. All these issues decrease the quality of life, create anxiety, and decrease the capability of patients to handle their health conditions on their own.

The disjointed healthcare systems are a major contributor to inappropriate polypharmacy. There is a high risk of ADRs due to poor communication between providers, the absence of a regular medication reconciliation procedure, and poor follow-up. Care transitions, including long-term care, hospital admission, and discharge, are one of the most critical times for medication errors (Osanlou et al., 2022). Medications that are necessary could be overlooked or even forgotten or duplicated without a keen examination, and those that are not essential could be administered without a thorough examination.

6. Strategies for Mitigation and Management

6.1 Deprescribing: A Systematic Approach to Medication Optimization

Deprescribing is the intended and guided activity of minimizing or discontinuing drugs that are not useful and can harm one. It is a preventive, patient-focused intervention and a competency of geriatric practice. The process of deprescribing involves several steps: (1) Make a complete

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medication list; (2) Find all PIMs with the help of such tools as STOPP/Beers criteria; (3) Determine the risk of drug withdrawal or reappearance of symptoms; (4) Prioritize drugs to be stopped; (5) Plan and implement a withdrawal program (e.g., tapering); and (6) Monitor improvements or resurgence of symptoms. This should be done in partnership with the patient and caregivers in terms of their care and health priorities.

6.2 Technological and Pharmacological Tools.

Health information technology is very important to support. Clinical Decision Support Systems (CDSS) that are integrated into electronic health records (EHRs) can produce alerts of drug-drug interactions, dose modifications based on renal function, and flags of PIMs based on the Beers Criteria (Noorda et al., 2022). When these systems are structured so that they reduce alert fatigue, crucial discussions on the relevance of medication can be triggered. Moreover, newer applications in pharmacogenomics, which is genetic testing to choose drugs and their dosage, promise to provide individualized treatment, especially in warfarin, some antidepressant drugs, and analgesics, though its application in geriatrics remains in the developmental phase.

6.3 Interdisciplinary Care Models and the Pharmacist.

Discontinuity of care should be substituted by collaborative and team-based models. The gold standard in the management of complex older adults is Comprehensive Geriatric Assessment (CGA), which is provided by an interdisciplinary team (physician, nurse, pharmacist, social worker) and necessarily involves an intensive medication review. The insertion of clinical pharmacists into the primary care clinics or geriatric departments has been very effective (Kotsalou, 2021). Pharmacist-managed medication therapy management (MTM) is an intensive review, detection of drug-related issues, and joint development of an expedited regimen in partnership with the prescribing physician. This intervention has been found to decrease polypharmacy, PIM use, and ADRs in addition to enhancing adherence and outcomes.

6.4 Educational, Policy, and Systemic Reforms.

This entails a long-term change that involves several layers of action. All healthcare professionals should be educated based on the principles of geriatric pharmacotherapy, de-prescribing, and awareness regarding the presence of atypical ADR. Policy interventions are influential; among the primary patient safety objectives, one can identify the requirement of medication reconciliation on every care transition (admission, transfer, discharge). The paradigm in quality metrics and reimbursement models to be used must focus on ensuring that proper prescribing and successful de-prescribing are encouraged and rewarded instead of just the quantity of prescriptions done (Alhumaidi et al., 2023). Lastly, the power of patients by conducting a review on their brown bags before they leave and establishing a culture where

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inquiring, Do I still need this pill? is not a trait of someone weak. are fundamental health promotion programs.

7. Conclusion

Polypharmacy and the adverse drug reactions, considered as a proximate etiological problem, are a silent epidemic in geriatric medicine, as they represent a serious mode of failure in how we practice managing multimorbidity. Guided by guideline-based care, systematic fragmentation, and clinical inertia, it subjects an already frail older adult to substantial and usually avoidable damage. This has also been felt by the individual, the family, and even the healthcare economy. To solve this iatrogenic crisis, there must be a paradigm shift from a default culture of prescription to a culture of constant critical review and de-prescribing. This change should be codified by the systematic use of evidence-based instruments, capitalized by smart technology, and conducted in the framework of integrative and interdisciplinary care models, where patient objectives and practical well-being are prioritized. It also necessitates similar reforms in education, policy, and funding. Finally, the use of medication in the elderly is not a question of depriving them of the needed treatment but a question of using the best concept of medicine, "Primum non nocere" (First, do no harm). This is essential to the realization of the fact that the gains of contemporary pharmacotherapy will bring its promise of long-term health and dignity in old age and not become one of the main agents of its loss.

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