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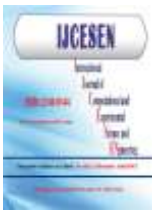

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Research Article

Role of Nursing in Managing Polypharmacy and Reducing Medication Errors in Older Adults

Abdullah Ghazi A Alotaibi[1]*, Samar Abdulrahman Saeed Almoahamadi[2], Mashta Abeer Mukhdhari E[3], Al Asmari Abdulaziz Shaflot A[4], Helalah Haueel Alslopi[5], Nuha Hussain Mohammed Ghammari[6], Alanazi Afaf Lafi O[7], Mohammed Abdulaziz F Almotairi[8], Mohammed Nasser Muqbil Alshammari[9], Alhanof Qadim B Alruwaili[10], Abeer Shukayr Sail Alanazi[11]

[1]Nursing Specialist – Osailah Primary Health Care Center – Riyadh Third Health Cluster – Ministry of Health – Al-Dawadmi – Riyadh Region – Saudi Arabia
* **Corresponding Author Email:** agal-toom@moh.gov.sa- **ORCID:** 0000-0002-5007-9950

[2]Technician Nursing – Al-Bander Primary Health Care Center – Yanbu Health Cluster – Ministry of Health – Yanbu – Madinah Region – Saudi Arabia
Email: SAlmohammadi@moh.gov.sa- **ORCID:** 0000-0002-1337-7000

[3]Technician Nursing – West Khamis Primary Health Care Center – Aseer Health Cluster – Ministry of Health – Khamis Mushait – Aseer Region – Saudi Arabia
Email: amashtah@moh.gov.sa- **ORCID:** 0000-0002-2337-7100

[4]S Technician Nursing – Eastern Primary Health Care Center, Taif – Taif Health Cluster – Ministry of Health – Taif – Makkah Region – Saudi Arabia
Email: asalasmari@moh.gov.sa- **ORCID:** 0000-0002-3337-7200

[5]Technician Nursing – Al Aziziyah Primary Health Care Center, Arar – Northern Borders Health Cluster – Ministry of Health – Arar – Northern Borders Region – Saudi Arabia
Email: halslopi@moh.gov.sa- **ORCID:** 0000-0002-4337-7300

[6]Technician Nursing – West Khamis Primary Health Care Center – Aseer Health Cluster – Ministry of Health – Khamis Mushait – Aseer Region – Saudi Arabia
Email: nanyhatan@gmail.com- **ORCID:** 0000-0002-6337-7400

[7]Technician Nursing – Al Aziziyah Primary Health Care Center – Al Jouf Health Cluster – Ministry of Health – Al-Qurayyat – Al Jouf Region – Saudi Arabia
Email: Aflalanazi@moh.gov.sa - **ORCID:** 0000-0002-7337-7500

[8]Technician Nursing – Mbayidh Primary Health Care Center – Al Jouf Health Cluster – Ministry of Health – Mbayidh – Al Jouf Region – Saudi Arabia
Email: moaalmotairi@moh.gov.sa- **ORCID:** 0000-0002-8337-7600

[9]Technician Nursing – Sharaf Hospital – Hail Health Cluster – Ministry of Health – Hail – Hail Region – Saudi Arabia
Email: Haily3938@gmail.com- **ORCID:** 0000-0002-9337-7700

[10]Nursing Specialist – Maternity and Children's Hospital, Al Jouf – Al Jouf Health Cluster – Ministry of Health – Sakaka – Al Jouf Region – Saudi Arabia
Email: Alhanofqa@moh.gov.sa- **ORCID:** 0000-0002-1137-7800

[11]Technician Nursing – Northern Borders Health Cluster – Ministry of Health – Arar – Northern Borders Region – Saudi Arabia
Email: aabbeerr.rr@icloud.com- **ORCID:** 0000-0002-8837-7900

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Abstract:

The role of nursing in managing polypharmacy among older adults is crucial, given the complexity of their health profiles, which often involves multiple chronic conditions. Nurses are positioned uniquely to monitor medication regimens closely, educate patients and their families about the importance of adherence, and assess for potential drug interactions and side effects. Through comprehensive medication reviews, nurses can identify unnecessary medications, promote the use of evidence-based guidelines, and advocate for deprescribing when appropriate. By fostering strong communication channels between patients, caregivers, and other healthcare providers, nurses can mitigate the risks associated with polypharmacy, thereby enhancing patient outcomes and ensuring safer medication practices. In addition to managing polypharmacy, nurses play a pivotal role in reducing medication errors in older adults. They are often the primary point of contact in healthcare settings and can help ensure that medication administration is performed accurately and safely. By implementing standardized protocols, conducting thorough medication reconciliation, and utilizing technology such as electronic health records, nurses can significantly diminish the likelihood of errors. Furthermore, their emphasis on patient education empowers older adults to take an active role in their medication management, fostering a better understanding of their treatment plans. Ultimately, by combining clinical expertise with compassionate care, nurses are essential in advancing medication safety and improving the quality of healthcare for older adults.

1. Introduction

The 21st century is witnessing a demographic revolution of unprecedented scale and consequence. Across the globe, from the highly industrialized nations of Europe and North America to the rapidly developing economies of Asia and Latin America, populations are aging at an accelerated pace. This transformation is driven by a confluence of factors: declining fertility rates, significant advancements in medical science, improved public health measures, and enhanced standards of living. The result is a fundamental shift in population pyramids, with a steadily and inexorably increasing proportion of individuals aged 65 years and older [1]. The World Health Organization projects that by 2050, the global population of older persons will double to reach nearly 2.1 billion, representing one in every six people worldwide. This demographic shift stands as a monumental testament to human progress; it reflects our collective success in conquering infectious diseases, managing acute conditions, and extending the human lifespan. However, this longevity dividend comes intertwined with a complex and demanding array of clinical, social, and economic challenges that fundamentally reshape the priorities of healthcare systems. The paradigm of care is shifting from acute, episodic interventions to the long-term management of chronic, co-existing conditions, a reality that places the issue of medication management at the very forefront of geriatric care [1].

Within this new demographic reality, the phenomenon of polypharmacy has emerged as a dominant, and often problematic, cornerstone of modern therapeutics for older adults. Conventionally defined as the concurrent use of five or more medications, polypharmacy is no longer an exception but a ubiquitous standard in the management of the older adult population [2]. This prevalence is rooted in clinical guidelines that rightfully advocate for aggressive management of individual chronic diseases—hypertension, type 2 diabetes, hyperlipidemia, osteoporosis, coronary artery disease, and heart failure, to name but a few. Each condition typically carries with it a recommended pharmacologic regimen. When these conditions aggregate in a single individual, as they frequently do, the simple arithmetic of disease-specific guidelines leads inevitably to a lengthy medication list. Thus, polypharmacy often originates from a place of appropriate therapeutic intent, aiming to prolong life, prevent catastrophic events like strokes or myocardial infarctions, and maintain functional independence. However, this practice swiftly transforms into a double-edged sword of formidable sharpness. The same collection of medications prescribed for legitimate benefit carries with it an exponentially amplified risk of harm. The probability of adverse drug events (ADEs), including severe reactions, rises dramatically with each additional agent introduced to a regimen [3]. The risk of potentially dangerous drug-drug and drug-disease interactions becomes a complex web that is increasingly difficult to navigate. Furthermore, polypharmacy is a primary driver of medication non-adherence, as the practical and cognitive burden of managing multiple pills with varying schedules and restrictions becomes overwhelming for many older individuals. The consequence is not merely pharmaceutical clutter; it

is a direct pathway to increased falls, delirium, hospitalizations, functional decline, and a profound erosion of quality of life, potentially undermining the very health goals the medications were meant to achieve [3].

The vulnerability of the older adult to the perils of polypharmacy is not simply a matter of quantity; it is fundamentally a matter of altered physiology. Aging induces a series of intricate and highly variable changes in pharmacokinetics (what the body does to the drug) and pharmacodynamics (what the drug does to the body), which collectively create a biological terrain where the margin between therapeutic benefit and toxic harm is dangerously narrowed [4]. Pharmacokinetically, key organs responsible for drug metabolism and excretion undergo decline. Renal function, as measured by glomerular filtration rate, decreases with age, often covertly, as serum creatinine levels may remain deceptively normal due to reduced muscle mass. This impaired excretion leads to the accumulation of renally cleared drugs, such as certain antibiotics, antivirals, and hypoglycemics, elevating the risk of toxicity [5]. Hepatic mass and blood flow diminish, affecting the metabolism of many drugs through the cytochrome P450 system, potentially slowing breakdown and prolonging drug action. Furthermore, changes in body composition—a decrease in lean body mass and total body water, coupled with an increase in adipose tissue—alter the volume of distribution. This means water-soluble drugs may reach higher concentrations, while fat-soluble drugs may have prolonged half-lives due to storage in fatty tissue [5]. Pharmacodynamically, older adults often exhibit increased end-organ sensitivity. The brain becomes more susceptible to the sedative and delirium-inducing effects of benzodiazepines, anticholinergics, and opioids. The cardiovascular system shows heightened sensitivity to the hypotensive effects of blood pressure medications and the orthostatic effects of diuretics. These physiological realities mean that standard adult doses can become dangerously excessive, and the manifestation of side effects is often atypical, presenting as confusion, weakness, or loss of balance rather than a classic textbook symptom [6]. This unique physiologic vulnerability makes the older adult population extraordinarily susceptible to the iatrogenic dangers of inappropriate medication use.

In this high-stakes clinical environment—defined by complex regimens and heightened biologic susceptibility—medication errors emerge as a persistent and threatening specter, capable of turning a carefully constructed therapeutic plan into an instrument of harm. Medication errors are defined as any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer [7]. These errors are not confined to a single moment of failure but can infiltrate every node of the medication use process: from the initial prescribing decision (e.g., wrong drug, wrong dose, wrong patient), through transcribing and dispensing, to the critical moments of administration and the ongoing phase of monitoring. For the older adult, already navigating the treacherous waters of polypharmacy and altered physiology, the impact of such an error is frequently catastrophic. A single dosing error of a anticoagulant can lead to a life-threatening bleed; an omission of a critical antihypertensive can precipitate a stroke; an administration error involving a sedative can trigger a protracted episode of delirium. The consequences are measured in tangible human cost: increased emergency department visits, avoidable hospital admissions, longer and more complicated lengths of stay, permanent disability, and increased mortality rates [7]. The economic burden reverberates through entire healthcare systems, with studies estimating that billions are spent annually on managing the fallout from drug-related morbidity and mortality, resources that could be redirected towards proactive, preventive care.

2. Medication Assessment and Reconciliation

The cornerstone of safe medication management in older adults is a meticulous and ongoing assessment, a process in which nurses are the primary conductors. This extends far beyond simply checking a medication list. Nursing assessment in this context is a sophisticated, investigative endeavor. It begins with a thorough medication history, which nurses are uniquely positioned to obtain through their therapeutic relationships. This history must encompass all prescription medications, over-the-counter products, herbal supplements, and vitamins—a totality often referred to as the "brown bag review" [5]. Nurses excel in gathering this information by creating an environment of trust and using open-ended questions to uncover the patient’s actual medication-taking behaviors, which may differ significantly from the prescribed regimen.

Central to this assessment is the rigorous process of medication reconciliation, a formalized procedure of creating the most accurate list possible of all medications a patient is taking and comparing it to the physician’s admission, transfer, or discharge orders [6]. Nurses perform reconciliation at every transition of care, identifying and resolving

discrepancies such as omissions, duplications, dosing errors, and potential interactions. This process is not a clerical task but a clinical one, requiring critical thinking to discern why discrepancies exist. For instance, a nurse might discover that a patient has stopped taking a statin due to muscle pain, a potential side effect that requires communication with the prescriber for evaluation and potential alternative therapy. Furthermore, nursing assessment integrates medication use with a holistic evaluation of the patient's clinical status. Nurses assess renal and hepatic function through laboratory monitoring and physical assessment, evaluate swallowing ability to determine the appropriateness of pill formulations, and identify cognitive or sensory deficits that may impair a patient's ability to manage their medications independently [7]. This comprehensive data collection forms the essential evidence base upon which all subsequent interventions are built.

3. Collaboration and Communication within the Interprofessional Team

Effective management of polypharmacy is fundamentally a team sport, and nurses serve as the crucial linchpin in the interprofessional healthcare team. The nurse's role is one of active collaboration, facilitation, and communication. Acting as the patient's constant advocate and clinical observer, the nurse is often the first to detect subtle signs of a potential adverse drug reaction, such as new-onset confusion, dizziness, fatigue, or a change in functional status. The timely and precise communication of these observations to physicians, pharmacists, and other providers is a critical nursing function that can prevent a minor issue from escalating into a serious adverse event [8].

Nurses actively participate in and often instigate formal medication review processes, such as interdisciplinary team meetings or consultations with clinical pharmacists specializing in geriatrics. In these forums, nurses contribute vital "real-world" data about the patient's medication adherence, practical challenges, and therapeutic response. They can advocate for the application of tools like the Beers Criteria, a list of medications potentially inappropriate for older adults, or the Screening Tool of Older Persons' Potentially Inappropriate Prescriptions (STOPP) criteria, to systematically evaluate each drug for necessity, efficacy, and safety [9, 10]. The nurse's communication extends to facilitating shared decision-making. By explaining complex medication information in understandable terms to both the patient and their family, the nurse ensures that the care plan reflects not only clinical guidelines but also the patient's values, preferences, and goals of care. This collaborative model, centered on clear and continuous communication, is essential for deprescribing—the planned and supervised process of dose reduction or discontinuation of medications where harms outweigh benefits—a key strategy in combating inappropriate polypharmacy [11].

4. Patient and Caregiver Education:

A pivotal strategy for mitigating the risks of polypharmacy and preventing errors is empowering older adults and their caregivers through comprehensive, tailored education. This is a core nursing responsibility that directly influences medication safety outcomes. Effective nursing education transcends the simple delivery of instructions; it is a patient-centered process of teaching, coaching, and evaluating understanding. Nurses assess the health literacy, cognitive capacity, and learning preferences of each patient to tailor their educational approach accordingly [12].

Key educational content delivered by nurses includes the purpose and expected benefits of each medication, along with its possible side effects and what actions to take if they occur. Nurses provide concrete strategies for organizing medications, such as the use of pill organizers, setting up reminder systems, and creating simple, easy-to-read medication schedules. For patients with dexterity issues, nurses educate on the use of assistive devices for opening bottles; for those with visual impairment, they recommend large-print labels or talking prescription devices [13]. Furthermore, nurses play a critical role in educating patients and families about "high-alert" situations, such as the dangers of doubling up on doses after a missed one or the risks of sharing medications. They reinforce the importance of maintaining an updated medication list and bringing it to every healthcare appointment. Education also involves coaching patients on how to be active participants in their care—encouraging them to ask questions like, "Is this medication still necessary?" or "Can we simplify my regimen?" [14]. By investing in thorough, repetitive, and reinforced education, nurses equip patients and caregivers with the knowledge and confidence needed to manage complex regimens safely at home, thereby reducing errors stemming from misunderstanding or mismanagement.

5. Safe Medication Administration:

The act of medication administration is the final, concrete step in the medication use process, and it

is here that nurses exercise direct and authoritative control as the last line of defense against errors. In institutional settings, nurses are governed by the rigorous "Five Rights" of medication administration: the right patient, right drug, right dose, right route, and right time [15]. However, contemporary nursing practice recognizes these as a foundation, not a totality. Advanced practice involves a "sixth right"—the right documentation—and more importantly, a culture of critical thinking that questions the "right reason" and the "right response" [16].

To ensure safety, nurses employ numerous vigilant practices. They perform independent double-checks for high-risk medications like insulin, opioids, and anticoagulants. They meticulously scan barcodes where technology is available, linking the patient, the medication, and the order in a failsafe electronic verification. They never administer a medication they did not personally prepare and they never circumvent safety protocols for convenience. For older adults specifically, nurses make crucial clinical judgments during administration. They assess the patient's current condition immediately prior to giving a drug; for example, holding a blood pressure medication if the patient is hypotensive or assessing pain level before administering an opioid [17]. They consider the timing of medications in relation to meals and other drugs to optimize absorption and minimize interactions. In home care settings, nurses observing family caregivers administer medications provide immediate feedback and correction, turning the home visit into a real-time educational and safety audit. This unwavering commitment to procedural rigor and contextual critical thinking during the administration phase is a non-negotiable component of the nurse's role in error prevention.

6. Monitoring, Evaluation, and Ongoing Surveillance

The nursing role in medication safety is inherently continuous, extending beyond the point of administration into the critical phases of monitoring and evaluation. Nurses are the principal agents of therapeutic surveillance, tasked with detecting both the intended and unintended consequences of pharmacotherapy. This involves systematic and knowledgeable observation for therapeutic effectiveness. Is the antihypertensive achieving its target blood pressure? Is the analgesic adequately controlling the patient's pain? Is the antidepressant improving mood and function? [18]. Equally important is the vigilant surveillance for adverse effects and interactions. Nurses are trained to recognize the often-atypical presentation of drug toxicity in older adults, which may manifest as delirium, falls, incontinence, or functional decline rather than classic textbook symptoms [19].

This monitoring is an active, analytical process. It involves tracking relevant laboratory values—such as renal function, electrolyte levels, and drug serum concentrations—and understanding their implications for dosing. Nurses perform regular physical assessments, listening for a new cough that could indicate angioedema from an ACE inhibitor, checking for edema from a calcium channel blocker, or observing for signs of bruising or bleeding in a patient on anticoagulants [20]. They also monitor for subtle cognitive and psychological changes. Perhaps most importantly, nurses evaluate the overall burden and practicality of the regimen from the patient’s perspective. They assess for pill fatigue, financial toxicity from medication costs, and the sheer logistical difficulty of managing multiple dosing schedules. This holistic surveillance generates a continuous stream of clinical data, enabling nurses to evaluate the ongoing appropriateness of the entire medication plan and to initiate timely interventions, whether that be reporting an adverse reaction, advocating for a dose adjustment, or reinforcing adherence strategies.

7. Advocacy, Ethical Practice, and System-Level Improvement

Nurses fulfill a broader duty to medication safety through patient advocacy and engagement in ethical practice and quality improvement initiatives. As advocates, nurses represent the patient’s voice and safety interests, especially when polypharmacy leads to questionable benefit or clear harm. This may involve formally questioning a prescribing decision that seems to contradict evidence-based guidelines for older adults or supporting a patient’s wish to discontinue a burdensome treatment near the end of life [21]. Ethical practice requires nurses to balance the principle of beneficence (doing good) with non-maleficence (avoiding harm), a balance that is constantly tested in the context of polypharmacy.

Beyond individual patient advocacy, nurses contribute to system-level safety. They are essential in reporting medication errors and near-misses through institutional incident reporting systems, providing invaluable data for root cause analyses [22]. By participating in quality improvement committees, nurses help design and implement safer medication processes, such as standardizing handoff communication during care transitions, improving the usability of electronic health record medication modules, or introducing pharmacist-led

medication review clinics [23]. Nurses also advocate for appropriate staffing levels and a non-punitive safety culture, understanding that system flaws, not individual carelessness, are often the primary cause of errors. This macro-level perspective ensures that the nursing role extends from the bedside to the boardroom, influencing the policies and environments that either support or undermine safe medication practices for all older adults.

8. Leveraging Technology to Enhance Safety and Coordination

In the modern healthcare ecosystem, technology serves as a powerful ally in the battle against polypharmacy and medication errors, and nurses are both primary users and key influencers of these technological tools. Electronic Health Records (EHRs) are now central to medication management. Nurses rely on EHRs for accurate, legible order entry, built-in clinical decision support (CDS) systems that alert them to potential drug-drug interactions, allergies, or inappropriate doses for renal function [24]. While alert fatigue is a real challenge, nurses learn to interpret and act on clinically significant warnings, using their judgment to filter out less relevant alerts. Barcode Medication Administration (BCMA) systems, when used consistently, provide a near-failsafe verification at the point of care, virtually eliminating errors involving wrong patient or wrong drug [25].Furthermore, technology facilitates better coordination. Electronic medication reconciliation tools help standardize and streamline the error-prone process of list compilation. Telehealth and remote patient monitoring platforms, increasingly managed by nurses, allow for closer surveillance of medication effects and adherence in home-dwelling older adults [26]. Nurses can use pill bottles with embedded sensors or mobile health applications to monitor adherence remotely and intervene proactively. Nurses also play a crucial role in educating patients on how to use these consumer-facing technologies safely. However, they remain critically aware of technology's limitations and the danger of over-reliance. Nurses ensure that the "digital picture" aligns with the "clinical picture," recognizing that technology is a tool to augment, not replace, clinical assessment, critical thinking, and the human connection that is vital for understanding a patient's true experience with their medications.

9. Conclusion:

The management of polypharmacy and the prevention of medication errors in older adults constitute one of the most pressing and complex challenges in contemporary healthcare. It is a challenge that demands a response which is systematic, knowledgeable, vigilant, and profoundly human. As this analysis has detailed, the nursing profession is uniquely and powerfully positioned to provide this response. From the foundational work of comprehensive assessment and reconciliation to the collaborative efforts within the interprofessional team; from the empowering act of patient education to the disciplined rigor of safe administration; from the continuous vigilance of monitoring to the broader advocacy for ethical practice and system improvement, nurses operate at every critical node of the medication use continuum.

They are the consistent thread that connects the prescriber's intent to the patient's experience, the clinical guideline to the individual context, and the technological safeguard to the personal touch. In an aging world where medication regimens grow increasingly intricate, the nurse serves as the indispensable sentinel—interpreting, coordinating, teaching, protecting, and advocating. Their holistic, patient-centered approach ensures that the goal of treatment remains not merely the biochemical manipulation of disease states, but the preservation of function, autonomy, and quality of life for older adults. Ultimately, optimizing medication safety for this vulnerable population is not possible without fully leveraging the expertise, perspective, and unwavering commitment of the nursing profession across all care settings. The evidence is clear: investing in and empowering nursing roles is not merely beneficial but fundamental to achieving safer, more appropriate, and more effective medication therapy for our aging global community.

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