Adherence and Impact of Medication Regimen Complexity among Geriatric Patients: A Review

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ABSTRACT

For medication therapy to be effective, adherence to a prescribed regimen is essential. The adherence of a patient to a treatment regimen can be affected by several factors, complexity of regimen being one of them. The complexity of a medication regimen can be measured by the Medication Regimen Complexity Index (MRCI), a tool developed to assess the complexities of prescribed regimens. Given that geriatric patients often experience chronic and multiple conditions, necessitating a complex pharmacotherapy approach for managing their clinical conditions, monitoring both the complexity and adherence to the medication regimen becomes crucial for achieving better therapeutic outcomes. This approach helps comprehensively understand the relationship between medication regimen complexity and adherence in geriatric patients. Geriatric patients frequently encounter polypharmacy, comorbidities and cognitive impairments, which can complicate their medication regimens. The MRCI helps healthcare providers evaluate these complexities and develop strategies to improve adherence. Simplifying regimens, providing patient education and leveraging technology-based interventions are essential strategies to enhance adherence. Interdisciplinary collaboration among healthcare professionals is vital in addressing these challenges. By combining expertise from various disciplines, comprehensive medication management programs can be created to support patient adherence and optimize treatment regimens. In conclusion, recognizing and managing medication regimen complexities in geriatric care are vital for promoting better health outcomes and improving the quality of life for older adults. The MRCI serves as a valuable tool in this process, aiding in the comprehensive evaluation and management of medication regimens to support adherence and achieve therapeutic goals.

Keywords: Medication Adherence, Medication Regimen Complexity, Medication Regimen Complexity Index (MRCI), Geriatrics, Health outcome, Quality of life.

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INTRODUCTION

Geriatrics is a specialized branch of internal medicine that addresses the health needs of the aged population. Categorized into three age categories, specifically Elderly (60-75 years), Old adults (76-90 years) and Very Old (above 91 years), geriatrics tackles various challenges associated with aging. Due to heightened awareness of healthy lifestyles and improved healthcare facilities, there is an anticipated increase in the number and proportion of individuals aged above 60 years globally. The world is projected to witness a rise from 900 million to two billion people aged 60 and above between 2015 and 2050, with the number of those aged 80 and above expected to reach around 400 million. Global trends indicate that men generally have a shorter life expectancy compared to women. These demographic shifts highlight the growing importance of geriatrics in addressing the distinct health needs of aging population's worldwide.[1]

In the population aged 70 and above, more than half grapple with persistent health issues like hypertension, coronary heart disease and cancer contributing to a significant burden. Government of India data indicates that cardiovascular disorders account for approximately one-third of mortality in this age group, with respiratory disorders, infections and neoplastic conditions also playing substantial roles.[2] The global rise in the elderly population, exceeding 65 years, has led to a notable increase in hospitalizations, presenting challenges to healthcare services. This sudden increase in admissions emphasizes the heightened vulnerability of the elderly to adverse outcomes arising from comorbidities and frailty. Beyond prevalent conditions like diabetes and high blood pressure, older patients may exhibit with atypical symptoms, necessitating tailored care. Recognizing the diverse cognitive, physical and social characteristics within the elderly demographic, a careful approach is essential. Comprehensive geriatric assessments aim to formulate integrated care plans, considering the unique needs and functional status

of each elderly individual. The prevalence of chronic ailments in the elderly population underscores the urgency for targeted healthcare interventions to address their complex health dynamics.[3] Top of Form

Geriatric patients commonly present with multiple comorbid conditions, making polypharmacy in the elderly a multifactorial issue. Factors contributing to polypharmacy include the involvement of multiple specialities, frequent hospitalizations, care transition, self-management practices, medication cascades and cognitive impairment. The consumption of multiple medications poses a significant risk of adverse effects arising from the drugs themselves, potential drug-drug interactions and interactions with existing medical conditions. Furthermore, overprescribing can lead to iatrogenic illnesses, poor adherence to prescribed regimens, increased susceptibility to falls, diminished overall quality of life, heightened rates of hospitalization and, in severe cases, mortality. To pinpoint the cause of new signs and symptoms in elderly individuals, a thorough examination of their medication list is essential. Performing a thorough review of medication at least once a year and following each care transition is crucial for assessing the necessity of the prescribed medications and ensure their appropriateness for the individual's health status.[3]

The Centers for Disease Control and Prevention (CDC) reports a increasing prevalence in diseases and comorbid conditions among individuals. The greater the number of comorbidities, the higher the likelihood of an increased prescription of medications to manage them. This escalation in the number of prescribed medications can result in a more complex treatment regimen for patients to adhere to and maintain. With the growing complexity of regimens, there is an elevated potential for poor medication adherence, including missed doses or incorrect timing. An essential first action in managing complex medication schedules is to recognize and measure them and the Medication Regimen Complexity Index (MRCI) stands out as a promising instrument for this purpose.[4]

COMPLEXITY OF MEDICATION REGIMEN WITHIN GERIATRICS

The concept of "medication regimen complexity" encompasses various aspects of a patient's drug regimen, extending beyond the simple quantity of medications, to factors such as the frequency of doses, quantity per dose, forms of dosage and supplementary instructions like taking the medication with food. Elevated medication regimen complexity has been linked to issues such as medication nonadherence, diminished quality of life and heightened utilization of health resources, such as increased hospital readmissions.[5]

The aging population presents unique challenges in healthcare management, particularly in the field of medication administration. Geriatric patients often contend with an abundance of chronic conditions, leading to the prescription of multiple medications. This complexity in medication regimens can result in substantial impacts on the health and well-being of older individuals, necessitating a careful approach to ensure optimal outcomes.

FACTORS CONTRIBUTING TO MEDICATION REGIMEN COMPLEXITY

Polypharmacy

Geriatric patients frequently grapple with polypharmacy, a situation where they are prescribed multiple medications concurrently. The cumulative effects of various drugs can lead to interactions, adverse reactions and difficulties in adherence.

Comorbidities

The presence of multiple chronic conditions in older individuals necessitates the use of diverse medications targeting different aspects of health. Coordinating these medications becomes increasingly challenging, with the potential for conflicting treatment goals.

Cognitive Decline

Cognitive impairment, prevalent in the elderly, poses a considerable barrier to understanding and managing complex medication regimens. Forgetfulness, confusion and difficulty following instructions can contribute to non-adherence and compromised therapeutic outcomes.

Functional Limitations

Physical limitations, such as impaired vision, dexterity, or mobility, can hinder a geriatric patient's ability to self-administer medications, making them reliant on caregivers or healthcare professionals for assistance.

Financial Constraints

Limited financial resources may result in patients not being able to afford all prescribed medications, leading to decisions about which medications to prioritize or omit, further complicating the regimen.

CONSEQUENCES OF MEDICATION REGIMEN COMPLEXITY

Increased Risk of Adverse Events

The more complex the medication regimen, the higher the likelihood of adverse drug reactions, drug interactions and unintended side effects, all of which can compromise the overall health of geriatric patients.

Reduced Adherence

Complexity often leads to poor adherence, as older adults may find it challenging to adhere to intricate medication schedules. Non-adherence can undermine the efficacy of treatments and exacerbate health issues.

Hospitalizations and Healthcare Costs

Medication-related issues contribute significantly to hospitalizations among geriatric patients, resulting in increased healthcare costs. Simplifying regimens can potentially reduce these adverse outcomes.

STRATEGIES FOR ADDRESSING COMPLEXITY

Healthcare professionals can employ various strategies to navigate medication complexity and enhance patient adherence:

- **Simplify Treatment Plans:** Where feasible, streamline medication regimens by minimizing the number of medications or consolidating doses to mitigate complexity.

- **Clear Communication:** Provide patients with clear and concise instructions regarding medication administration, including dosage, frequency and any special considerations.

- **Patient Education:** Educate patients about the importance of adherence and equip them with tools and resources to manage their medications effectively.

- **Regular Monitoring:** Monitor patient adherence and medication use routinely, intervening promptly to address adherence challenges.

- **Collaborative Care:** Foster collaboration and open communication among healthcare providers, patients and caregivers to address medication-related concerns and optimize treatment outcomes.

By addressing medication regimen complexity and promoting adherence, healthcare professionals can play a pivotal role in enhancing patient outcomes and improving overall quality of care.

MEDICATION REGIMEN COMPLEXITY INDEX (MRCI)

The concept of drug regimen complexity is a theoretical construct, unaffected by clinical, pharmacologic and demographic variables. When formulating Medication Regimen Complexity Index (MRCI), the primary considerations involved presuming the significance of dosage forms, frequency of doses and supplementary directives that play a crucial role in guiding administration. The 65-item Medication Regimen Complexity Index (MRCI) proves to be a dependable and valid instrument developed by George *et al.* for assessing the intricacy of medication regimens with potential implications in both clinical settings and academic investigations. The instrument consisted of three parts to encompass details regarding the dosage form (section A), frequency of doses (section B) and supplementary instructions (section C). The complexity index is determined by totaling the scores from these three sections.[6] The MRCI is structured as an unrestricted index, allowing for an unlimited number of prescribed drugs or additional instructions within a specific regimen. Each element of the MRCI has been individually identified as factors influencing patient adherence.[7]

ADHERENCE PATTERNS IN GERIATRIC PATIENTS

The use of medications is prevalent among the elderly demographic. Surveys reveal that 90% of older individuals employ one or more prescription drugs weekly, with 41% managing five or more and 12% handling a regimen of 10 or more medications per week.

Adherence is a complex phenomenon influenced by various factors, exhibiting variability across different populations. Elements such as age, gender, socioeconomic status, disease severity, medication complexity, social acceptance, poor patient-related relationships, cost, forgetfulness and the presence of psychological issues have all been identified as contributors to adherence variations among diverse groups. Medication nonadherence poses a multifaceted challenge, contributing to significant issues in medical and public health, including impaired therapeutic outcomes, increased hospitalization rates and escalated healthcare costs.[8]

In the context of the elderly, complex medication regimens are prevalent, primarily due to the high incidence of multiple comorbidities, escalating the need for polypharmacy. Recurrent hospitalizations further contribute to alterations in the drug therapy regimen, especially following hospital discharge. This post-hospitalization phase may introduce increased complexity to the medication regimen due to the initiation of newly prescribed medications. Such complexities in medication management are significant factors contributing to medication non-adherence among the aging population.[9]

Various elements can impact medication adherence in the elderly, including unclear instructions, inadequate patient education and limited involvement in the treatment plan, medication costs, side effects and the complexity of dosing regimens. Research consistently indicates that a considerable portion of the elderly population does not adhere to prescribed medication schedules, often influenced by factors such as the number of medications prescribed, interactions with multiple healthcare providers addressing diverse health concerns and the challenges associated with physical and cognitive limitations. Moreover, Insufficient comprehension of their health conditions and the importance of medications in ongoing management can lead to intentional non-compliance with prescribed treatments.[8]

INFLUENCE OF MEDICATION REGIMEN COMPLEXITY ON ADHERENCE AMONG GERIATRICS

Non-adherence to prescribed therapy is a widespread issue across various settings and populations, leading to suboptimal control of conditions like hypertension and diabetes, with significant healthcare and economic consequences. Numerous studies have highlighted the need for profiling noncompliant patients to guide preventive interventions. However, findings on patient profiles vary based on populations and methodologies employed. For example, younger individuals are more prone to noncompliance in diabetes, but this pattern doesn't necessarily apply to hypertensive populations. Generally, age and female gender are frequently identified as non-modifiable factors associated with poor compliance, though conflicting results exist. Other poorly modifiable correlates include lower educational level, economic disadvantage, cognitive/physical impairment and specific conditions like chronic renal failure.

Conversely, regimen complexity, measured by the number of prescribed drugs, stands out as a crucial and partially modifiable factor influencing adherence. Therefore, it is highly advisable to consider strategies to reduce the number of prescribed drugs, particularly in elderly patients, not only to enhance adherence but also to mitigate the risk of adverse drug reactions.

The complexity of medication regimens may play a more substantial role in fostering non-adherence than the overall quantity of drugs taken. In terms of therapeutic regimen considerations, factors like multiple daily dosing and the burden of pill management, such as the need to cut tablets, could exert a significant influence on medication adherence, especially among elderly patients. Strikingly, only a restricted few investigations have delved into this aspect of potential correlation among regimen factors and non-adherence.[10]

The initial stage in enhancing compliance among elderly individuals with multiple health condition involves conducting a thorough evaluation of all recommended medications and any additional substances they may be using. The objective is to pinpoint concerns such as excessive medication use, possible interactions between drugs, unsuitable prescription selections, utilization of unlicensed and expired drugs and to assess the complexity of drug treatment.[7]

OUTCOME OF POOR ADHERENCE IN GERIATRICS

Failure to adhere to prescribed medications can result in increased morbidity, mortality and healthcare costs. Ensuring the effectiveness of medical treatment regimens and promoting positive health outcomes heavily relies on strict adherence to prescribed medications. Unfortunately, poor medication adherence is a common occurrence, manifesting in various forms, including neglecting to fill prescriptions, avoiding medication altogether, missing doses, incorrect dosage, taking medication at inappropriate times, deviating from prescribed administration instructions (e.g., with or without meals), intentionally discontinuing it temporarily, or completely halting usage.[7]

Poor adherence to medication schedules among geriatric patients can have significant negative outcomes on their health and well-being. Non-compliance with medication schedules among geriatric patients can lead to a cascade of adverse consequences, including worsening of chronic conditions, increased risk of hospitalization and emergency department visits, elevated healthcare costs and reduced quality of life. Older adults are often managing multiple chronic conditions simultaneously and inadequate adherence exacerbates the progression and severity of these conditions, leading to poorer health outcomes. Furthermore, poor adherence can result in suboptimal therapeutic effects, diminishing the effectiveness of prescribed medications and potentially leading to treatment failures. This may necessitate adjustments in medication regimens, additional healthcare interventions and increased reliance on acute care services, placing further strain on healthcare resources and contributing to healthcare disparities among older adults.

Moreover, non-adherence elevates the likelihood of medication-related negative outcomes and medication interactions, particularly in older adults who may be more vulnerable to the effects of medications due to age-related physiological changes and comorbidities. These adverse events can result in unnecessary suffering, decreased functional status and impaired cognitive function, further compromising the overall health and independence of geriatric patients. Addressing adherence challenges through tailored interventions and support systems is essential to optimize health outcomes and enhance the well-being of older adults.

INTERVENTIONS FOR IMPROVING ADHERENCE IN GERIATRICS

To enhance medication Compliance among underprivileged older adults with multiple concurrent health conditions, a comprehensive approach is essential. The first step involves conducting a thorough evaluation of all prescribed therapy and any additional drugs they may be taking. This assessment aims to pinpoint concerns such as over use of medication, possible medication interactions, improper prescriptions and unauthorized or expired medications. Additionally, evaluating the complexity of the medication regimen is crucial in understanding the challenges faced by these individuals.

Following this assessment, the subsequent step should emphasize enhancing health understanding and disease-related awareness among older adults. This includes providing clear explanations about the healing intentions of medications, potential adverse

effects, specific guidelines and the importance of adherence. Achieving this objective requires collaboration between professionals employing a patient-focused method. Effective interaction between older adult patients and healthcare providers is crucial to guarantee that information is conveyed in a comprehensible and actionable manner.[7]

Tailored interventions are keys to addressing the unique needs of older adults with multiple comorbidities. Strategies such as medication simplification, medication therapy management programs, education and counselling sessions and the use of reminder systems can play a significant role in promoting adherence. Additionally, leveraging technology, including telemedicine and mobile health application, can facilitate communication and enable remote monitoring of medication adherence behaviours.

Ultimately, by considering individual factors such as cognitive function, physical abilities and social support systems, healthcare providers can effectively support older adults in managing their medications and improving adherence. This holistic approach not just promotes improved health outcomes while also enhancing overall quality of life for this vulnerable population.

DISCUSSION

According to study conducted by Nikhilesh Andhi *et al.* assessing medication complexity and adherence in 280 geriatric patients over six months. Data were collected from both inpatient and outpatient departments using the Medical Regime Complexity Index (MRCI) tool. Results indicate that the majority (79.27%) of patients were aged 60-75, with cardiovascular illnesses being the most prevalent (33.57%). The complexity level was higher for 70% of prescriptions, predominantly involving tablets/capsules (100%) and once-daily dosing (98.57%). Additional/administration instructions were provided for 73.57% of prescriptions and over 5 drugs were prescribed for 77.86% of patients. The study showed a correlation between high MRCI and the patient's health status, number of comorbidities and number of medications prescribed. This highlights the MRCI as an effective tool for assessing regimen complexity.

Frasia Oosthuizen *et al.* Conducted a pilot study of assessing the complexity of medicine regimens. Studies show that the complexity of treatment regimens can negatively affect adherence and treatment outcomes. The aim of this study was to assess the complexity of drug treatment. In this retrospective study, the complexity of outpatient regimens was assessed using the Medication Regimen Complexity Index (MRCI). The correlation between the complexity of the drug and the parameters of age, sex, underlying disease and drug quantity was determined. Age and number of medications were found to be important parameters influencing medication complexity. Therefore, elderly patients and patients taking multiple medications should be monitored for compliance and adherence should be emphasized.

The study concluded that MRCI is a valuable tool for pharmacists to identify patients who may have intricate medication regimens and could encounter challenges in adhering to their medication instructions.[11]

Two studies were conducted by Vicki S. Conn, Susan G. Taylor and Suzanne Kelley to explore the correlation between the complexity of medication routines and adherence in elderly individuals, with one group newly discharged from hospitals (*N*=178) and another group not newly hospitalized (*N*=98). The Medication Complexity score (Fillenbaum, 1988) was employed to gauge regimen complexity, considering the count, regularity and variety of actions necessary for medication compliance. Adherence occurred through pill quantification and verbal self-disclosure. Although the expected inverse relationship between regimen complexity and adherence was observed, they did not reach statistical significance. These findings suggest that medication regimen complexity might exert a more substantial influence on aspects of medication management beyond adherence to prescribed regimens.[12]

Ruoxi He *et al.* conducted a prospective study of associations between medication regimen complexity, medication adherence and clinical outcomes in patients with acute exacerbations of Chronic Obstructive Pulmonary Disease (COPD) after hospital discharge. The cohort comprised 2,853 patients from a nationwide study in China. The Medication Regimen Complexity Index (MRCI) was calculated 30 days post-discharge and patients were categorized based on COPD-specific and non-COPD MRCI scores. The main outcomes included medication withdrawal rates and clinical events (re-exacerbations and COPD-related readmissions) during the 30-day to 6-month follow-up period. Key findings indicated that a high MRCI score (>7) was observed in 46.1% of patients, with 91% of the MRCI score being COPD-specific. Higher MRCI scores were linked to an increased risk of re-exacerbation and readmission. The study found that medication regimen complexity, as assessed by MRCI scores, was relatively low in post-hospitalized patients with acute exacerbations of COPD in China. Higher MRCI scores were positively associated with medication adherence and correlated with an elevated risk of re-exacerbation and readmission during the follow-up period.[13]

Study conducted by Eri Wakai *et al.* at Mie University Hospital focused on the impact of the number of medications and medication regimen complexity on medication adherence and blood pressure management in hospitalized patients with hypertension. The analysis, encompassing 1,057 patients, revealed that while age ≥71 years and an oral Medication Regimen Complexity Index (MRCI) score ≥19.5 were identified as risk factors for poor medication adherence, the number of oral medications did not significantly contribute. Notably, the study underscored that medication regimen complexity, particularly indicated by the oral MRCI score, played a more

crucial role in influencing medication adherence and blood pressure management than the simple quantity of medications. As a result, the findings highlight the importance for healthcare professionals, including physicians and pharmacists, to carefully consider and address the complexities of medication regimens when making therapeutic adjustments for individuals with hypertension during their hospitalization.[14]

Wubshet H. Tesfaye *et al.* conducted retrospective cohort study involving 204 older adults with Chronic Kidney Disease (CKD) examined the impact of medication regimen intricacy at hospital discharge on readmission rates. While no significant association was found with 30-day readmission, higher medication regimen complexity, as measured by the Medication Regimen Complexity Index (MRCI), was linked to a shorter time to readmission within 12 months. The results highlight the importance of addressing medication regimen complexity in medical interventions to reduce the risk of readmissions over an extended period in older CKD patients.[15]

Krystina PARKER *et al.* done prospective study focused on elderly population with advanced end stage Chronic Kidney Disease (CKD), predominantly undergoing dialysis. The Medication Regimen Complexity Index (MRCI) was employed to evaluate medication regimen complexity, while medication adherence was evaluated utilizing the Morisky Medication Adherence Scale (MMAS-8). The analysis included 157 patients with a mean age of 76 ± 7.2 years. The findings revealed that female sex, a Charlson Comorbidity Index of 4 or 5 and the utilization of multiple categories of phosphate binders were linked with increased drug regimen complexity. However, the study revealed no clear correlation between the complexity of medication, age, or other factors and self-reported adherence to medication. Despite the intricacy of drug regimens in this geriatric CKD population, compliance remained generally high. These results underscore the multifaceted nature of medication management in elderly CKD patients, emphasizing the need for personalized approaches to address complexity-related challenges in medication regimens.[16]

The study conducted by Norazida Ab Rahman *et al.* aimed to assess medication burden, regimen complexity and adherence among Patients diagnosed with Type 2 Diabetes Mellitus (T2DM) attending public health clinics in Malaysia between January 2018 and May 2019. The average age of the cohort was 60.4 years, with 62.9% females. Medication burden, measured by medication count, averaged 4.8 and regimen complexity, assessed using the Medication Regimen Complexity Index (MRCI) tool, had a mean score of 15.1. The findings suggest that patients with a high medication count, complex regimens and low adherence are more likely to have poor glycemic control. The study recommends using these parameters to identify individuals with complex

pharmacotherapy regimens for targeted interventions to improve outcomes and facilitate self-care.[17]

This study by Anne M. Libby *et al.* explores medication regimen complexity across populations with chronic diseases (geriatric depression, HIV, diabetes and hypertension). Using the Medication Regimen Complexity Index (MRCI) at the patient level, the research reveals that dosing frequency and prescribed medications outside disease-specific categories significantly contribute to complexity. MRCI scores effectively differentiate patients within cohorts, suggesting potential utility in identifying candidates for intervention in chronic disease management programs. The study emphasizes the importance of considering all medications to reduce complexity and calls for future research to simplify the MRCI and enhance its connection to adherence and health services.[18]

CONCLUSION

According to above studies it is evident that medication regimen complexity plays a significant role in medication adherence, treatment outcomes and healthcare utilization across various patient populations and disease conditions. Addressing this complexity through personalized interventions and enhanced clinical strategies is essential for optimizing medication management and improving patient care.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICAL APPROVAL

Ethical approval has been taken from KIMS Al Shifa Healthcare Pvt. Ltd., (KAS: ADM: IEC: 0109I:23).

PATIENT CONSENT FORM

The Patient's Consent has been obtained.

ABBREVIATIONS

MRCI: Medication Regimen Complexity Index; **CKD:** Chronic Kidney Disease; **COPD:** Chronic Obstructive Pulmonary Disease; **T2DM:** Type 2 Diabetes Mellitus; **MMAS-8:** Morisky Medication Adherence Scale; **CDC:** Centers for Disease Control and Prevention.

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