



Prevalence of Inappropriate Medication Use, Polypharmacy and Study of Medication Adherence among Patients with Diabetes Mellitus in the Geriatric Population

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(Received: 16 June 2025

Revised: 20 July 2025

Accepted: 04 August 2025)

KEYWORDS

Diabetes mellitus, Inappropriate medication, Beers criteria, Polypharmacy, Medication adherence

ABSTRACT:

Introduction: Diabetes mellitus (DM) is one of the most common lifelong condition causing significant morbidity and mortality particularly in the elderly population. Among the most serious issues in diabetic elderly patients are the very high rate of polypharmacy, misuse of drugs and medication adherence resulting in drug side effects, reduced quality of life and escalated health care costs.

Objectives: This study aims to find the prevalence of inappropriate medication use, polypharmacy, and medication adherence among elderly diabetic patients.

Methods: A six-month cross-sectional observational study was done at a tertiary care hospital among patients of 60 years and above who had diabetes mellitus. Information about demographics, clinical, comorbidity and medications were collected through a structured questionnaire. Inappropriate drug prescribing was evaluated by the Beers Criteria. We also used the Morisky Medication Adherence Scale to measure medication adherence in our patients.

Results: The study had 218 patients with a mean age of 68 years. Polypharmacy was seen in 90.34% of the subjects and inappropriate use of drugs in 34.4% of the subjects. Nonadherence to medication was seen in 58% of the patients, among which significant predictors were comorbidities, complexity of the regimen, and absence of education in managing diabetes. The majority of the patients were on combined medications, and some of the problems concerned probable drug-drug interaction.

Conclusions: Inappropriate drug use and polypharmacy are significantly prevalent among elderly DM patients, thus prescription practices and patient education on well-prescription need to be enhanced. The above patients should receive systematic multidisciplinary treatment and drug review in order to promote compliance and maximize therapeutic benefits.

1. Introduction

The concept of "geriatric" has evolved throughout the past few decades. Eighty five and older were considered the oldest-old a few decades ago. Later, as an older Three

age categories of adults were identified: young adults (65–74 years old), middle-aged adults (75–85 years old), and the oldest-aged adults (> 85 years old). The World Health Organisation (WHO) classifies older people as



those who are 60 years of age or older, however most nations classify those between the ages of 60 and 65 as geriatric[1]. It is projected that there would be 700.2 million individuals with diabetes mellitus globally by 2045, up from an estimated 537 million in 2021[2].

Globally, diabetes mellitus (DM) is becoming more common, particularly among the elderly. Specifically, among older persons, type 2 diabetes mellitus is more prevalent than type 1. Because of a decline in insulin production and increased insulin resistance to varied degrees, this particular form of diabetes mellitus presents as hyperglycemia. As people age, these two illnesses often worsen, leading to an increase in the proportion of older persons with diabetes mellitus[3].

Potentially inappropriate medicines (PIMs), which are defined as drugs that have more negative than positive effects on senior citizens, are strongly associated with polypharmacy and pose a significant public health risk to senior citizens[4]. Owing to the complexity of their medical conditions and multiple drug use, elderly individuals are at higher risk of taking medications inappropriately. Some drugs are classified as PIMs for older patients because they increase the risk of adverse drug events in this patient population[5].

Polypharmacy is the use of multiple medications simultaneously. Although the use of five or more medications is the most frequently used definition of polypharmacy, use of ten or more drugs has more recently been referred to as hyperpolypharmacy[6]. Although polypharmacy may be beneficial in some older adults[6], this practice is associated with several negative outcomes including increased healthcare services utilization (HSU), adverse drug events (ADEs), cognitive impairment, decreased compliance, falls, and death[7].

Medications adherence refers to the ability of patients to take their drugs as prescribed by their doctor. Older adults battling chronic health conditions still struggle mightily with taking their medicines. Noncompliance may lead to additional medical or surgical operations, increased rates of hospital readmission for drug-related problems, treatment failure, and increased healthcare costs. Additionally it may lead to death[8]. There are several ways that medication non-adherence can manifest itself, such as failing to fill a prescription,

not taking medication at all, skipping a dose, using the wrong dosage, taking medication at the wrong time of day, or not taking it as prescribed (e.g., with or without food). It can also involve purposely discontinuing the drug for a while or not taking it at all. While inadvertent non-adherence results from various circumstances including forgetfulness, misunderstanding of drug regimens, lack of access to medicine, or language hurdles, purposeful non-adherence occurs when patients consciously choose not to take their medications as directed[9].

It is crucial to study the association between inappropriate medication use and polypharmacy and medication adherence in older adults with diabetes simultaneously. In this study we aim to find the prevalence of inappropriate medication use, polypharmacy and medication adherence in older adults with diabetes mellitus.

2. Materials and methods

Study design and setting

This cross-sectional observational study was conducted in a tertiary care hospital in Erode district, Tamil Nadu, with a study population of 218. The study included patients above 60 years of age with diabetes mellitus and excluded critically ill patients (ICU), mentally retarded and other disabled patients with auditory, visual and speech impairment.

Data collection

A data collection form was designed and has two sections. The first section of the form included sociodemographic data along with the medical and medication history. The second section included a set of 8 questions for assessing the medication adherence of the patients using the standard 8-item Morisky scale. Then the sociodemographic details and medical history of the individuals were recorded. The details of all present medications taken were collected and obtained from prescriptions, medical records, pharmacy bills and from interviews with individuals and caregivers.

Statistical analysis

The data collected were tabulated, analysed, and interpreted using standard statistical tools. The statistical procedure was undertaken with the help of the statistical package social science statistics. The p-values less than or equal to 0.05 was fixed as the level of



significance. The statistical method used here is chi-square test.

Ethics

The study was approved by the institutional ethics committee under the protocol number JKKMMRAFCP/IHEC/2024/005. Informed consent was obtained from individuals/family members before data collection.

3. Results

There were a total of 218 patients in the study. The distribution of age (see **table 3.1**) indicates most participants (62.39%) were within the age group 60–69

years, then 27.06% in the age group 70–79 years, and 10.55% over 80 years, which confirms a dominance of young elderly individuals. Gender is revealed to be mildly dominated by men (54.13%), which might imply a fairly balanced sample. Educational was heterogeneous with the majority (28.44%) having attended primary education, and 13.30% being illiterate, a factor which could have a direct influence on health literacy and medication use. Occupation-wise, the majority (64.22%) were unemployed or retired, as would be expected in this age group, and could restrict economic access to medication.

Table 3.1: Socio-Demographic Data

Parameter	Category	Frequency	Percentage (%)
Age	60–69	136	62.39
	70–79	59	27.06
	Above 80	23	10.55
Gender	Male	118	54.13
	Female	100	45.87
Education	Primary School	62	28.44
	High School	45	20.64
	Higher Secondary	31	14.22
	Degree	51	23.39
	Illiterate	29	13.30
Occupation	Employed	78	35.78
	Unemployed / Retired	140	64.22
Social History	Smoker	17	7.80
	Alcoholic	28	12.84
	Smoker and Alcoholic	48	22.02
Health Insurance	Yes	46	21.10
	No	172	78.90
Present medical illness	Diabetes mellitus	218	100
	Hypertension	138	63.30
	Hyperlipidemia	71	32.57
	Arthritis	38	17.43
	Coronary artery disease	19	8.71
	Chronic kidney disease	27	12.38
	Chronic obstructive pulmonary disease	14	6.42
Number of comorbidities	≤ 2	47	21.56
	Three or more	171	78.44



Social history revealed 7.80% smoked, 12.84% drank alcohol, and 22.02% used both the habits, identified risk factors that may complicate care for diabetes. As unbelievable as this sounds, there was a health insurance cover of just 21.10% among the participants, and 78.90% of the participants had no cover, which can potentially result in low access to healthcare facilities, non-payment for medications, and low follow-up.

With respect to comorbidities, all the patients were diabetic, according to the inclusion criteria, with the most frequent associated illness being hypertension (63.30%), then hyperlipidemia (32.57%), arthritis (17.43%), chronic kidney disease (12.38%), coronary artery disease (8.71%), and chronic obstructive pulmonary disease (6.42%). A vast majority of patients (65.60%) were on

vitamin supplements, most probably because of age-related deficiency and overall well-being maintenance. Calcium channel blockers (39.73%) and statins (34.78%) were most frequently prescribed. Proton pump inhibitors (44.94%) were also common, probably related to gastrointestinal side effects of polypharmacy or prophylactic use among the elderly. The predominance of NSAIDs (21.10%) and analgesics (14.68%) points towards high incidence of chronic pain or inflammatory illness, whereas drugs such as DMARDs (7.34%) and corticosteroids (6.88%) reinforce comorbid autoimmune or rheumatologic disease. Cardiovascular medications were represented by beta-blockers (5.34%), alpha beta-blockers (4.42%), diuretics (11.93%), antiplatelets (8.26%), and anticoagulants (2.75%), showing the high prevalence of cardiovascular comorbidities.

Table 3.2: Distribution Of Inappropriate Medications

S.NO	INAPPROPRIATE MEDICATIONS	FREQUENCY	PERCENTAGE (%)
1	GLIBENCLAMIDE	12	5.50%
2	GLIMEPIRIDE	28	12.84%
3	ASPIRIN	15	6.88%
4	DICLOFENAC	09	4.13%
5	IBUPROFEN	04	1.83%
6	SPIRONOLACTONE	07	3.21%

The most common inappropriate medications used based on beers criteria (see **table 3.2**) was glimepiride (12.84%) as the most common reported inappropriate medication, followed by glibenclamide (5.50%) and aspirin (6.88%). Diclofenac (4.13%), ibuprofen (1.83%),

and spironolactone (3.21%) also less frequently present. These findings shows that comprehensive drug reviews must be conducted to prevent inappropriate drugs in elderly, and to increase patient safety.

Table 3.3: Distribution of Polypharmacy

POLYPHARMACY	FREQUENCY	PERCENTAGE (%)
No polypharmacy (≤ 4 Drugs)	21	9.63%
Major polypharmacy (≥ 5 Drugs)	173	79.36%
Hyper polypharmacy (≥ 10 Drugs)	24	11.01%

Distribution of Polypharmacy is shown in **Table 3.3** here majority 79.36%, of the patients were under hyper polypharmacy (five or more drugs), followed by 11.01% being under hyper polypharmacy (ten or more drugs). Only 9.63% was not under polypharmacy, receiving four or less drugs. This shows that the majority of the elderly

patients in this study were under the effect of the harmful effects of polypharmacy.

Based on the Morisky Medication Adherence Scale (< 6 for low adherence, 6 to < 8 for medium adherence, 8 for high adherence) (see **table 3.4**) 57.8% of the patients do not have good drug adherence, 24.31% have a medium



degree of adherence, and only 17.89% have high adherence. This indicates that a substantial percentage of

the population finds it difficult to stick to medication as directed.

Table 3.4: Distribution of patients based on the Morisky Medication Adherence Scale

MEDICATION ADHERENCE (MMAS-8)	FREQUENCY	PERCENTAGE (%)
Low Adherence	126	57.80%
Medium Adherence	53	24.31%
High Adherence	39	17.89%

Table 3.5: Association of age in patients with inappropriate medication, polypharmacy and medication adherence

AGE	60-69	70-79	ABOVE 80	CHI SQUARE	P-VALUE
INAPPROPRIATE MEDICATION					
YES	35(46.67%)	34(45.33%)	06(8%)	19.333	0.000063
NO	101(70.63%)	25(17.48%)	17(11.89%)		
POLYPHARMACY					
NO	17(80.95%)	04(19.05%)	0(0)	31.0166	< 0.00001
MAJOR	116(67.05%)	40(23.12%)	17(9.83%)		
HYPER	03(12.5%)	15(62.5%)	06(25%)		
MEDICATION ADHERENCE					
LOW	84(66.67%)	36(28.57%)	06(4.76%)	12.13	0.0163
MEDIUM	31(58.49%)	11(20.75%)	11(20.75%)		
HIGH	21(53.85%)	12(30.77%)	06(15.38%)		

Significant with $p < 0.05$

Table 3.5 indicates the extent to which inappropriate use of medication, prevalence of polypharmacy, and medication adherence differ based on different age groups of elderly diabetic patients and whether the relationship is statistically significant. Highest rates of inappropriate drug utilization were recorded among age groups 60–69 years (46.67%) and 70–79 years (45.33%), and there were hardly any instances in patients aged more than 80 years (8%), and the association was found to be significant ($p = 0.000063$). With regard to polypharmacy, the majority of patients without polypharmacy were young old (60–69 years, 80.95%), whereas hyper polypharmacy (>10 drugs) was predominant in older ages—62.5% in 70–79 and 25% in >80, significantly associated ($p < 0.00001$). For medication adherence, lowest adherence was highest among the age group of 60–69 (66.67%), whereas medium and high adherence declined with increase in age, and whereas more equal distribution of medium and high adherence was observed, a marginally greater number of patients aged over 80 demonstrated medium or high adherence. This

also was statistically significant ($p = 0.0163$). In general, these results emphasize that younger-old patients are most vulnerable to risk of inappropriateness in prescribing and adherence, whereas older patients have a higher drug burden, emphasizing the need for careful, age-related prescribing and patient counselling.

4. Discussion

This study reveals the importance of medication management among elderly diabetic patients in a tertiary care hospital. Our findings show that inappropriateness in the use of medications, polypharmacy, and medication nonadherence are common according to reports from around the world over the last decade. Surprisingly, the prevalence of polypharmacy (≥ 5 medications) was as much as 79.36%, while hyperpolypharmacy (≥ 10 medications) was observed in 11.01% of the participants. These findings agree with Endalifer et al., noting that polypharmacy is extremely prevalent in comorbid elderly patients, especially diabetes, since the illnesses



require treating comorbidities such as hypertension, hyperlipidemia, and arthritis[5].

Inappropriate use of medications was present in about 34% of the subjects, primarily sulfonylureas glimepiride (12.84%) and glibenclamide (5.50%), and NSAIDs diclofenac and ibuprofen. Long-standing use of these drugs among geriatric patients is problematic because they are highlighted under the Beers Criteria, American Geriatrics Society for increased risk of hypoglycemia and gastric bleed[10]. These results reflect in line with the study by Samara et al., show that despite well-established worldwide guidelines, such risk medications are still being prescribed to the elderly on a regular basis[11].

Medication non-adherence was a prominent concern, where 57.8% of patients were found to have low adherence by the Morisky Medication Adherence Scale (MMAS-8). Non-adherence is most likely caused by intricate regimens, excessive pill burden due to polypharmacy, and inadequate health literacy since nearly 13.3% of patients in the study were illiterate. The findings are in agreement with Liu et al., which have previously proved that multimorbidity and polypharmacy negatively affect adherence[8].

It's interesting to note that when age was correlated with drug outcomes, patients aged 60–69 years had greater rates of inappropriate prescribing and low adherence, and patients aged 70–79 and older had higher rates of hyperpolypharmacy. This suggests that while older age increases drug burden, younger-old adults might be more vulnerable to inappropriate medication possibly due to physician's perception of greater physiological reserve and also face more barriers to adherence due to lifestyle factors. Collectively, these results indicate that optimization of diabetes care in elderly individuals should be based on patient-oriented treatment. Regular review of medications, application of reliable instruments such as Beers Criteria, and patient education strategies could effectively reduce inappropriate prescribing and improve adherence.

5. Conclusion

In conclusion, this study demonstrates that the improper use of medication and polypharmacy is very common among geriatric diabetic patients with low levels of

adherence. The findings support international findings on the unsafe use of multiple medicines and inappropriate prescribing by older people and advocate the need for established medication review processes and more effective patient education strategies.

Using multidisciplinary care models with pharmacists, geriatricians, and diabetes educators may reduce potentially inappropriate use of medications and promote adherence, with a consequent reduction in complications and quality of life in this high-risk population. Local context-adapted interventions should be the focus of future research, particularly for the youngest elderly subgroup where non-adherence and inappropriate prescribing are most significant.

Acknowledgement

We express our heartfelt gratitude to **Dr. N. Senthil Kumar, M.Pharm., Ph.D.**, Principal, for his continuous supervision and support. Our sincere thanks to **Maruthi Medical Centre Hospital, Erode**, for providing the opportunity and necessary assistance to carry out our project successfully.

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