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Medication compliance among individuals with hypertension and type 2 diabetes mellitus in urban slums of amalapuram: Findings from a cross-sectional study.

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Abstract

Background: Medication adherence is essential for effective management of chronic conditions such as hypertension and type 2 diabetes mellitus. In urban slum populations, adherence is often hindered by socioeconomic limitations, low health literacy, and lack of awareness, contributing to poor clinical outcomes.

Objective: This study aimed to evaluate the prevalence of medication adherence among individuals with hypertension and type 2 diabetes mellitus, identify associated sociodemographic and clinical factors, and explore barriers to adherence.

Methods: A descriptive cross-sectional study was carried out in the urban slums of Amalapuram from January 2025 to June 2025. A total of 100 adult patients with both hypertension and type 2 diabetes were enrolled. Data regarding sociodemographic characteristics, clinical history, and treatment practices were collected using a pretested structured questionnaire. The 8-item Morisky Medication Adherence Scale (MMAS-8) was used to assess adherence levels. Descriptive statistics were applied to determine prevalence, while associations with influencing factors were explored.

Results: The mean age of participants was 54.2 ± 9.6 years, with females accounting for 56%. Most patients (71%) belonged to the lower socioeconomic class. The average duration of hypertension and diabetes was 7.3 ± 3.8 years and 6.1 ± 3.2 years, respectively. Adherence assessment revealed that 28% had high adherence, while 36% each showed medium and low adherence. Younger age (<50 years), female gender, higher education, shorter disease duration, and middle socioeconomic status were positively associated with better adherence. The main reasons for poor compliance were forgetfulness (44%), discontinuation after symptomatic relief (28%), financial constraints (15%), and adverse drug reactions (8%).

Conclusion: Medication adherence among patients with coexisting hypertension and diabetes in Amalapuram urban slums was suboptimal, with nearly three-fourths demonstrating medium or low compliance.

Recommendations: Regular patient counseling, routine adherence assessment, and ensuring affordable access to medicines are essential to improve compliance and reduce long-term complications.

Keywords: *Hypertension, Type 2 Diabetes Mellitus, Medication Adherence, Urban Slums, Compliance.*
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Introduction

Hypertension and type 2 diabetes mellitus are among the most prevalent chronic non-communicable diseases worldwide, contributing significantly to cardiovascular morbidity, disability, and premature mortality. The coexistence of these two conditions substantially increases the risk of serious complications such as myocardial infarction, stroke,

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renal impairment, and retinopathy, thereby posing a major public health challenge [1]. Effective long-term management of both diseases depends largely on consistent adherence to prescribed pharmacological regimens and lifestyle modifications [2].

Despite the availability of effective therapeutic options, medication non-compliance remains a persistent challenge, particularly in low-resource settings. Poor adherence has been shown to result in inadequate blood pressure and glycemic control, recurrent hospitalizations, increased healthcare expenditure, and reduced quality of life [3]. The World Health Organization has reported that adherence to long-term therapies for chronic illnesses averages only about 50% in developed countries, with even lower rates documented in developing nations due to barriers such as poor health literacy, economic constraints, limited healthcare access, and cultural perceptions of illness [4].

In India, these challenges are amplified in urban slum populations, where poverty, overcrowding, poor sanitation, and restricted access to healthcare facilities further hinder adherence. Previous studies from southern and eastern India have highlighted suboptimal adherence among patients with coexisting hypertension and diabetes, particularly in vulnerable groups [1,2,4]. Research in urban slums of Navi Mumbai revealed that compliance was particularly poor in low-income communities [3], while studies from eastern and rural regions of India have identified education level, socioeconomic status, and age as key determinants of adherence [4,6]. Moreover, slum populations are at heightened risk of developing type 2 diabetes due to lifestyle and environmental factors, further compounding the burden [5].

Although several regional studies have explored medication adherence among patients with chronic illnesses, there remains a paucity of data focusing specifically on urban slum populations with dual diagnoses of hypertension and type 2 diabetes mellitus. Understanding compliance patterns in these vulnerable communities is essential for designing targeted interventions to improve treatment outcomes and reduce the burden of complications.

The present study was undertaken to evaluate the level of medication adherence, identify influencing sociodemographic and clinical factors, and explore barriers contributing to poor compliance among patients with hypertension and type 2 diabetes mellitus in the urban slums of Amalapuram. Generating such evidence is essential for developing targeted interventions aimed at improving treatment adherence and reducing the burden of complications in these high-risk populations.

Methodology

Study Design and Setting

A descriptive cross-sectional study was conducted in the urban slums of Amalapuram, situated in the Konaseema district of Andhra Pradesh, India, over a period of six months from January 2025 to June 2025. Amalapuram is a semi-urban coastal town located in the Godavari delta region, with a total population of approximately **53,000** as per the 2011 Census, and nearly one-fourth of the inhabitants live in notified slum areas. The major economic activities include agriculture, small-scale trading, fishing, and daily wage labor. The community predominantly belongs to lower- and middle-income groups, residing in densely populated neighborhoods with limited sanitation facilities and variable access to healthcare. Public health services are primarily delivered through government primary health centers and urban health posts, supplemented by private clinics and pharmacies. The study was carried out in these slum clusters under the jurisdiction of the Amalapuram Urban Health Centre to ensure representation across different socioeconomic backgrounds.

Study Population

The study included adult patients diagnosed with both hypertension and type 2 diabetes mellitus who were undergoing treatment and residing in the urban slums of Amalapuram.

Sample Size and Sampling Technique

The sample size was calculated based on the expected prevalence of medication non-compliance among patients with both hypertension and diabetes mellitus in similar community settings. Assuming a prevalence of 50% (for maximum variability), a confidence level of 95%, and a margin of error of 10%, the required minimum sample size was estimated using the formula

$$n=Z2\times p(1-p)/d2$$

where Z = 1.96, p = 0.5, and d = 0.1, yielding a minimum sample size of approximately 96. To account for potential non-responses and incomplete data, the final sample size was rounded to **100 participants**. Participants were selected using convenience sampling, considering feasibility within the study period and available resources.

Inclusion Criteria:

Adults aged ≥18 years.

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Patients diagnosed with both hypertension and type 2 diabetes mellitus for at least 6 months.
Individuals are currently on pharmacological treatment for either or both conditions.
Residents of the urban slums of Amalapuram who gave informed consent.

Exclusion Criteria

Patients with severe cognitive impairment or psychiatric illness interfere with communication.
Pregnant or lactating women
Pregnant or lactating women.
Individuals unwilling to participate.

Data Collection Tool

Data were collected using a pretested structured questionnaire covering sociodemographic details, clinical history, type of therapy, and treatment practices. Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8), a validated tool widely used to measure adherence to chronic disease therapy. Scores were categorized as:
High adherence (score = 8)
Medium adherence (score = 6–7)
Low adherence (score < 6)

Data Collection Procedure

Eligible participants were interviewed face-to-face at their households and local health centers. Information on sociodemographic characteristics, disease duration, prescribed therapies, and self-reported barriers to medication adherence was obtained.

Bias and Mitigation

Efforts were made to minimize potential biases during data collection and analysis. Selection bias was addressed by including all eligible patients meeting the inclusion criteria within the study period, irrespective of gender or socioeconomic status. Recall bias was reduced by cross-verifying responses related to medication adherence with prescription records and medicine strips whenever available. Interviewer bias was minimized by training the field investigators using standardized instructions and employing the validated MMAS-8 questionnaire to ensure uniformity of data collection. All analyses were performed objectively using coded datasets to avoid investigator influence on outcome interpretation.

Data Analysis

Collected data were entered in Microsoft Excel and analyzed using SPSS software version 25. Descriptive statistics such as frequencies, percentages, mean, and standard deviation were used to summarize data. Associations between adherence and influencing factors (age, gender, education, socioeconomic status, and disease duration) were assessed using the chi-square test, with $\mathbf{p < 0.05}$ considered statistically significant.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee of Konaseema Institute of Medical Sciences, Amalapuram. Written informed consent was taken from all participants before data collection, and confidentiality of responses was maintained throughout the study.

Results

Participant Recruitment and Screening

A total of 118 individuals residing in the urban slums of Amalapuram were initially approached for participation. Of these, 110 were screened for eligibility after providing preliminary consent. Ten individuals were not available for detailed assessment, leaving 100 participants who fulfilled all inclusion criteria and consented to participate.
Among the screened individuals, 8 were excluded: 4 due to incomplete clinical records, 2 owing to cognitive impairment that interfered with communication, and 2 who were pregnant or lactating at the time of data collection. Thus, 100 eligible participants were included in the final analysis.
The recruitment and screening process is summarized in Figure 1, which provides an overview of participant inclusion and exclusion.

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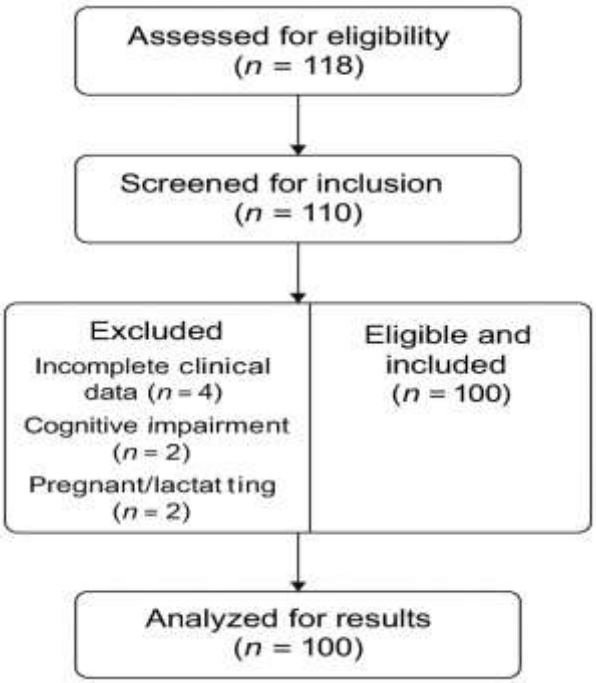

Figure 1. Participant Flow Diagram

A total of 100 individuals with coexisting hypertension and type 2 diabetes mellitus from the urban slums of Amalapuram were included in the study.

Sociodemographic Characteristics

The mean age of participants was 54.2 ± 9.6 years, with the majority belonging to the 50–59 years age group (42%). Females constituted 56% of the study population, and most participants were married (64%). A considerable proportion (71%) belonged to the lower socioeconomic class as per the Modified BG Prasad's classification. The detailed sociodemographic profile is presented in Table 1.

Table 1. Sociodemographic Characteristics of Study Participants (n = 100)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
< 50	22	22
50–59	42	42
≥ 60	36	36
Gender		
Male	44	44
Female	56	56
Marital status		
Married	64	64
Unmarried/Widowed/Separated	36	36
Socioeconomic status*		
Lower class	71	71
Middle class	29	29

**As per Modified BG Prasad's classification*

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Clinical Profile

The mean duration of hypertension was 7.3 ± 3.8 years, whereas the mean duration of diabetes mellitus was 6.1 ± 3.2 years. In terms of treatment, 20% of participants were on monotherapy for either condition, 48% received dual therapy (oral hypoglycemic agents and antihypertensives), while 32% were on combination therapy including insulin. The clinical characteristics are summarized in Table 2.

Table 2. Clinical Profile of Participants

Variable	Mean ± SD / Frequency	Percentage (%)
Duration of Hypertension (years)	7.3 ± 3.8	–
Duration of Diabetes (years)	6.1 ± 3.2	–
Type of therapy		
Monotherapy (either HTN/DM)	20	20
Dual therapy (OHA + Anti-HTN)	48	48
Combination incl. insulin	32	32

Medication Compliance

Medication adherence, assessed using the MMAS-8 scale, revealed that only 28% of participants had high adherence, while 36% had medium adherence and 36% showed low adherence. Thus, nearly three-fourths of the study population demonstrated suboptimal compliance (Table 3).

Table 3. Medication Compliance (MMAS-8 Scores)

Compliance Category	Frequency (n)	Percentage (%)
High adherence	28	28
Medium adherence	36	36
Low adherence	36	36
Total	100	100

Factors Influencing Compliance

Higher adherence was observed among participants aged <50 years (42%) compared to those ≥60 years (18%). Female participants showed slightly better compliance (31%) compared to males (24%). Education had a notable effect, with high adherence seen in 40% of those with secondary education or above, as opposed to 15% among illiterates. Similarly, individuals belonging to the middle socioeconomic class reported better compliance (38%) than those in the lower class (22%). Disease duration also influenced adherence: patients with <5 years of illness had higher adherence (35%) than those with a longer disease duration (23%). These associations are detailed in Table 4.

Table 4. Factors Associated with Medication Compliance

Factor	High Adherence (%)	Medium/Low Adherence (%)
Age group		
< 50 years (n=22)	42	58
≥ 60 years (n=36)	18	82
Gender		
Male (n=44)	24	76
Female (n=56)	31	69
Education		
Illiterate (n=40)	15	85
≥ Secondary education (n=60)	40	60
Socioeconomic status		
Lower class (n=71)	22	78

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Middle class (n=29)	38	62
Disease duration (<5 yrs)	35	65
Disease duration ≥5 yrs	23	77

Discussion

The present cross-sectional study evaluated medication compliance among 100 individuals with coexisting hypertension and type 2 diabetes mellitus in the urban slums of Amalapuram. Only 28% of participants reported high adherence, while nearly three-fourths demonstrated medium or low adherence, highlighting a substantial gap in treatment compliance. These findings align with recent evidence from Indian slum populations, where poor adherence to treatment for chronic diseases has been consistently reported. A record-based study from Chhattisgarh demonstrated a high burden of hypertension and diabetes in urban slums, indicating that long-term disease control remains a significant challenge in such vulnerable communities [7]. Similarly, a 2025 tertiary care study in India also revealed low adherence among diabetes patients, suggesting that the problem extends across both community and institutional settings [8]. International observations have also highlighted comparable trends, with research in China showing inappropriate medicine usage for hypertension management among diabetic patients in peri-urban areas, resulting in inadequate disease control [9].

This study found that younger age, female gender, higher education, and middle socioeconomic status were associated with better adherence. These determinants are consistent with reports from southern India, which observed that awareness and health-seeking behavior were better among literate individuals in urban slums [10]. The relationship between adherence and quality of life is also well established, with studies in India demonstrating that poor medication compliance among diabetes patients is strongly correlated with diminished health-related outcomes [11]. Similar patterns have been observed internationally, with studies in Bulgaria and Cambodia showing that socioeconomic disadvantage and limited awareness remain significant predictors of non-compliance [12,13].

The main barriers reported by participants in this study included forgetfulness, discontinuation of medications after symptomatic relief, financial constraints, and adverse effects. Comparable challenges have been documented in other Indian and Southeast Asian studies, suggesting that both individual-level and systemic factors contribute to suboptimal adherence [7,12,13]. Polonsky and Henry [14] emphasized that poor adherence in type 2 diabetes is a multifaceted issue, influenced by treatment complexity, psychological burden, and inadequate communication between patients and providers.

The findings of this study underscore the urgent need for interventions targeting slum populations. Patient counseling, simplified treatment regimens, reminder-based approaches, and family involvement may help address behavioral barriers, while policy-level measures ensuring affordability and accessibility of essential medications are equally important. Strengthening community health services and integrating routine adherence assessments into clinical care could significantly improve long-term outcomes for patients with coexisting hypertension and diabetes mellitus in resource-limited urban settings.

Generalizability

The findings of this study can be cautiously generalized to similar low-resource urban slum populations across India, where socioeconomic disparities, limited healthcare access, and low health literacy prevail. However, because the study was conducted in a single district with a relatively small sample size, the results may not fully represent all urban or rural settings. Future multicentric studies with larger and more diverse populations are needed to confirm these observations and strengthen external validity.

Conclusion

This study highlights that medication compliance among individuals with coexisting hypertension and type 2 diabetes mellitus in the urban slums of Amalapuram is suboptimal, with nearly three-fourths of patients demonstrating medium or low adherence. Factors such as younger age, female gender, higher education, shorter disease duration, and better socioeconomic status were associated with improved adherence. Major barriers identified included forgetfulness, discontinuation after symptomatic relief, financial limitations, and adverse drug effects. These findings emphasize the urgent need for patient-centered interventions, including regular counseling, simplified treatment regimens, reminder-based support, and improved affordability of medicines, to enhance adherence and reduce long-term disease complications.

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Strengths and Limitations

The strength of this study lies in its focus on an underserved urban slum population, providing valuable insights into real-world adherence challenges. However, the study had certain limitations, including a modest sample size, a cross-sectional design, and reliance on self-reported adherence, which were subject to recall and social desirability biases.

Recommendations

To improve medication adherence among patients with hypertension and type 2 diabetes mellitus in urban slums, multifaceted strategies are needed. Healthcare providers should incorporate routine screening of adherence using validated tools such as MMAS-8 during clinical visits. Patient education programs must emphasize the chronic nature of these diseases and the risks of irregular medication use. Reminder-based interventions, family involvement, and counseling can help address forgetfulness and treatment fatigue. Ensuring affordable access to essential drugs through government health schemes is crucial. Strengthening doctor–patient communication and community-based awareness initiatives can further enhance compliance and optimize long-term treatment outcomes.

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Abbreviations

HTN – Hypertension;
DM – Diabetes Mellitus;
MMAS-8 – 8-item Morisky Medication Adherence Scale;
OHA – Oral Hypoglycemic Agents;
SD – Standard Deviation;
SPSS – Statistical Package for the Social Sciences;
WHO – World Health Organization.

Source of funding

The Study has no funding

Conflict of interest

The Author declares no conflict of interest.

Author contributions

TN-Concept and design of the study, results interpretation, review of literature, and preparation of the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. **BNR**-Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript, revision of the manuscript. **SS**-Review of literature and preparing the first draft of the manuscript. Statistical analysis and interpretation. **SBS**- preparing first draft of manuscript. Statistical analysis and interpretation, revision of the manuscript

Data availability

Data available on request

Author Biography

Dr. T. Nageswara Rao is currently serving as an Associate Professor of Pharmacology at Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, East Godavari District, Andhra Pradesh, India. He holds a doctoral degree in Medical Pharmacology from the prestigious Index Medical College and Research Institute, Madhya Pradesh. With over 16 years of teaching experience in various medical institutions, Dr. Nageswararao has made significant contributions to the field of pharmacology. His academic work includes nine research publications in reputed national and international journals, including one article indexed in PubMed. His dedication to research and education continues to enrich the academic and clinical landscape of medical pharmacology.**T.Nageswara Rao**:https://orcid.org/0009-0005-1638-6897

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She has published extensively in reputed national and international journals, with a focus on drug safety, rational therapeutics, and experimental pharmacology. Her research has been recognized with best research paper awards at both university and international conferences.

In addition to research, Dr. Suguna is an experienced educator, actively engaged in teaching undergraduate and postgraduate students. She has guided D.Pharm students clinically, supervised undergraduate and postgraduate university projects, and mentored ICMR-funded student research. She also serves as a clinical guide and examiner for academic and fellowship programs. She is a recipient of the Department of Health Research Fellowship in Transdisciplinary Research and contributes significantly to academic and ethical committees of her institution. Dr. Suguna remains committed to fostering rational drug use, promoting evidence-based medicine, and advancing scientific inquiry in pharmacology. **ORCID ID:** https://orcid.org/0000-0001-8874-3706

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