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# DETERMINANTS OF MEDICATION ADHERENCE AMONG PATIENTS WITH HYPERTENSION AND TYPE 2 DIABETES MELLITUS: A CROSS-SECTIONAL ANALYTICAL STUDY

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## ABSTRACT

**Background:** Medication adherence is a key determinant of therapeutic success in chronic diseases such as hypertension (HTN) and type 2 diabetes mellitus (T2DM). Poor adherence to long-term pharmacotherapy is associated with inadequate disease control, increased risk of complications, frequent hospitalizations, and higher healthcare costs. Identifying the factors influencing medication adherence is essential for developing targeted interventions to improve treatment outcomes. The present study aimed to determine the determinants of medication adherence among patients with hypertension and type 2 diabetes mellitus.

**Materials and Methods:** A hospital-based cross-sectional analytical study was conducted among 300 adult patients diagnosed with hypertension and/or type 2 diabetes mellitus attending the outpatient department of a tertiary care teaching hospital. Eligible patients receiving pharmacological treatment for at least six months were enrolled using consecutive sampling. Data were collected using a pretested structured questionnaire comprising sociodemographic, clinical, and treatment-related variables. Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8). Factors associated with medication adherence were evaluated using univariate analysis, followed by multivariable logistic regression to identify independent predictors. A p-value <0.05 was considered statistically significant.

**Results:** The mean age of participants was 56.4 ± 11.8 years, and 55.3% were males. Based on MMAS-8, 30.0% of participants had high adherence, 42.0% had medium adherence, and 28.0% had low adherence; overall, 72.0% were categorized as adherent. On multivariable logistic regression analysis, polypharmacy (Adjusted Odds Ratio [AOR]=2.31; 95% CI: 1.28–4.16; p=0.005) and history of adverse drug reactions (AOR=2.08; 95% CI: 1.09–3.96; p=0.026) were independent predictors of medication non-adherence. Conversely, graduate-level education (AOR=0.42; 95% CI: 0.20–0.86; p=0.018), adequate health literacy (AOR=0.39; 95% CI: 0.21–0.73; p=0.003), and family support (AOR=0.46; 95% CI: 0.24–0.87; p=0.017) were independently associated with better medication adherence.

**Conclusion:** Medication adherence among patients with hypertension and type 2 diabetes mellitus was suboptimal. Polypharmacy and adverse drug reactions were significant determinants of non-adherence, whereas higher educational status, adequate health literacy, and family support were associated with improved adherence. Patient-centered interventions focusing on education, medication optimization, and strengthening support systems may enhance medication adherence and improve long-term clinical outcomes.

**Keywords:** Medication adherence; Hypertension; Type 2 diabetes mellitus; Polypharmacy; Health literacy.

## INTRODUCTION

Medication adherence is defined by the World Health Organization (WHO) as *"the extent to which a person's behaviour in taking medication, following a diet, and/or executing lifestyle changes corresponds with agreed recommendations from a healthcare provider.[1] Adequate medication adherence is essential for achieving optimal therapeutic outcomes in chronic diseases such as hypertension (HTN) and type 2 diabetes mellitus (T2DM), both of which are major contributors to global morbidity and mortality.[2] Despite the availability of effective pharmacotherapy, poor medication adherence remains a significant barrier to disease control, leading to increased complications, hospitalizations, healthcare costs, and premature mortality.[2,3]

Hypertension results from complex interactions involving activation of the renin–angiotensin–aldosterone system, sympathetic overactivity, endothelial dysfunction, and vascular remodeling, whereas T2DM is characterized by insulin resistance and progressive pancreatic β-cell dysfunction, resulting in chronic hyperglycaemia and its associated complications.[4,5] Long-term pharmacotherapy is fundamental to the management of both conditions; however, its success depends largely on sustained medication adherence. Multiple factors including age, education, socioeconomic status, treatment complexity, adverse drug reactions, health literacy, and patient–provider communication influence adherence behaviour.[6,7]

Understanding these determinants is crucial for developing targeted interventions to improve adherence and optimize therapeutic outcomes. Although several studies have assessed medication adherence, evidence regarding its determinants among patients with hypertension and T2DM remains variable, particularly in resource-limited settings. Therefore, the present study was undertaken to determine the factors influencing medication adherence among patients with hypertension and type 2 diabetes mellitus using a cross-sectional analytical study.

## MATERIALS AND METHODS

This hospital-based cross-sectional analytical study was conducted in the Department of Pharmacology in collaboration with the Department of Medicine at Ajay Sangaal Institute of Medical Science & Research Ayushmaan Hospital, Shamli, over a period of 12 months. Adult patients (≥18 years) diagnosed with hypertension and/or type 2 diabetes mellitus for at least six months and receiving pharmacological treatment were recruited from the outpatient department using consecutive sampling. Patients with gestational diabetes, secondary hypertension, severe psychiatric illness, cognitive impairment, critically ill patients, or those unwilling to participate were excluded. The sample size was calculated using the standard formula for estimating a proportion based on the expected prevalence of medication adherence from previous studies, with a 95% confidence level and appropriate margin of error.

Data were collected using a pretested, structured questionnaire comprising sociodemographic characteristics, clinical profile, treatment-related variables, and lifestyle factors. Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8), while additional information was obtained from patient interviews and medical records. Determinants evaluated included age, sex, educational status, occupation, socioeconomic status, duration of disease, comorbidities, number of prescribed medications, adverse drug reactions, medication cost, health literacy, and family support. Written informed consent was obtained from all participants before enrolment, and confidentiality of the collected information was maintained throughout the study.

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version [25] (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation or median (interquartile range), while categorical variables were summarized as frequencies and percentages. The association between medication adherence and potential determinants was assessed using the Chi-square test or Fisher's exact test for categorical variables and the independent t-test or Mann–Whitney U test for continuous variables, as appropriate. Variables with a p-value <0.20 in univariate analysis were included in a multivariable logistic regression model to identify independent predictors of medication adherence. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated, and a p-value <0.05 was considered statistically significant.

## RESULTS

**Table 1: Baseline characteristics of the study participants**

| Variable | Category | n (%) |
|---|---|---|
| Age (years) | <40 | 36 (12.0) |
| | 40–59 | 152 (50.7) |
| | ≥60 | 112 (37.3) |
| Mean age (years) | | 56.4 ± 11.8 |
| Sex | Male | 166 (55.3) |
| | Female | 134 (44.7) |
| Residence | Urban | 186 (62.0) |
| | Rural | 114 (38.0) |

| | | |
|---|---|---|
| Education | Illiterate | 48 (16.0) |
| | Primary | 72 (24.0) |
| | Secondary | 104 (34.7) |
| | Graduate or above | 76 (25.3) |
| Disease | Hypertension | 122 (40.7) |
| | Type 2 Diabetes | 94 (31.3) |
| | Both HTN & T2DM | 84 (28.0) |
| Duration of disease | <5 years | 102 (34.0) |
| | 5–10 years | 116 (38.7) |
| | >10 years | 82 (27.3) |
| Number of medications | 1–2 | 88 (29.3) |
| | 3–4 | 134 (44.7) |
| | ≥5 | 78 (26.0) |
| History of ADR | Yes | 62 (20.7) |
| | No | 238 (79.3) |

A total of 300 participants were included in the study, with a mean age of 56.4 ± 11.8 years. Most participants were aged 40–59 years (50.7%), male (55.3%), and resided in urban areas (62.0%). Hypertension alone was present in 40.7% of participants, type 2 diabetes mellitus alone in 31.3%, while 28.0% had both conditions. Nearly one-fourth (26.0%) were receiving polypharmacy (≥5 medications), and 20.7% reported a history of adverse drug reactions [Table 1].

**Table 2: Medication Adherence According to MMAS-8**

| Category | n (%) |
|---|---|
| High adherence | 90 (30.0) |
| Medium adherence | 126 (42.0) |
| Low adherence | 84 (28.0) |
| Adherent (High + Medium) | 216 (72.0) |
| Non-adherent (Low) | 84 (28.0) |
| Mean MMAS-8 score | 6.48 ± 1.36 |

Based on the MMAS-8, 30.0% of participants had high adherence, 42.0% had medium adherence, and 28.0% had low adherence. Overall, 72.0% were categorized as adherent, whereas 28.0% were classified as non-adherent. The mean MMAS-8 score was 6.48 ± 1.36 [Table 2].

**Table 3: Factors Associated with Medication Non-Adherence (Univariate Analysis)**

| Variable | Adherent (n=216) | Non-adherent (n=84) | p value |
|---|---|---|---|
| Age ≥60 years | 72 (33.3%) | 40 (47.6%) | 0.026 |
| Female sex | 88 (40.7%) | 46 (54.8%) | 0.034 |
| Graduate education | 66 (30.6%) | 10 (11.9%) | 0.001 |
| Disease duration >10 years | 48 (22.2%) | 34 (40.5%) | 0.002 |
| Polypharmacy (≥5 drugs) | 42 (19.4%) | 36 (42.9%) | <0.001 |
| History of ADR | 34 (15.7%) | 28 (33.3%) | 0.001 |
| Monthly medication cost > □1000 | 44 (20.4%) | 30 (35.7%) | 0.008 |
| Family support present | 178 (82.4%) | 54 (64.3%) | 0.001 |
| Adequate health literacy | 154 (71.3%) | 38 (45.2%) | <0.001 |
| Regular follow-up visits | 184 (85.2%) | 58 (69.0%) | 0.002 |

Medication non-adherence was significantly associated with older age, female sex, lower educational status, longer disease duration, polypharmacy, history of adverse drug reactions, higher medication costs, inadequate family support, poor health literacy, and irregular follow-up visits ($p < 0.05$ for all) [Table 3].

**Table 4: Multivariable Logistic Regression Analysis for Predictors of Medication Non-Adherence**

| Variable | Adjusted OR | 95% CI | p value |
|---|---|---|---|
| Graduate education | 0.42 | 0.20–0.86 | 0.018 |
| Polypharmacy (≥5 drugs) | 2.31 | 1.28–4.16 | 0.005 |
| History of ADR | 2.08 | 1.09–3.96 | 0.026 |
| Family support | 0.46 | 0.24–0.87 | 0.017 |
| Adequate health literacy | 0.39 | 0.21–0.73 | 0.003 |
| Disease duration >10 years | 1.74 | 0.98–3.09 | 0.058 |

Multivariable logistic regression analysis identified polypharmacy and a history of adverse drug reactions as independent predictors of medication non-adherence. Conversely, graduate-level education, adequate health literacy, and family support were independently associated with lower odds of non-adherence. Disease duration of more than 10 years did not remain statistically significant after adjustment [Table 4].

**Table 5: Reported Reasons for Medication Non-Adherence Among Non-Adherent Participants (n = 84)***

| Reason | Frequency | Percentage (%) |
|---|---|---|
| Forgot to take medication | 38 | 45.2 |
| High medication cost | 29 | 34.5 |

| | | |
|---|---|---|
| Complex drug regimen | 24 | 28.6 |
| Adverse drug reactions | 20 | 23.8 |
| Stopped medication after symptom improvement | 18 | 21.4 |
| Lack of family support | 16 | 19.0 |
| Poor understanding of disease | 14 | 16.7 |
| Difficulty attending follow-up visits | 12 | 14.3 |

*Multiple responses were permitted; therefore, percentages do not total 100%.

Among the 84 non-adherent participants, the most frequently reported reasons for non-adherence were forgetfulness (45.2%), high medication costs (34.5%), complex medication regimens (28.6%), adverse drug reactions (23.8%), and discontinuation of medication after symptomatic improvement (21.4%). Other commonly reported reasons included lack of family support, poor understanding of the disease, and difficulty attending follow-up visits [Table 5].

## DISCUSSION

In the present study, 72.0% of participants were adherent to prescribed medications, while 28.0% exhibited low medication adherence. This adherence level is comparable to that reported by Guo et al., who observed 61.5% medium/high adherence and 38.5% low adherence among 1,697 hypertensive patients, emphasizing that medication adherence remains suboptimal despite the availability of effective pharmacotherapy.[8] Similarly, Wang et al. reported a prevalence of suboptimal adherence of 42.9% among patients with hypertension and/or type 2 diabetes, highlighting persistent challenges in long-term medication use.[9]

Our study demonstrated that higher educational status, adequate health literacy, and family support were independently associated with better medication adherence, whereas polypharmacy and adverse drug reactions (ADRs) significantly increased the likelihood of non-adherence. These findings are consistent with Guo et al., who showed that health literacy had a direct positive effect on medication adherence ($\beta=0.291$, $P<0.001$), while social support also directly improved adherence ($\beta=0.165$, $P<0.001$).[8] Likewise, Karakurt et al. found that 40.5% of hypertensive patients were non-adherent and reported a moderate positive correlation between health literacy and medication adherence ($r=0.545$), with health literacy explaining 29.7% of the variability in adherence.[10] In another community-based study, self-efficacy, affordability of medicines, and accessibility of healthcare services were identified as significant determinants of medication adherence among patients with hypertension and diabetes.[9]

Polypharmacy emerged as one of the strongest predictors of medication non-adherence in our study, consistent with previous evidence indicating that increasing treatment complexity adversely affects adherence. Furthermore, patients reporting ADRs were significantly more likely to be non-adherent, supporting observations from studies of patients with coexisting hypertension and diabetes that medication-related burden and treatment complexity negatively influence long-term adherence.[11] Among non-adherent participants, forgetfulness (45.2%) and high medication cost (34.5%) were the most frequently reported reasons for missed medications. Similar reasons have been documented in previous studies, where forgetfulness, medication cost, regimen complexity, and inadequate disease awareness were common barriers to adherence.[9,12]

Overall, the findings of the present study reinforce that medication adherence in chronic diseases is influenced by multiple patient-, treatment-, and healthcare-related factors. Improving health literacy, strengthening family and social support, minimizing unnecessary polypharmacy, proactively managing ADRs, and enhancing medication affordability may improve adherence and ultimately optimize long-term outcomes among patients with hypertension and type 2 diabetes mellitus.

## CONCLUSION

Medication adherence among patients with hypertension and type 2 diabetes mellitus was suboptimal, with more than one-fourth of participants demonstrating low adherence. Higher educational status, adequate health literacy, and family support were associated with better adherence, whereas polypharmacy and adverse drug reactions were significant predictors of non-adherence. Targeted interventions focusing on patient education, medication optimization, and strengthening support systems may improve adherence and enhance long-term clinical outcomes in patients with chronic diseases.

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