MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.7.588.594

OPEN ACCESS

Key Words
Type 2 diabetes mellitus, hypertension, medication adherence, morisky medication adherence scale, public health, chronic diseases

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Received: 9 April 2024
Accepted: 28 June 2024
Published: 8 July 2024

Citation: Prashant Jain, Toshi Tiwari and Brijesh Verma, 2024. Assessment of Medication Adherence among Patients with Hypertension and Diabetes Mellitus in Tertiary Health Care Centre. Res. J. Med. Sci., 18: 588-594, doi: 10.36478/makrjms.2024.7.588.594

Assessment of Medication Adherence among Patients with Hypertension and Diabetes Mellitus in Tertiary Health Care Centre

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Abstract
The prevalence of chronic non-communicable diseases, notably hypertension and diabetes, is rising globally, posing significant public health challenges. This study evaluates medication adherence among individuals with type 2 diabetes mellitus (T2DM) and hypertension in a tertiary healthcare center in central India, identifying factors contributing to non-compliance. A prospective cross-sectional study was conducted at Department of General Medicine, Sri Aurobindo Medical College and P.G. Institute, Indore. With 300 participants diagnosed with T2DM or hypertension. The Morisky Medication Adherence Scale (MMAS) was used to assess adherence levels. Data on demographics, education, employment, socioeconomic status and healthcare utilization were collected and analyzed. Among 300 participants, 59.13% had hypertension alone, 21.15% had diabetes alone and 19.71% had both conditions. Adherence levels were high in 8%, moderate in 24% and poor in 68% of patients. Major non-compliance factors included financial constraints and forgetfulness. Only 41.2% of diabetic patients and 26.8% of hypertensive patients took all prescribed medications the day before the interview. Disease control was significantly better in patients with high adherence. Medication non-adherence is prevalent among patients with T2DM and hypertension, primarily due to financial constraints and lack of symptom awareness. Effective interventions, including family involvement and affordable medication access, are crucial to improve adherence and health outcomes.

INTRODUCTION

The health sector is undergoing a swift transformation due to the increasing prevalence of chronic non-communicable diseases among adults in both industrialised and developing nations. Worldwide, hypertension and diabetes are the primary factors that contribute to the prevalence of non-communicable illnesses and frequently occur together. Long-term treatment adherence and the danger of numerous consequences make them a significant public health concern for the population. The worldwide occurrence of diabetes in persons aged 18 and above has increased from 4.7% in 1980-8.5% in 2014. By 2045, IDF projections show that 1 in 8 adults, approximately 783 million, will be living with diabetes, an increase of 46%. Over 90% of people with diabetes have type 2 diabetes, which is driven by socio-economic, demographic, environmental and genetic factors. The key contributors to the rise in type 2 diabetes include: Urbanisation, An ageing population, Decreasing levels of physical activity, Increasing overweight and obesity prevalence[1]

There are 537 million people living with diabetes today. It is projected that by 2045, 700 million people will have the disease worldwide. Diabetes has devastating effects on individuals, societies and countries or territories and leads to over 4 million deaths a year. It affects all ages, communities and continents. There are proven and effective actions that countries or territories must urgently take to improve prevention and management of diabetes. While the general public might believe that T2D is simply associated with obesity, lack of exercise and a poor diet, preventing and controlling diabetes is quite complex due to a number of factors. That includes someone's genetics, as well as logistical, social and financial barriers within a country's structural system, especially in low-and middle-income countries

An increment in DM prevalence will increase the number of chronic complications of diabetes which affects patients' quality of life, health services demand and economic costs[2]. The chronic complications of DM can be classified into vascular and nonvascular complications. The vascular complications include microvascular and macrovascular complications. Microvascular complications are neuropathy, retinopathy and nephropathy. Macrovascular complications include peripheral vascular disease, coronary artery disease and cerebrovascular disease. Problems such as gastroparesis, skin changes, and sexual dysfunction due to diabetes are classified as nonvascular complications[1,5].

A multinational study which included 28 countries showed that macrovascular complications and microvascular complications were 27.2% and 53.5%, respectively[6]. A study conducted in China identified that among patients with diabetes, 76.4% reported at least one kind of complication.7 A study reported that neuropathy (25%), retinopathy (32%) and nephropathy (23%) were common chronic complications of diabetes in Spain.8 The ocular complications of diabetes were found in 14-18% and signs of neuropathy were present in up to 48% of diabetics in sub-Saharan Africa[9]. Diabetic foot ulcers developed in 10-15% of people with diabetes at some stage of their lives and almost 50% of all DM-related admissions are due to diabetic foot problems in sub-Saharan Africa[10]. A previous study in Ethiopia identified that 29.4% of people with diabetes have experienced at least one chronic complication. The study also expressed that peripheral neuropathy (20.5%), retinopathy (19.8%) and chronic kidney disease (4.6%) were the three most common chronic complications[11].

Globally, elevated blood pressure is projected to result in 7.5 million fatalities, accounting for approximately 12.8% of the overall mortality rate. This represents a total of 57 million disability-adjusted life years (DALYs), which is equivalent to 3.7% of the overall DALYs[2].

As per Indian council of medical research, Indian diabetes ICMR INDIAB study published in 2023 the prevalence of diabetes is 10.1 million.

It is worrisome to know that even after multiple options of treatment., only 7% of patients meet the recommended treatment target.

The lack of adherence to medication is becoming increasingly worrisome for healthcare systems, doctors and other parties involved, as there is a growing body of research showing its prevalence and its connection to negative outcomes and increased healthcare expenses[3]. Adherence is a fundamental factor that determines the success of treatment, as inadequate adherence reduces the maximum clinical advantage and increases the likelihood of problems[4]. Enhancing medication adherence is highly important, as indicated by numerous research that suggest interventions can enhance prescription adherence. An important part of methods aimed at enhancing drug adherence is to comprehend its significance[5]. Once this information is acquired, appropriate measures can be implemented to mitigate the issue using pertinent tactics.

Diabetes is renowned for its diverse and enduring complications. Early prevention of these issues can be achieved through simple and cost-free self-care practises. The compliance with lifestyle modifications is a crucial component in the treatment of diabetes, and it may differ from individual to individual[6].

The present study aims to evaluate the adherence to therapy for diabetes and hypertension among individuals previously diagnosed with these conditions in tertiary health care centre of Central India. Additionally, it sought to identify the factors contributing to non-compliance with hypertension and diabetes medication in the population.

It is expected that the total diabetes related health expenditure will reach one trillion US dollerby 2030.

MATERIALS AND METHODS

This study is a prospective cross-sectional investigation that took place in a tertiary care hospital located in central India. Our study included a cohort of 300 participants diagnosed with type 2 diabetes mellitus or hypertension. Every patient underwent screening according to our established process. The eligibility criteria for our study consisted of patients aged 35 years and older, of any gender, who had been diagnosed with Type 2 DM or hypertension for at least one year and were currently on therapy. Their willingness to participate was also evaluated. A comprehensive pro forma was completed for each patient following the acquisition of written informed consent. The study eliminated patients who failed to provide accurate information or lacked a family member or relative to provide consent or information. The Medication Adherence evaluation utilised the Morisky Medication Adherence Scale (MMAS) questionnaire, which participants completed. Each correct answer on the questionnaire received a score of 0, while each incorrect answer received a score of 1. The scores were tallied, and the individuals were classified as follows: A score of 8 indicates high adherence, a score between 6 and less than 8 indicates moderate adherence, and a score less than 6 indicates poor adherence.

RESULTS AND DISCUSSIONS

The study included all 300individuals. Among the 300 patients, 177 (59.13%) had hypertension alone, 63 (21.15%) had diabetes alone and 60 (19.71%) had both diabetes and hypertension. The study group consisted of 123 patients (40.86%) with diabetes and 237 patients (78.84%) with hypertension.

The study population consisted of 140 males (46.6%) and 160 females (53.4%). The average age of the participants in the study was 54.3 years, with a standard deviation of 12.6. The median age was 53 years, as shown in Table 1.

Out of 300 participants, 284 (94.7%, 150 females and 134 males) identified as Hindus, while 16 (5.3%, 10 females and 6 males) identified as Muslims, in this community that is primarily Hindu. A grand total of 242 patients, accounting for 81% of the sample, were married. In contrast, 51patients, representing 16.3% of the sample, were widowed. Four individuals, accounting for 1.9% of the total, were separated, while two individuals, representing 0.9% of the total, Out of the total number of patients, 123 (41%) had no prior education, 85 (28.3%) had received primary education, 54 (18%) had completed middle school education. And 38(12.7%) had completed higher education and graduation.

Among the entire study population, 76 individuals (25.3%) were unemployed, 126 individuals (42%) were unskilled workers, 41individuals (13.7%) were semi-skilled workers, 11 individuals (3.8%) were skilled workers, and 46 individuals (15.3%) were engaged in small-scale business. A total of 264 individuals, accounting for 88% of the sample, were classified as belonging to socioeconomic Class III or IV (middle and lower middle) according to the B. G. Prasad Classification, updated for the year 2017.

The average age at which diabetes was first detected was 50 years, with a standard deviation of 9.7. The median age was 58.5 years. The average age at which hypertension was detected was 48.3 years with a standard deviation of 10.5, while the middle value (median) was 52 years. The average length of treatment for diabetes since detection was 8.6 years (with a median of 7.0, a standard deviation of 5.7 and a range of 2-27, with a third quartile at 13). In comparison, the average length of treatment for hypertension was 6.4 years (with a median of 4.5, a standard deviation of 5.2 and a range of 2-27, with a third quartile at 8.0).All of the patients admitted to discontinuing treatment at some point after their illness was detected and none of them had any documentation at the time of detection. A study revealed that 37% of the population utilised government health-care facilities, while 63% of the population opted for private health-care facilities. The patients were also questioned about the impact of drug shortages on their ability to comply with treatment, to which all of them responded negatively.

All patients reported adherence to the current prescribed treatment. When questioned about whether they had failed to take their medication on any two days within the previous two weeks, it was discovered that 230 (97.5%) individuals with hypertension and 119 (96.5%) individuals with diabetes had indeed missed their medication. When asked about their medication intake the day before the interview, it was discovered that only 51 out of 123 patients with diabetes (41.2%) and 63 out of 236 patients with hypertension (26.8%) had taken all of their prescribed medications.

Of the patients with hypertension, only 40 (17.1%) had systolic blood pressure levels of 130mmHg or below, and only 61 (25.6%) had diastolic blood pressure levels of 80mmHg or below on the day of the interview. These levels align with the target set by the American Heart Association hypertension guidelines. Majority of diabetic patients failed to monitor their blood glucose levels within the past 3 months. A majority of patients with diabetes (91.8%) and hypertension (94.5%) concur that the treatment currently prescribed to them is suitable and should be adhered to. Nevertheless, there are variations in the treatment approach [Table 2].

Table 1: Intgerpretation of Morisky Medication Adherence Scale

Morisky Medication Adherence Scale	Score
High adherence	8
moderate adherence	6,7
poor adherence	<6

Table 2: Prevalence of Hypertension and Diabetes among Patients

Disease	Number of Patients	Percentage
Hypertension alone	177	59.13%
Diabetes alone	63	21.15%
Both Diabetes and Hypertension	60	19.71%
Total with Diabetes	123	40.86%
Total with Hypertension	237	78.84%

Table 3: Demographic Profile of Study Participants

Particulars	Number of Participants	Percentage
SEX		
Males	140	46.6%
Females	160	53.4%
Religion		
Hindus	284 (150 females, 134 males)	94.7%
Muslims	16 (10 females, 6 males)	5.3%
Marital Status		
Married	243	81%
Widowed	51	17%
Separated	4	1.3%
Others (Separated)	2	0.7%
Education Level		
No Education	123	41.0%
Primary Education	85	28.3%
Middle School Education	54	18.0%
Higher Education and Graduation	38	12.7%
Employment Status		
Unemployed	76	25.3%
Unskilled Workers	126	42.0%
Semi-skilled Workers	41	13.7%
Skilled Workers	11	3.7%
Small-scale Business Owners	46	15.3%
SES		
Class I	02	0.67%
Class II	34	11.33%
Class III	100	33.33%
Class IV	164	54.67%

Table 4: Characteristics and Health-care Utilization of Patients with Diabetes and Hypertension

Attribute	Diabetes	Hypertension
Average Age at Detection (years)	50	48.3
Standard Deviation	9.7	10.5
Median Age at Detection (years)	58.5	52
Average Length of Treatment (years)	8.6	6.4
Standard Deviation	5.7	5.2
Median Length of Treatment (years)	7.0	4.5
Range (years)	2-27	2-27
Third Quartile of Treatment (years)	13	8.0
Health-care Utilization		
Government Facilities (%)	37	
Private Facilities (%)	63	
Impact of Drug Shortages	Negative	Negative

Table 5: Treatment behavior of patients with diabetes and hypertension

Response to questions	Patients with diabetes	Patients with hypertension
Stops taking medication if feels better symptomatically	120(97.6)	230 (97.6)
Aware that will get sick on stopping medication	82 (67.1)	160(67.7)
Aware that this disease causes complications	69 (56.5)	152 (64.6)
Aware that medication will delay complications	69 (56.5)	151 (64.0)
Agree that the drug treatment currently prescribed to them iscorrect and satisfactory	113 (91.8)	223 (94.5)

Table 6: Association between adherence to medication and disease controlled (N = 300)

Adherence pattern	Number of patients	Controlled (N %)	Not Controlled (N %)	p-value
High adherence	24	18	6	x2=8.17,
moderate adherence	72	34	38	
poor adherence	204	9	195	p = 0.017
Total	300	61	239	

The primary factors contributing to noncompliance were financial constraints (50.58% of patients with diabetes and 73.78% of patients with hypertension) and challenges in adhering to daily medication regimens due to work commitments or forgetfulness (49.41% of patients with diabetes and 26.21% of

patients with hypertension).All patients acknowledged the significant role of family in ensuring timely medication intake and overall adherence to treatment.

Many studies omit discussing the age at which a condition first appears, as it is more focused on the age at which the condition is detected, particularly in the case of hypertension and diabetes. These non-communicable diseases are known to remain asymptomatic for a significant period of time. The average age at which diabetes was detected in this study was 50 years, while for hypertension it was 48.3 years. The study revealed a marginally earlier commencement of the disease in contrast to other studies. In a comparable study conducted in the urban slums of Hyderabad[7] the average age of individuals with hypertension was 54.5 years (standard deviation ±11.03).Similar findings were identified in a study conducted in Karachi, Pakistan[8], where the average age was 54 years. The Chennai Urban Rural Epidemiology Study[9] conducted in 2006 revealed a change over time in the age at which diabetes is diagnosed, with a tendency towards younger individuals. This finding contrasts with the results of the earlier National Urban Diabetes Study[10].

Health consciousness is the paramount foundation for averting diseases. The educational status of the current study population was extremely low, with 69.33% being illiterate and primary education only 12.7% having completed higher education. In a comparable study conducted in the urban slums of Hyderabad, it was discovered that the majority (64.9%) of individuals were unable to read or write. The majority of the study participants (55.7%) belonged to socioeconomic Class IV, In a investigation conducted in the Mumbai[11], a significant majority of the participants [50.5%]were classified as belonging to the upper lower socioeconomic classes, Socioeconomic status is a well-established influential factor in determining adherence to medical treatment.

The primary reasons for noncompliance were challenges in adhering to daily medication due to work commitments or forgetfulness (reported by 100% of patients with diabetes and 99.4% of patients with hypertension) and financial constraints (reported by 50.6% of patients with diabetes and 73.8% of patients with hypertension). Similarly, in a study conducted in Thiruvananthapuram, South India[12], The primary factors linked to noncompliance were identified as the lack of symptoms in hypertension and the unavailability of cost-free medications from the local health centre. The disease's mild symptoms and limited understanding of hypertension and diabetes make patients more likely to not follow their prescribed drug regimen and only take medications for immediate relief of symptoms. In a study conducted in South India, patients provided reasons for non-compliance, including forgetting to take medications (63%), experiencing side effects (22%), and the remaining 15% were unable to collect medications from the centre due to reasons such as being out of town or unable to physically come to the centre[13].

A study conducted in Hyderabad found that out of 376 participants, 232 (61.7%) demonstrated a high level of adherence to their antihypertensive medications. In the study conducted by Rao[14] was found that 60.6% of the participants were considered adherent to the prescribed medication. A study conducted by Bhandari[15] revealed a treatment adherence rate of 73% (95% confidence interval: 68%-78%). The study conducted in a coastal population in South India revealed a compliance rate of 82.2% for hypertension treatment, while 83.6% of individuals with Type 2 diabetes mellitus were found to be on regular medication. The study conducted by Thomas[16] in Bengaluru reported that 50.3% of the participants followed their antihypertensive medication regimen.

The study revealed that every patient diagnosed with diabetes and hypertension had ceased their treatment at some stage after being identified. Furthermore, the study revealed that individuals (97.5%) with hypertension and individuals (96.5%) with diabetes had failed to adhere to their medication regimen for at least two days within the previous two weeks. When asked about their medication intake the day before the interview, it was discovered that only (41.2%) patients with diabetes and (26.8%) patients with hypertension had complied with their medication regimen. A study conducted in Palestine[17] found that 24% of the participants failed to adhere to their medication regimen at least once in the two weeks prior to the interview. However, 91.4% of the participants had successfully taken all their medications on the day preceding the interview. A study conducted in rural Maharashtra[18] revealed that 29.5% of patients with diabetes and 23.3% of patients with hypertension consistently adhered to their treatment without any interruptions.

Additionally, it was discovered that 56.5% of the patients had diabetes and 64.6% had hypertension. We were unaware of the complications associated with diabetes and hypertension. These factors also contribute significantly to the elevated rates of nonadherence to treatment. In contrast, a study conducted in South India found that approximately 79% of the patients were knowledgeable about at least one of the complications associated with diabetes. During a study conducted in Loni, Maharashtra[19], it was found that only 58% of the patients who took one pill per day and had regular checkups were able to consistently adhere to their medication for duration of 12 months. The patients who were prescribed to take

three pills a day had the lowest level of compliance. Among patients who had regular follow-ups, 28.3% were non-compliant, while among those who visited irregularly, only 3.7% were non-compliant. This indicates that there is a direct correlation between the number of pills prescribed and the level of compliance observed. Additionally, it was discovered that the dropout rate from the therapy rose in direct correlation with the escalation in the daily pill count. In a study conducted by Akgol *et al.,* the causes for treatment noncompliance were identified as limited treatment accessibility (due to factors such as high treatment costs, distant location of medical centres, busy schedules of physicians, and failure to arrange appointments) and the absence of bothersome symptoms[20]. A review of studies conducted in Spain between 1975 and 2011 found that treatment compliance was observed in 74.8% of cases, while noncompliance was observed in 25.62% of cases[21]. These studies indicate a rise in adherence due to the use of a single-dose formulation of combined therapies[22].

The study revealed that 56.5% of diabetic patients and 64.6% of hypertensive patients were unaware of the ability of medications to delay and prevent complications related to their respective conditions. This could be a significant determinant of inconsistent adherence to treatment and cessation of treatment due to the alleviation of symptoms. It was also observed that all the patients believed that families play a role in facilitating the intake of medicines. This study is limited by the fact that compliance was assessed using self-report, which may be subject to recall bias.

According to our study findings, disease control was better among patients that adhered with their medication compared with their non-adherent counterparts and this finding is similar to the findings of Sajith[23] Hence, it can be concluded that if patients adhere with their appropriately prescribed medication, outcome will be improve. Hence, clinicians attending to NCD clinic patients should inquire rationally for medication adherence at every clinical encounter with patients. This will prevent the clinician from attributing lack of response to medications as therapeutic failure rather than medication adherence problems[23].

CONCLUSION

The study findings indicate that patients do not perceive hypertension and diabetes as chronic conditions that necessitate long-term adherence to treatment. Furthermore, they lack sufficient motivation to do so. Within lower socioeconomic groups, the cost of medication, taking into account the long-term duration of treatment, is also a concern. The absence of symptoms during the progression of diseases and a lack of awareness about health are the primary factors linked to no adherence. The policies pertaining to health programmes targeting the prevention and management of hypertension and diabetes must adequately address these concerns. There is a need to incorporate tools that actively involve family members in case management and improve treatment compliance rates. Promoting affordable alternative medications and ensuring their accessibility to the target population can aid in preventing the development of health issues resulting from noncompliance with treatment.

Further investigation should be conducted to explore the obstacles related to medication adherence among the population and address them in order to achieve the desired clinical outcomes.

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