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Assessment and Improvement of the Factors Affecting Medication Adherence in Diabetic Patients

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ABSTRACT

Diabetes is a metabolic disorder of multiple causes which is characterized by chronic hyperglycemia (elevated blood glucose levels) with disturbance of fat, protein, and carbohydrate metabolism as a result of the secretion of insulin and action of insulin. Types of Diabetes Mellitus- Type-1 Diabetes Mellitus, Type-2 Diabetes Mellitus, Gestational Diabetes Mellitus **Aim** To access and improve medication adherence in diabetic patients and the factors influencing it. **Methodology** The study was prospective observational study conducted in department of surgery, general medicine and Obstetrics and Gynecology in ESI hospital, 500 bedded secondary care hospital located in Nacharam, Hyderabad for the duration of 6 months. Subjects with the age above 45 years male and females who are diagnosed with Diabetes Mellitus and associated co-morbidities. **Results** In our study According to Morisky medication adherence scale (MMAS), the rate of medication adherence before follow-up was found to be 55%, was medium adherence, and high adherence rate was found to be 17%. The high adherence rate of medications after follow up found to be 66% and low adherence was found to be 2%. **Conclusion** In our study, the most common reason for non-adherence was forgetfulness and work, After patient counseling patients are more likely adherent to medications and have shown good improvement in their adherence result. Most of the adherence was improved by using methods like pillboxes, sticky notes, monthly calendar.



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I. INTRODUCTION

The term diabetes is described as a metabolic disorder of multiple causes which is characterized by chronic hyperglycemia (elevated blood sugar level or blood glucose level) with disturbance of fat, protein, and carbohydrate, metabolism as a result of the secretion of insulin, action of insulin or both. This gradually leads to damage to the heart, blood vessels, eyes, kidneys, and nerves.^[1] Diabetes is widely prevalent all over the world including in under-developed, developed, and developing nations. In 2020 463 million people suffered from diabetes in the world, this was according to IDF and in southeast Asia there was 88 million people who were affected with diabetes. Out of these Indian people were 77 million. According to IDF the prevalence of people with diabetes were 8.9%. Diabetes is a challenge that is growing, among 20 to 70 years diabetic population was estimated to be 8.7% that is only in India. The rising of diabetes and its prevalence among non-communicable diseases is given by a combination of factors- unhealthy diets, sedentary lifestyles, rapid urbanization, tobacco use, and increasing life expectancy.^[2] Medication adherence can be defined as “The extent to which a patient's medication-taking behaviors coincide with the intention of the health advice he or she has been given”. There are certain situations where adherence is extremely important for better therapeutic outcomes. These include: In diseases of public health importance: Example as tuberculosis, Acquired Immunodeficiency [AIDS] and opportunistic infections, hepatic infections, and preventive strategies such as immunization programs. In severe diseases such as diabetes and hypertension: Example: where adherence is important to prevent short and long-term complications such as diabetes ketoacidosis, and macrovascular and microvascular diseases due to long-standing diabetes and hypertension.^[3] Factors which influence medication adherence are Age, sex, marital status: As the age increases medication adherence also increases, older people with weak memory easily forget about taking their medication. Lifestyle: As with the medication, along with the lifestyle modification, I hope that the patient will adhere to the medication. Attitude: Patients with psychological conditions, depression, low memory, and dementia are low adherent to medication. Considering health as a low priority. Higher medication costs may lead some patients not able to afford medication. An unfavourable effect (adverse effect) of the drug: the patient may stop taking the medication by himself/herself due to adverse effects without informing the health care provider. Lack of benefits of perceived therapy. Medication provides only symptomatic relief. Lack of knowledge for physicians in diagnosis and treatment.^[4] There are few methods to improve medication adherence that increase the

patient's quality of life. It includes placing a sticky note on the washroom door or mirror so that they help to take medication for morning tablets. Monthly calendar is the easy way to ensure medication adherence when it comes to completing a treatment regimen, using it medication calendar. It allows the monitoring track of progress and makes several adjustments given by the doctor, in an instant. If patients take the medication in the morning, tick in the right corner of the calendar at a particular date. If patients take the medication in the afternoon, tick in the middle corner of the calendar at a particular date. If patients take the medication in the evening or night, tick in the right corner of the calendar at a particular date.^[5] A medication chart-It is an important source of information to the patients as well as health care providers regarding individual medication. It provides an additional reminder and support for the health care providers and patients. For patients, it serves as the accuracy of medication outcomes. Examples of the chart: A chart of seven days with each dose listed in the chart and print it out for one month and cross it over when the medication is taken. Use a dry-erase box to make a weekly chart. Note down the number of days of the week on the left hand along with the times of medicines on the top. Draw the lines and create boxes and put a checkmark whenever the medication is taken. If the patient uses only one medication per day, it is better to make use of a magnetic board and create a medication chart. Note the number of days of the week on the left-hand side and on the top of the right use the word 'taken' and 'not taken'. Place the magnet on the not taken box at starting, after taking the medication patient can move the magnet towards the taken.^[6] Medical watches: By wearing a medical watch we can overcome nonadherence. Medical reminder watches can vibrate. They are mostly recommended for absent-minded seniors, people with Alzheimer's, diabetes mellitus, etc. Most watches can ring the alarm and even display a message that indicates which pills should be taken. Wearable devices also have benefits in increasing efficacy. For example- patients with atrial fibrillation who has medical smartwatches receive notifications for better adherence ^[7] A low-tech pillbox is like a container divided into boxes. The pills or medications for every time taken in a day are divided into various compartments. In a mid-tech pillbox, there is an alarm that does not dispense medication. A high-tech pillbox is a locked box that will dispense medications at the correct time and notifies the caretaker of the patient if a dose gets missed.^[8]

II. MATERIALS AND METHODS

This study is designed to be a prospective observational study, conducted in E.S.I HOSPITAL SANATH NAGAR (relocated at Nacharam), Hyderabad, Telangana. The study period is of 6 months i.e., from November 2021- to April 2022 with a sample size of 100.

A. PATIENT CONSENT FORM

The consent form provides information to decide on the participation of subjects in a study. The patient was given complete information regarding the study and next to their acceptance, they participated after signing the consent form.

B. PATIENT DATA COLLECTION FORM:

The data collection form was designed with the help of a physician and a guide was used to collect the following details about the patients. Demographic information and socio-economic details which include the patient's age, sex, and location, chief complaints; all the signs and symptoms of diabetic.

Mellitus were included in this. The patient's history includes the previous medical conditions with which the patient suffered or still suffering Family history and personal history are necessary to associate the risk of developing diabetes. Laboratory investigations include blood sugar levels and other tests like complete blood pictures. It also includes diagnosis, medications given to the patient, drugs prescribed, generic name, route of administration, dose, and duration.

C. MORISKY MEDICATION ADHERENCE SCALE: (MMAS)

It is a questionnaire to assess the severity of medication adherence. It is a measure of taking medication behaviors that have been used widely in diabetic patients. 1-7 questions consist of an informative reply from the patients and address ordinary reasons from the patients. The 8th question is answered using 5 points and explains the difficulty in remembering to take all the medications. Scores range from 0 to 8.

SCORING:

Every item is given a scoring on a scale of, a score of less than 6 indicates low adherence, followed by 6-7 medium adherence, and greater than 8 indicates high adherence to medications.

D. PATIENT INFORMATION LEAFLET:

The patient information leaflet consists of methods for medication adherence that increase medication adherence in subjects. The patient information leaflet includes the methods to improve medication adherence. It includes the following:

VISUAL REMINDERS: A monthly calendar, tech alarms, Mobile medical app, Pillboxes-Low-tech, High-tech, Smart pill bottle, medical watches.

III. RESULTS AND DISCUSSION

The present study assessment and improvement of factors affecting medication adherence in diabetic patients was the attempt to evaluate the medication adherence in nacharam ESI hospital. The study was conducted among the general public and out-patients and in-patients of general medicine, orthopedics, surgery departments of ESI hospital nacharam, Hyderabad.

Table 1: Distribution of study patients based on their age

AGE GROUP[YEARS]	NUMBER OF PATIENTS	PERCENTAGE
31-40	10	10%
41-50	31	31%
51-60	36	36%
61-70	20	20%
71-80	6	6%
OVERALL	100	100%

- A total of 100 patients were included in our study. The highest number of diabetes patients was seen in the age group of 51-60(36%). The lowest number of diabetic patients was seen in the age group of 71-80(6%).

- The highest mean value was 6.4 in the age group of 31-40 and the lowest mean value was 6 in the age group of 71-80.

Age is the main factor in the risk of medication adherence. Age groups of 31-80 were included in our study, out of which major population i.e., 36% fall in 51-60years following

least population i.e., 6% fall in 71-80 years, whereas in a study conducted by Godfrey Mutashambara Rwegerera et. al ^[9] the highest population is 55% fall in 34-81years.

Table2: Distribution of study patients based on gender

GENDER	NUMBER OF PATIENTS	PERCENTAGE
MALE	62	62%
FEMALE	38	38%
OVERALL	100	100%

We observed that Male population (62%) are majorly suffering from diabetes mellitus, whereas 38% were female patients.

Male and female populations were included in the study. The male population was found to be 62% standing higher than the female population 38%, whereas in the study conducted by John Billimek et. al ^[10] the highest population was females i.e.: 67.9% and the male was found to be 32.1%.

Table 3: Distribution of study patients based on locality.

LOCALITY	NUMBER OF PATIENTS	PERCENTAGE
URBAN	92	92%
RURAL	8	8%
OVERALL	100	100%

In the locality-wise distribution of 100 patients, most people live in urban regions i.e.: 92%. Their percentage for urban, and rural were found to be 92%, and 8% respectively.

The population living in an urban area would have more facilities like medication availability and hospitality. Our study contains a population majorly from urban areas i.e., 92% followed by rural which is the lowest 8%, whereas a study conducted by Mastewal Abebaw et. al ^[11] has the largest population from urban i.e., 83.3%.

Table 4: Distribution of study patients based on signs and symptoms

SIGNS AND SYMPTOMS	NUMBER OF PATIENTS	PERCENTAGE
FREQUENT URINATION	63	63%
INCREASED THIRST	67	67%
HUNGER	40	40%
BLURRED VISION	45	45%
TINGLING	30	30%
DRY MOUTH	65	65%
PRURITIS	21	21%
WEIGHT LOSS	47	47%
NAUSEA	21	21%
VOMITING	15	15%
FRUITY SMELLING BREATH	4	4%
MOOD SWINGS	15	15%
WEAKNESS	83	83%
HEADACHE	49	49%
FATIGUE	57	57%
POOR WOUND HEALING	21	21%

83% of the patients were identified to be having weakness, which is the commonly observed symptom in our study population.

Table 5: Distribution of study patients based on family history

FAMILY HISTORY	NUMBER OF PATIENTS	PERCENTAGE
MOTHER	21	21%
FATHER	5	5%
WIFE	2	2%
HUSBAND	1	1%
NO HISTORY	71	71%
OVERALL	100	100%

Family history data were collected to know the inheritance pattern of diabetes among 100 patients 71% did not have any family history.

Table 6: Distribution of study patients based on social habits (smoking)

SMOKING	NUMBER OF PATIENTS	PERCENTAGE
SMOKER	24	24%
NON-SMOKER	76	76%
TOTAL	100	100%

The personal history was accessed by collecting data from 100 patients. Among these patients, no bad habits were reported of which 76% of patients were non-smokers and 24% were smokers.

Personal history always plays a vital role in developing certain diseases. In our study smokers are of 24% followed by non-smokers who are greater in number i.e., 76%, a study conducted by Akiyo Nagasaki et. al. ^[12] reported that non-smokers are 52.8%. Alcohol consumption is 45% and non-alcohol consumers are 55%, whereas a study performed by Akiyo Nagasaki et. al ^[12] has reported the absence of alcohol consumption i.e., 95%. In our study, non-consumers of the pan are high i.e., 95%.

Table 7: Distribution of study patients based on social habits (alcohol)

ALCOHOL	NUMBER OF PATIENTS	PERCENTAGE
CONSUMER	45	45%
NON-CONSUMER	55	55%
TOTAL	100	100%

The personal history was accessed by collecting data from 100 patients. Among these patients, no bad habits were reported of which 55% were non-consumers and 45% were alcohol consumers.

Table 8: Distribution of study patients based on social habits (pan)

PAN	NUMBER OF PATIENTS	PERCENTAGE
CONSUMER	5	5%
NON-CONSUMER	95	95%
TOTAL	100	100%

The personal history was accessed by collecting data from 100 patients. Among these patients, no bad habits were reported of which 95% were non-consumers and 5% pan consumers.

Table 9: Distribution of study patients based on diet

DIET	NUMBER OF PATIENTS	PERCENTAGE
VEG	8	8%
MIXED	92	92%

Among 100 patients included in the study, 92% were found to be consuming a mixed diet and only 8% were found to be vegetarian.

Table 10: Distribution of study patients based on GRBS

GRBS	NUMBER OF PATIENTS	PERCENTAGE
70-150	14	14%
151-230	32	32%
231-310	41	41%
311-390	13	13%

A total of 100 patients were included in our study. The highest percentage was found to be 32% for patients between GRBS range 151-230. The lowest percentage was found to be 13% for patients between the GRBS range 311-390.

Table 11: Distribution of study patients based on diagnosis

DIAGNOSIS	NUMBER OF PATIENTS	PERCENTAGE
DIABETES MELLITUS	100	100%
HEMORRHOIDS	2	2%
HYPERTENSION	22	22%
CELLULITIS	4	4%
CORONARY ARTERY DISEASE	1	1%
GASTROENTERITIS	2	2%
ACUTE EXACERBATIONS	1	1%
PANCREATITIS	2	2%
APPENDICITIS	1	1%
ULCER	6	6%
ANAEMIA	1	1%
UTI	1	1%
FISSURES	1	1%
HEPATITIS	1	1%
PERENNIAL ABSCESS	3	3%
DIABETIC FOOT	5	5%
THYROID	2	2%
DORSAL FEMUR	1	1%
DIABETIC RETINOPATHY	1	1%
ABSCESS	1	1%
OSTEOMYELITIS	1	1%
HERNIA	2	2%
OSTEOARTHRITIS	2	2%
CHOLELITHIASIS	1	1%
BRONCHIAL ASTHMA	2	2%
ANTRAL EROSION	1	1%
RENAL COLIC	1	1%
AMENORRHEA	1	1%
DYSLIPIDEMIA	1	1%

Of 100 diabetic patients, the highest number of patients had hypertension i.e.: 22% and 1% had coronary artery disease, acute exacerbations, pancreatitis, appendicitis, 1% had anemia, 1% had UTI, 1% had fissures, 1% had hepatitis, 3% had a perennial abscess, dorsal femur, diabetic retinopathy, abscess, osteomyelitis, cholelithiasis, antral erosion, renal colic, amenorrhea, dyslipidemia.

In our study, the highest number of patients (100%) are diagnosed with diabetes mellitus and the lowest number of patients (1%) are diagnosed with coronary artery disease, acute

exacerbations, appendicitis, anemia, UTI, fissures, hepatitis, diabetic retinopathy, osteomyelitis, cholelithiasis. whereas a study conducted by Suliasnaia P. Bruce et. al ^[13], reported that 47.5% of type-2 diabetes mellitus, 66.5% of diabetic retinopathy, 73% of foot ulcers, 35% of neuropathy.

Table 12: Distribution of study patients based on types of medications taken

TYPES OF MEDICATIONS	NUMBER OF PATIENTS	PERCENTAGE
ANTI-DIABETIC	100	100%
ANTI-HYPERTENSIVE	48	48%
ANTI-THYROID	2	2%
ANTIBIOTIC	44	44%
ANTACID	35	35%
ANTI-EMETIC	12	12%
ANTI-TUSSIVE	3	3%
ANTI-SPASMODIC	3	3%
ANTI-COAGULANT	3	3%
ANTIHISTAMINE	5	5%
ANTI-CONVULSANT	6	6%
ANTI-VERTIGO	2	2%
ANTI-DIURETIC	1	1%
NSAID'S	52	52%
HORMONAL DRUGS	2	2%
VITAMIN SUPPLEMENTS	24	24%
BRONCHODILATORS	4	4%
BENZODIAZEPINES	3	3%
STATINS	17	17%
ALKALIZERS	5	5%
PANCRELIPASE	1	1%

Among 100 diabetic patients, the highest number of patients had NSAID medications

i.e.: 52% and the lowest number of patients had anti-diuretic and pancrelipase medications i.e.: 1%.

Table 13: Distribution of study patients based on the number of medications taken

NUMBER OF MEDICATIONS TAKEN	NUMBER OF PATIENTS	PERCENTAGE
1-5	42	42%
6-10	58	58%

A total of 100 patients were included in our study. The percentage of patients with several medications taken from 1- 5 was found to be 42% and 6-10 was found to be 58%.

Table 14: Distribution of study patients based on MMAS-scale

SCORE	ADHERENCE RATE	NO. OF PATIENTS (before)	PERCENTAGE	NO. OF PATIENTS (after)	PERCENTAGE
<6	LOW	28	28%	2	2%
6-7	MEDIUM	55	55%	32	32%
>8	HIGH	17	17%	66	66%

Before and after follow-up

The highest percentage of patients were seen with a medium adherence rate before following up whose score 6-7(55%) and the lowest percentage of patients were seen with a high adherence rate who scored >8(17%) and mean was found to be 33.33.

The highest percentage of patients were seen with a highest adherence rate after following up whose score >8 (66%) and the mean was found to be 33.33.

In our study, the medium adherence rate of medications before the follow-up was found to be 55% and the high adherence rate was found to be 17%. A study conducted by Tefera Kassahun et. al^[14] reported that 37.9% is of medium adherence.

In our study, the high adherence rate of medications after follow-up was found to be 66% and low adherence was found to be 2%. A study conducted by Adnan Mannan et. al. ^[15] reported that high adherence was 53.7% and low was found to be 46.3%.

Table 15: Distribution of study patients based on factors influencing low adherence

FACTORS	NUMBER OF PATIENTS	PERCENTAGE
EFFICACY	17	17%
TRUST	31	31%
BELIEVE IN NATIVE DOCTORS	18	18%
FASTING AND PRAYERS	35	35%
WORK	41	41%
THE PATIENT DOES NOT CONSIDER IT AS A SERIOUS CONDITION	20	20%
POOR MEMORY	39	39%
SOCIAL PRESSURE	26	26%
UNDERSTANDING	29	29%
SIDE EFFECTS	28	28%
UNPLEASANT DRUGS	14	14%

Of 100 diabetic patients, the highest factor influencing low adherence was 41% i.e.:work and the lowest was unpleasant drugs i.e.: 14%.

In our study, the factor influencing low adherence is work (41%), followed by fasting and prayers (35%), side effects of drugs (28%), whereas a study conducted by Nasir TWabe et. al. ^[16] reported that side effects of drugs i.e: 29.2% and 6.5% patients missed their medications.

Table 16: Distribution of study patients based on adherence to improving methods

ADHERENCE IMPROVING METHODS	NUMBER OF PATIENTS	PERCENTAGE
MONTHLY CALENDAR	38	38%
STICKY NOTES	33	33%
PILLBOX (LOW TECH, HIGH TECH)	86	86%
MEDICAL WATCHES	31	31%
MEDICAL APPS	13	13%
WATCH WITH THE ALARM FEATURE	20	20%

Among 100 patients, the highest number of patients were recommended pillboxes (low tech, high tech) i.e.: 86%, and the lowest were recommended medical apps i.e.: 13%.

In our study, the highest adherence-improving method suggested was pill box-low tech (86%), and the lowest adherence-improving method was medical apps (13%). Watch with alarm feature is 20%. Pill counts are frequently utilized and can provide information about the number of pills taken. A study conducted by Nasir T Wabe et. al ^[16] reported that pillbox has increased the rate of adherence i.e.: by 86.65% and others such as using alarm clock i.e.: 1.72%.

IV. CONCLUSION

The study has shown that before patient counseling patients with diabetic mellitus who were non-adherent to medications were 17% out of 100 patients' key reason for non-adherence was forgetfulness and work, after patient counseling patients are more likely to adhere to medications and have shown good improvement in their adherence results. Most of the adherence was improved by using methods like pill boxes, sticky notes, and monthly calendars.

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