A Community Based Study to Evaluate the Impact of Pharmacists Intervention in Improving Medication adherence by Identifying Barriers in type 2 Diabetic Patients

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ABSTRACT
Medication adherence is a critical factor in managing Type 2 diabetes, and non-adherence can lead to increased morbidity, mortality, and healthcare costs. This community-based study aims to assess the effectiveness of pharmacist interventions in identifying and addressing barriers to medication adherence among Type 2 diabetic patients. A prospective interventional study was conducted over a period of 6-month in a community setting involving 100 Type 2 diabetic patients above the age of 18 from various Dakshina Kannada district locations. The Morisky Medication Adherence Scale (MMAS-8) and a research-constructed, pre-validated questionnaire were used to identify the barriers and evaluate the adherence among type 2 diabetes patients. After the interview, the participants received educational interventions such as patient information leaflets (PILs), the teach-back approach, and verbal counselling. The same individuals were questioned three months after the intervention to get post intervention data. The impact of pharmacist interventions on medication adherence and associated clinical outcomes was analyzed using appropriate statistical methods. According to the study findings only a small percentage of the research sample’s had adequate adherence to their medication regimen. Forgetting to take the prescription was shown to be the most prevalent reason, followed by poor knowledge, not having enough money and taking too many drugs. Following the pharmacist’s assistance, adherence significantly improved i.e low adherence dropped from 56% to 11% and Good adherence increased significantly after the intervention, going from 16% to 35%.

In conclusion, Pharmacist interventions play a crucial role in enhancing medication adherence among Type 2 diabetic patients by identifying and addressing barriers. The study highlights the importance of integrating pharmacists into diabetes care teams to provide personalized support, education, and counseling to patients. This community-based approach holds promise for improving long-term health outcomes and reducing the economic burden associated with poorly managed Type 2 diabetes.

Keywords: Diabetes mellitus, Barriers, Interventions, Adherence, Medication regimen

I. INTRODUCTION
Diabetes mellitus is recognized as a disease of significant concern in India due to its rapidly rising prevalence as well as the reality that type 2 diabetes has become an epidemic across the globe and that both its incidence and prevalence are rising. Diabetes prevalence in India increased from 7.1% in 2009 to 8.9% in 2019. Adherence is a crucial element in the successful implementation of both pharmaceutical and non-pharmaceutical methods, as well as in the effective management of chronic illnesses.

An important first step when addressing any...
healthcare problem (medication nonadherence) is to identify and assess the factors which are leading to the non-compliance, so that interventions can be designed to minimize or remove these factors. The study focuses on identifying the barriers involved in medication adherence and thereby providing the interventions to overcome this impediment.

OBJECTIVE

To evaluate the impact of pharmacist’s intervention in improving medication adherence by identifying barriers in patients with type 2 diabetes mellitus.

METHODOLOGY

Study Design:
- A prospective interventional study to evaluate the impact of pharmacist’s intervention in improving medication adherence by identifying barriers in patients with type 2 diabetes mellitus.

Study Site:
- The study was conducted at Srinivas Institute of Medical Science and Research Centre, Mukka - 574146.

Study Duration:
- The study was conducted for a duration of 6 months from March 2022 – August 2022.

Sample Size:
- The sample taken for the study was 100.

Ethical Clearance:
- The study protocol was approved by the Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science, Mukka, Mangaluru.

Study Criteria:
- Inclusion criteria: Gender equality was maintained. Both genders were already diagnosed as diabetic patients with oral antidiabetic medications having age of more than 18 years were included.
- Exclusion criteria: Patients who were not willing to or unable to give consent to participate and if they were terminally ill, having visual and hearing impairments were excluded from the study.

Source of Data:
- Data was collected using data collection form through direct interaction with the study subjects at their residences.

Study Method:
- Preparation for the study
- Patient data collection forms, patient information leaflets demonstrating different interventions to overcome barriers and thereby improve medication adherence in patients with type 2 diabetes mellitus were prepared.

- Obtaining informed consent
  - Informed consent form will be obtained from the selected patients in English and Kannada.

- Patient categorization
  - Total MMAS-8 scores can range from 0 to 8 and have been categorized into three levels of adherence: high adherence (score = 8), medium adherence (score of 6 to < 8), and low adherence (score < 6).

- Providing intervention
  - After the collection of data (socio demographic data, knowledge, medication adherence score), patient information leaflets (PILs) were provided to the patients in medium adherence group, whereas for patients in low adherence group the patient information leaflets (PILs) was provided along with patient counselling using teach back method.

- Post educational intervention assessment
  - Diabetic patients who scored low and medium from MMAS, has been further considered for the study. The study design was divided into pre and post educational intervention, where the post educational intervention assessment was done after 1 month using the same study questionnaire and MMAS-8.

Data Analysis:
- Data was analyzed using Social Science Statistics software. Association of gender with adherence was done using student t-test. Karl Pearson correlation was used to observe association of age with adherence. Education level, employment status and duration of treatment was associated with adherence using one way ANOVA test.

II. RESULTS

The study was conducted in 100 patients, containing equal number of male (50%) and female (50%) participants. Out of 100 participants, 13 were belonged to the age group of 30-44 years, 54 belonged to the age group of 45-60 years and 33 were above 60 years of age. Majority of the participants (53%) had completed college level of education, 23 (23%) participants had secondary level of education, 12 (12%) had completed primary level of education and 12 (12%) were illiterate. 62 (62%) of the participants were...
employed, (23%) were unemployed and 15 (15%) were retired (Table 1).

### Table 1: Demographic details of the patient

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Frequency (%) (N=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50 (50%)</td>
</tr>
<tr>
<td>Female</td>
<td>50 (50%)</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
<td></td>
</tr>
<tr>
<td>30-44</td>
<td>13 (13%)</td>
</tr>
<tr>
<td>45-60</td>
<td>54 (54%)</td>
</tr>
<tr>
<td>60 and above</td>
<td>33 (33%)</td>
</tr>
<tr>
<td><strong>Employment Status</strong></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>62 (62%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>23 (23%)</td>
</tr>
<tr>
<td>Retired</td>
<td>15 (15%)</td>
</tr>
<tr>
<td><strong>Level of Education</strong></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>12 (12%)</td>
</tr>
<tr>
<td>Primary</td>
<td>12 (12%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>23 (23%)</td>
</tr>
<tr>
<td>College Level</td>
<td>53 (53%)</td>
</tr>
</tbody>
</table>

**SOCIAL AND MEDICAL HISTORY**

Out of 100 participants, 20 participants had history of alcohol consumption only, 9 participants had history of smoking and 8 had both. In the study group, 40 participants (40%) have been on medication for more than 5 years; meanwhile 37 participants (37%) had treatment history of 1-5 years and 23 (23%) were on medication for less than one year. The social history and duration of treatment of the participants are depicted in Figure 1 and Figure 2 respectively.
Assessment of medication adherence in patients with type 2 diabetes mellitus

Adherence pattern (pre intervention)
From the study population, mean score of MMAS-8 was found to be 4.69 before the intervention. Majority of participants were found to have low adherence (56%). The study revealed that 16 (16%) participants had high adherence and 28 (28%) had medium adherence. The average adherence score for females was 3.855 whereas for males it was 5.53.

Adherence pattern (post intervention)
After the intervention, 35 subjects were classified into the highly adherence group, 54 subjects into medium adherence group and 11 subjects in low adherence group respectively.

Table 2: Distribution of respondents on the basis of MMAS-8 Score

<table>
<thead>
<tr>
<th>Category</th>
<th>Pre-test</th>
<th>Pre-test %</th>
<th>Post-test</th>
<th>Post-test %</th>
</tr>
</thead>
<tbody>
<tr>
<td>High adherence (≥8)</td>
<td>16</td>
<td>16%</td>
<td>35</td>
<td>35%</td>
</tr>
<tr>
<td>Medium adherence (6-&lt;8)</td>
<td>28</td>
<td>28%</td>
<td>54</td>
<td>54%</td>
</tr>
<tr>
<td>Low adherence (&lt;6)</td>
<td>56</td>
<td>56%</td>
<td>11</td>
<td>11%</td>
</tr>
</tbody>
</table>
Figure 3: Proportion of participants according to their adherence (pre vs post)

Reasons for non-adherence to anti-diabetic medication

The study also identified various reasons for non-adherence to the treatment. Out of 100 participants, the main reason was forgetfulness (41%) and lack of knowledge (41%). Another major cause for non-adherence was high direct and indirect costs of treatment (15%), followed by multiple medications (8%), whereas (6%) regarded to be due to travelling, followed by (4%) due to poor follow-up, (4%) due to side effects, about (2%) of patients stopped taking medicines after they felt that there is an improvement in their health status.

<table>
<thead>
<tr>
<th>Reasons for non-adherence</th>
<th>Number of participants</th>
<th>Percentage of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forgetfulness</td>
<td>41</td>
<td>41%</td>
</tr>
<tr>
<td>Lack of knowledge</td>
<td>41</td>
<td>41%</td>
</tr>
<tr>
<td>Lack of finance</td>
<td>15</td>
<td>15%</td>
</tr>
<tr>
<td>Multiple medications</td>
<td>8</td>
<td>8%</td>
</tr>
<tr>
<td>Travelling</td>
<td>6</td>
<td>6%</td>
</tr>
<tr>
<td>Poor follow up</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Side effects</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Do not consider necessary</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>Health improved</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Taking drugs for many years</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>
Null Hypothesis:
According to this study, the null hypothesis was rejected since there was a relationship between pharmacist intervention and improvement in medication adherence after identifying barriers in patients with type 2 diabetes.

III. DISCUSSION
The preliminary study was conducted with the aim of assessing the socio-demographic profile of patients with their adherence to medication regimen as well as the barriers associated with adherence. The medium adherence group was educated with PILs and the low adherence group was educated with the help of patient counselling and PILs, Pill box, Pill card, SMS alerts, medication adherence apps (Medication reminder and tracker) with regard to their barriers. The aim was to assess the impact of pharmacist intervention on medication adherence by identifying barriers.

Adherence to medication is the prior factor for the management of DM. A good clinical outcome is possible only with the eradication of barriers to adherence. In the study, MMAS-8 was used to assess the medication adherence of the subjects. A pre-test was conducted to assess the Medication adherence in diabetic patients using MMAS-8 and the results revealed that more than half of the subjects had low adherence.

According to this study, females were associated with low adherence which could be attributed to the fact that women in Dakshina Kannada were engaged in household work. There was a significant association between education level and adherence (p<0.01). This association was brought about by the fact that education level has a beneficial impact on the amount of information patients will have, which will ultimately result in greater medication adherence. Many studies reported association between socio-demographic characteristics and adherence. Gebre Teklemariam Demoz et al. found that poor adherence was seen in females and participants with no formal education. The participants with more than 5 years of treatment were found to be poorly adherent to their medications. A study conducted in Malaysia by Zeinab Jannoo et al., revealed that patients who had low medication adherence level had a longer diabetes duration of 8.8 years compared with those in the other levels.

Forgetfulness was found to be the major reason for patients not adhering to their therapy in the study which could be associated with the increasing age of the patients as 39.02% of the patients were above the age of 60. This result corresponded with a study done by Lyndsay A. Nelson et al., where the most frequently reported barrier was forgetting to take medications. Forgetfulness was followed by Poor

Figure 4: Reasons for non-adherence

0% 5% 10% 15% 20% 25% 30% 35% 40% 45%
Forgetfulness Lack of knowledge Lack of finance Multiple medication Traveling Poor follow up Side effects Do not consider necessary Health improved Taking drugs for many years

41% 15% 8% 6% 4% 4% 3% 2% 1%
knowledge of subjects regarding the disease, as 41% was categorized to have low level knowledge about diabetes. The study by Ahmad et al., showed that for every one percent decrease in knowledge about the disease, treatment non-adherence had a 3.6-point increase\(^8\). The findings of the current study conform with results of study done by Kassahun T. et al., have revealed that low level of knowledge of diabetes among participants is demonstrated to have poor adherence to medications\(^5\).

Lack of finance which could be linked to the employment status of the patients. The majority of individuals who cited financial constraints as a barrier to medication adherence were unemployed or retired, which explains why they had difficulty in affording their prescribed medications. This coincided with the study conducted by Smita Sontakke et al., which revealed various factors that lead to medication adherence, such as which unawareness (55.66%), forgetfulness (50.66%) and high cost of the medication (43.33%) were the common causes of non-adherence\(^10\).

Complex treatment regimen is one of the factors that contributes towards non-adherence. The number of drugs taken by patients depends on the severity of T2DM and comorbidities. According to a US survey, 50% of diabetic patients received prescription having more than seven medications. This included anti-diabetic drugs as well as other drugs to treat comorbidities\(^1\). Thus, the drug regimen for patients with diabetes mellitus can become complex, and adherence may definitely be a challenge for patients. Studies have previously demonstrated that patients with more than two medications were more likely to be non-adherent, especially the elderly\(^12\), which could be correlated as 33% of subjects involved were elderly in this study. Travelling is observed as one of the barriers of medication adherence. This study revealed that 53% patients forgets to take medications while travelling, which is similar to the study done by Venkatesan Metal., showed forgetting to take tablets during travel is the 2nd most reason for poor adherence\(^3\).

Adherence to prescription regimen is greatly influenced by the physician–patient relationship. Lack of effective communication between the physician and the patient may contribute to medication non-adherence. In a similar study, patients reporting poor patient-provider communication and dismissing attachment were significantly less likely to adhere to their medication and consequently had poorer glycemic control\(^14\). General dissatisfaction with the quality of health services provided at a health facility is also a recognised barrier to medication adherence in patients who received care there\(^15\). Dissatisfied patients are also less likely to attend follow-up clinics and have little trust in the medication prescribed.

Side effects were also one of the reasons for non-adherence in the current study which was in agreement with the study done by Mohammed Arifulla et al., which side effects of medication can be prevented by taking medication with a meal. Also, to help lessen the risk of severe diarrhea anti-diabetic medications are started on low dose. Sometimes it could lead to anemia causing tiredness due to depletion of vitamin B12 which can be corrected by taking vitamin supplements. Hypoglycaemia is one of the most common side effects of anti-diabetic medications which causes headache, sweating, fatigue, dizziness. Eating or drinking something that’s mostly sugar or carbohydrates to raise the blood sugar level quickly. Pure glucose available in tablets, gels and other forms is the preferred treatment. When patients can clearly see how the prescribed medication is causing some beneficial and relatively quick effects, they are more inclined to stick to their prescription regimens.

Another problem is that patients may feel cured and stop taking their medication because of lack of information about the consequences of non-adherence. There research provided interventions to T2DM patients by counselling and informing to take medication regularly to prevent complications. The results of the study shows that interventions provided including pharmacist counseling, medication adherence app, and the patient information leaflets were effective in improving medication adherence in Type 2 diabetes mellitus patients.

**IV. CONCLUSION**

This study assessed medication adherence issues among type 2 diabetes patients and was able to assess that majority of type 2 diabetes mellitus patients have suboptimal medication adherence. From the findings, the
forgetfulness, lack of knowledge, multiple medication, lack of finance, Poor follow up were the major reasons contributing to non-adherence. The variety of interventions to overcome these barriers were employed through patient information leaflets, which included pill card, pillboxes, as well as the integration of new technologies like medication reminder mobile applications and medication SMS reminders/alerts.

In conclusion, the pharmacists can have a huge impact on patients adherence to medication. They can adopt a strategic approach to adherence discussions. The collection of information, the development of a cooperative connection, the usage of open-ended questions, the promotion of education, and the eradication of obstacles are all crucial first steps. Health professionals should be willing to develop and implement potentially effective means to achieve this.

V. ACKNOWLEDGEMENT

I would like to extend my gratitude to my guide, Ms. Vinetha K, Assistant Professor, Department of Pharmacy Practice, for advising and guiding me throughout this study. I would also like to thank Dr. A.R Shabaraya, HOD and Principal, Srinivas College of Pharmacy, Mangalore and Srinivas Institute of Medical Sciences and Research Centre, Mukka for providing all the necessary facilities to carry out this research work. I would like to extend our thanks to the study participants who helped to make this research a success by taking part and cooperating throughout the study.

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