Assessing the impact of Mobile application enhancing Medication Adherence and Self-care practices among Patients with Diabetes Mellitus

Sanjana Chaudhary¹, Saloni Vasani¹, Saj Patel¹, Drashti Patel¹, Sandipkumar P. Bhatt²* Chintankumar S. Patel³

¹Pharm.D Student, K.B.Institute of Pharmaceutical education and research, Gandhinagar, Gujarat-382024
²*Associate Professor, K.B.Institute of Pharmaceutical education and Research, Gandhinagar, Gujarat-382024
³Assistant Professor, K.B.Institute of Pharmaceutical education and research, Gandhinagar, Gujarat-382024

BACKGROUND: Nowadays, technology advancement provides mobile health applications (apps) to manage the disease and provide health-care services. This study aims to evaluate barriers such as medication adherence, self-care and knowledge related about medication and disease among people with type 1 and type 2 Diabetes mellitus through mobile application.

METHODOLOGY: An android based application with healthcare professional monitoring "DiaMedic" is developed. An Interventional- Randomized controlled trial study was carried out. Entire study was carried out in multi-speciality hospitals and clinic. RBS, FBS, PPBS, Medication adherence, Knowledge Questionnaire and self-care activities were collected at the baseline. Patients were followed up for a period of 3 months.

RESULT: At the third month, patients with the app group showed improved medication adherence (52.50 % to 71%), improved medication knowledge (63% to 68%), diabetes knowledge (54.66% to 63%) and also better self-care (2.83 to 3.19). whereas, patients in control group also improved the following parameters as knowledge provided by health care professionals but not on a large scale.

CONCLUSION: In conclusion, there is an increase in adherence, knowledge and self-care through mobile intervention. Diabetes is managed better through mobile application and patient can self-monitor and also by health care provider.
INTRODUCTION:
According to WHO, the number of adults aged 22 to 79 living with diabetes globally is currently at 537 million, and it is projected to increase to 643 million by 2030 and 1342 million by 2045. The average prevalence of diabetes in adult populations is estimated to be 16.8% in males and 14.6% in females. [1]
Effective self-management of Diabetes has been found to have significant impact on various aspects of an individual’s life. Studies have shown that when individuals with diabetes take proactive steps towards managing their condition including maintaining blood glucose levels and psychological well-being, their quality of life improves significantly. Diabetes patients require lifelong treatment, which can impact their quality of life. A crucial aspect of diabetes treatment is adherence to prescribed medication, diet, and exercise plans. However, adherence to medication in chronic diseases such as diabetes is often sub-optimal, with less than half of Type 2 diabetes patients taking their medication as prescribed. [2]
Reasons for non-adherence include dose omission, forgetfulness, and unwillingness to take medicines. To improve adherence, reminders, follow-up, and accessible information are necessary.
With the emergence of telemedicine in the 1960s, modern communication and internet technologies have paved the way for digital health practices. Digital health includes mobile health, health information technology, wearable devices, telehealth and telemedicine, and personalized medicine. The use of mobile applications has shown positive results in improving diabetes self-management, medication adherence, physical activity, and blood glucose monitoring. [3]
However, a systematic review has shown that only half of the high-quality, publicly available free apps achieve high to moderate medication adherence. Therefore, we aimed to assess the effectiveness of mobile applications to improve medication adherence, medication knowledge, and changes in glycemic results.
MATERIALS AND METHOD
Study Design
This study was a multi-centric, interventional randomized controlled trial, approved by the KBIEC and conducted in accordance with the Declaration of Helsinki. Eligible participants were recruited by investigators from Synergy Specialty Clinic, Hi-Tech Hospital, and Sharda Hospital. Informed consent was obtained from all participants prior to their inclusion in the study.
Sampling Method
The entire study population was divided into two groups: an intervention group and a control group. The sample size was 68, with 34 participants in each group. Patient data was collected by the investigators, and a mobile application called "DiaMedic" was installed only in the intervention group.
Sample Size
Sample size was carried out on the basis of eligibility criteria and selected sample size is 68. Sample size is calculated using formula for comparison of means in two groups.
FORMULA: \[ N = 2 \left( \frac{\delta}{\Delta} \right)^2 (Z_{\alpha} + Z_{\beta})^2 \]
\[ N = 2 \left( \frac{0.571}{5} \right)^2 (1.96 + 1.65)^2 \]
\[ N = 34 \]
Our sample size for control group is 34 and for interventional group is also 34. So, our total sample size is 68.
Intervention
Patients in the intervention group were provided with the DiaMedic app, which stored their information, set reminders for adherence, and included training on app usability.
Inclusion Criteria
Patients between the ages of 20-70 years diagnosed with type 1 and 2 DM, with or without comorbidities, who had a personal smartphone with Android operating system, basic knowledge of digital usage, and an interest in participating in...
the study from baseline to regular interval follow-ups were included.

**Exclusion Criteria**
Participants who were pregnant, cognitively impaired, diagnosed with psychological issues, prisoners, bed-bound and undergoing tube feeding, or prescribed medication for the first time were excluded from the study.

**Withdrawal Criteria**
Patients were allowed to withdraw from the study without any questions or arguments.

**Statistical Analysis**
Data analysis will be conducted using Windows 8, Microsoft Office 2010, Graph Pad Prism 5.0, and IBM SPSS 20. Data will be expressed as numbers and percentages.

**Method**
Study was divided into 2 parts. Initiated with application development. The application named “DiaMedic” for diabetes was developed. The purpose of this application was to improve medication adherence by providing reminders for medications, improving diabetes knowledge and promoting self-care behaviour. The app is developed through PHP coding language. The app has main 2 sides and both sides are interlinked with its own unique features.

A. The admin - operated by healthcare provider
B. The user - operated by participants

Participants were recruited based on inclusion and exclusion criteria. Informed consent was obtained from all participants prior to enrollment. Participants were randomly assigned to either the intervention or control group.

Participants in the intervention group were provided with a mobile application called "DiaMedic." The app stored user information, set reminders for adherence, and provided training on app usability. Participants in the control group did not receive the mobile app.

The study involved administering the Summary of Diabetes self-care Activities (SDSCA) Questionnaire, assessing diabetes knowledge, and collecting medication information from patients in two groups. Both groups filled out a questionnaire on adherence. The interventional group received education through a mobile app. Baseline data was collected, and the server was used to monitor app usage by patients. At the last follow-up, patients filled out questionnaires again and their random glucose sugar levels were tested to ensure adherence to therapy.

**Baseline Data Collection**
At baseline, demographic details, medical history, lab parameters, medication details, medication adherence, diabetes knowledge, medication knowledge, self-care diabetes activity, and RBS were collected.

**Follow-Up Visits**
Follow-up visits were conducted at one-month intervals. During the first follow-up visit, medication adherence and RBS were measured. During the second follow-up visit, medication adherence, diabetes knowledge, medication knowledge, self-care diabetes activity, RBS, and app review were collected.

**Data Analysis**
All data collected during the study was analyzed by the investigators to determine outcomes and conclusions.
RESULT
We included 68 patients; through the randomization we divided them into control and intervention group. Table 1 shows the demographic details of the study participants. Among them 19(55.88%) patients were male and 15(44.11%) were female. Majority of patients were educated and age group of patients were ranging from 45-54 years. The patients provided with mobile application, an intervention group were able to assess the technology. Other details are shown in table below.
[Table 1. Demographic details of respondents]

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Demographic details</th>
<th>Control Group (N=34) (%)</th>
<th>Intervention Group (N=34) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>19 (55.88)</td>
<td>19 (55.88)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>15 (44.12)</td>
<td>15 (44.12)</td>
</tr>
<tr>
<td>2.</td>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25-34</td>
<td>2 (5.88)</td>
<td>2 (5.88)</td>
</tr>
<tr>
<td></td>
<td>35-44</td>
<td>4 (11.76)</td>
<td>8 (23.53)</td>
</tr>
<tr>
<td></td>
<td>45-54</td>
<td>13 (38.23)</td>
<td>11 (32.35)</td>
</tr>
<tr>
<td></td>
<td>55-64</td>
<td>12 (35.29)</td>
<td>7 (20.59)</td>
</tr>
<tr>
<td></td>
<td>65-74</td>
<td>3 (8.82)</td>
<td>6 (17.65)</td>
</tr>
<tr>
<td>3.</td>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary (illiterate )</td>
<td>8 (23.53)</td>
<td>6 (17.65)</td>
</tr>
<tr>
<td></td>
<td>Secondary (SSC education)</td>
<td>10 (29.41)</td>
<td>12 (35.29)</td>
</tr>
<tr>
<td></td>
<td>Tertiary (Graduate)</td>
<td>16 (47.05)</td>
<td>16 (47.05)</td>
</tr>
<tr>
<td>4.</td>
<td>Duration of Diabetes(years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;1</td>
<td>4 (11.76)</td>
<td>2 (5.88)</td>
</tr>
<tr>
<td></td>
<td>1-5</td>
<td>11 (32.35)</td>
<td>16 (47.05)</td>
</tr>
<tr>
<td></td>
<td>6-10</td>
<td>12 (35.29)</td>
<td>16 (47.05)</td>
</tr>
<tr>
<td></td>
<td>11-15</td>
<td>6 (17.65)</td>
<td>0 (00)</td>
</tr>
<tr>
<td></td>
<td>&gt;15</td>
<td>1 (2.94)</td>
<td>0 (00)</td>
</tr>
<tr>
<td>5.</td>
<td>Co-morbid Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single co-morbid condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td>5 (14.70)</td>
<td>10 (29.41)</td>
</tr>
<tr>
<td></td>
<td>Hypothyroidism</td>
<td>1 (2.94)</td>
<td>0 (00)</td>
</tr>
<tr>
<td></td>
<td>Peripheral neuropathy</td>
<td>1 (2.94)</td>
<td>0 (00)</td>
</tr>
<tr>
<td></td>
<td>Arthritis</td>
<td>1 (2.94)</td>
<td>0 (00)</td>
</tr>
<tr>
<td></td>
<td>Multiple co-morbid condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hypertension+CKD</td>
<td>1 (2.94)</td>
<td>0 (00)</td>
</tr>
<tr>
<td></td>
<td>Hypertension+Psoriasis</td>
<td>1 (2.94)</td>
<td>0 (00)</td>
</tr>
<tr>
<td></td>
<td>Hypertension+Dyslipidemia</td>
<td>4 (11.76)</td>
<td>0 (00)</td>
</tr>
<tr>
<td></td>
<td>Hypertension+Hypothyroidism</td>
<td>0 (00)</td>
<td>1 (2.94)</td>
</tr>
<tr>
<td></td>
<td>Hypertension+IHD</td>
<td>0 (00)</td>
<td>1 (2.94)</td>
</tr>
<tr>
<td></td>
<td>Hypertension+Dyslipidemia+Stroke</td>
<td>0 (00)</td>
<td>1 (2.94)</td>
</tr>
<tr>
<td></td>
<td>Hypothyroidism</td>
<td>0 (00)</td>
<td>1 (2.94)</td>
</tr>
<tr>
<td></td>
<td>No Co-morbid condition</td>
<td>17 (50)</td>
<td>21 (61.76)</td>
</tr>
</tbody>
</table>
6. Occupation
Housewife 12 (35.29)
Job 14 (41.18)
Business 6 (17.65)
Retired 2 (5.88)

7. Blood Sugar (mg/dl)

<table>
<thead>
<tr>
<th>Blood Sugar Levels</th>
<th>RBS (N=7)</th>
<th>FBS (N=24)</th>
<th>PPBS (N=20)</th>
<th>RBS (N=13)</th>
<th>FBS (N=20)</th>
<th>PPBS (N=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td>0 (00)</td>
<td>3 (12.5)</td>
<td>0 (00)</td>
<td>2 (10)</td>
<td>0(00)</td>
<td>0(00)</td>
</tr>
<tr>
<td>101-150</td>
<td>2(28.57)</td>
<td>8(33.33)</td>
<td>3(15)</td>
<td>1(7.69)</td>
<td>1(5.88)</td>
<td>7(41.18)</td>
</tr>
<tr>
<td>151-200</td>
<td>3(42.86)</td>
<td>1(4.16)</td>
<td>2(10)</td>
<td>1(7.69)</td>
<td>2(10)</td>
<td>2(11.76)</td>
</tr>
<tr>
<td>201-250</td>
<td>0(00)</td>
<td>2(10)</td>
<td>3(15)</td>
<td>1(7.69)</td>
<td>3(15)</td>
<td>0(00)</td>
</tr>
<tr>
<td>251-300</td>
<td>2(28.57)</td>
<td>0(00)</td>
<td>3(15)</td>
<td>0(00)</td>
<td>0(00)</td>
<td>1(5.88)</td>
</tr>
<tr>
<td>&gt;301</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Blood sugar levels of patients were assessed through RBS, FBS, and PPBS tests in both the control and interventional group. A comparison between the baseline and last follow-up data revealed a significant reduction in mean RBS levels by 15.21% and 18.72%, mean FBS levels by 10.03% and 14.31%, and mean PPBS levels by 20.81% and 18.49% in the control and interventional groups, respectively.

**Medication Adherence**

The MMAS is a generic self-reported, medication-taking behaviour scale in which the specific health issue (high blood pressure, diabetes, elevated cholesterol, HIV, contraception, etc.) is inserted for the “health concern”. The MMAS consists of four items with a scoring scheme of “Yes” = 0 and “No” = 1. The items are summed to give a range of scores from 0 to 4.

To measure medication adherence levels, an adherence test was carried out in both the control and interventional groups. The graph indicated that adherence levels increased from 57% at baseline to 65% at last follow-up in the control group, while the interventional group showed a significant improvement of 18.5%. The medication adherence score at last follow-up was 2.618 (0.1581) in the control group, whereas in the interventional group, it was 2.824 (1.058).

Among the interventional group, medication adherence scores improved in the age group of 25-34 and tertiary level educated patients, while the highest score was observed in the 35-44 age groups in the control group.

[Figure 1. Follow up vs. mean medication adherence score (%)]

![Figure 1. Follow up vs. mean medication adherence score (%)](image-url)
**Diabetes knowledge test (DKT)**

Diabetes knowledge was assessed with the Diabetes Knowledge Questionnaire. The diabetes knowledge questionnaire elects information about the respondents understanding of the cause of diabetes, lab test, type of diabetes, self-management skills and its complications. Response options are “true” or “false” and the final score was based on the percentage of correct scores, with maximal possible score of 16.

Diabetes knowledge test was performed to assess the disease knowledge at baseline and last follow up. In control group mean score of DKT at baseline and last follow up were 9.17 and 9.73 respectively. Whereas in Intervention group mean score of DKT at baseline and last follow up were 8.73 and 9.73 respectively. So we can see there is more increase of knowledge in intervention group compared to control group. Patients from age group 25-34 and tertiary educated shows higher knowledge improvement regarding to disease than others.

**Medication knowledge test (MKT)**

The Medication Knowledge test is to be conducted in diabetes mellitus patient which consists of 9 questions including knowledge score, date of baseline and date of 3rd follow up. The scoring marked with 0,1or2 that is based on the appropriateness of the participant’s answers. Therefore, each question consists of 2 marks and total score is declared out of 18. These questions are summed to give a range of score between 1 to 18 from the assessment to identify knowledge gaps and develop a knowledge improvement plan.

Medication knowledge test was performed to assess the medication knowledge at baseline and last follow up. In control group mean score of MKT at baseline and last follow up were 10.97 and 11.53, whereas in Interventional group mean score of MKT at baseline and last follow up were 11.35 and 12.24 respectively. There is major improvement observed in intervention group at age group of 35-44 and tertiary level educated patients.

**Self Care Diabetes Activity (SCDA)**

Self-care behaviour was assessed with the 11 item summary of diabetes self-care activities scale. The summary of diabetes self-care activity scale measures frequency of self-care activity in the last 7 days for 5 aspects of the diabetes regimen: general diet (follow healthy diet), specific diet, afoot-care, blood glucose testing, exercise and cigarette smoking. For this analysis, general diet, foot-care, blood glucose testing and exercise were used.

Self–care activity questionnaire form were filled by patients to assess the self-care in management of diabetes. In control group mean score of self-care at baseline and last follow up were 2.66 and 3.13, Whereas in Intervention group mean score of self-care at baseline and last follow up were 2.83 and 3.19 respectively.

![Figure2. Follow up vs. mean SCDA Score (%)](image-url)
**Statistical Analysis**

Two Sample T test:

T test is used as a hypothesis testing tool to determine if there is a significant difference between the means of two groups. In this study T test is performed on medication adherence, and all knowledge test scores.

T value and P value have significant difference between two visits. If the calculated P value is less than 0.05 than it indicates strong evidence against the null hypothesis. Therefore, we reject the null hypothesis and accept the alternative hypothesis. Hence the effectiveness of mobile application in the levels of MAT, DKT, MKT, and Self-care score is observed in last follow up.

**DISCUSSION**

We have a rapidly evolving healthcare systems with progressively more complex business processes than ever before. There are many studies that have found employing mobile phone technology improving glycemic control significantly across the world. Several articles found which focuses on the low adherence rates in the chronic diseases like Diabetes. Patients having more than one oral hypoglycemic drugs in course are moderately adhered to medications.

This study is based on evaluating mobile phone intervention and inform of raising awareness of diabetic control as well as imparting knowledge to increase adherence in diabetes. In the technological era, utilization of the diabetes application provided evidence that endorse further innovative ways to challenge barriers associated with ineffective self-care management of patients with type two diabetes mellitus in the understood patient population. This study based on mobile technology needs to be incorporated into clinical practice associated with management of type 2DM. Mobile – based technology will help patients achieve their target glycemic goals and reduce mortality and morbidity as well as generating awareness, changes in behavioural communication and also improving adherence in patients.

Several studies reported earlier have shown that providing education can make a difference and can increase in the adherence rates. Imparting Diabetes education, creating awareness and motivating for self-care not only enhances care and reduces the burden of complications but also indirectly reduces the overall economic costs of diabetes. Diabetes Education provides motivation to the patients and helps in decreasing non adherence in patients.

**Effect on adherence**

Adherence plays a key role in treatment of diabetic patients. In our study there are two groups, control group and intervention group. In control group we found that 21% patients were non adherent at baseline based on medication adherence test and 79.4% patients were moderate at baseline. After application intervention, the adherence was raised, in which 18% highly adherent to medication. Whereas in intervention group 29.4% patients were non adherent at baseline and 0 patients were highly adherent to medication. After mobile intervention 32.35% patients were highly adherent to medication. So in intervention group more improvement was seen than the control group which supports the effectiveness of mobile application for improving medication adherence. [4]

**Effect on education**

Education of diabetes disease and medicines improve knowledge and attitude which help to better glycemic control. In our study we focused on providing education through mobile application for their easy and quick access of knowledge to better glycemic control.

Our study also focuses on medication knowledge. The medication knowledge was increased from 61% to 64% in control group. Whereas in intervention group it was increased from 63% to 68% after giving intervention through mobile application at last follow up. So in both the diabetes and medication knowledge, more
improvement was observed in intervention group as compared to control group. [5]

**Effect on Self-care activities**

Important factor for managing diabetes is a self-care activities. Diabetes is a long-term disease for managing it self-care play important role. It’s been reported that self-care activities and self-care awareness is very rare in patients. [2]

In our study self-care activities score was increased from 41% to 45% in control group. After intervention through mobile application in intervention group it was increased from 43% to 49%. So the higher improvement was observed in intervention compared to control group.

**Effect on Blood sugar level**

To control blood sugar level normal, patients must adhere to medication, improve knowledge and self-care activities. In our study RBS reduced to 15.21%, FBS reduced to 10.03% and PPBS reduced to 20.81% in control group. While through mobile application intervention RBS reduced to 18.72%, FBS 14.31% and PPBS 18.49% in intervention group. [6]

**Effect on diet**

Various studies have been performed noting the self-activities in Diabetes patients. In a study conducted in Chandigarh, 80% were aware that fatty foods and sweets should be avoided whereas only 8.3% were avoiding them. Similarly, blood glucose monitoring was also poor in Chandigarh residents around 46%. The oral hypoglycemic compliance was found to be 62.9%[7] Gopalan R et al[8], in their study in Pondicherry, concluded that only 50 % of the patients followed their diet as their self-management routine. In Gujarat Refinery hospitals, a study was performed in 60 diabetes patients, where patients with education intervention reported that there was significant decrease in fasting blood sugar, lipids, and total fat intake as compared to the baseline and those of with no education provided.[9]

In the diet aspect of the present study, improvement of 8% observed in intervention group from baseline to last follow up, where as in control group 5% improvement observed from baseline to intervention group.

**Effect on Foot-care**

In our study, we have imparted education on foot care as one of the self-care management activities. Patients reported to have poor foot care management activities during the enrolment of study. Around 27% had foot care activities in both the group. After educational intervention this was increased to 34% of patients who started foot care activities in intervention group, whereas in control group this was increased to 28%.Higher improvement was observed in intervention group. [10] [11]

**Effect on Exercise**

A study to assess the impact of education on exercise and its benefit in 100 diabetic patients revealed that 38.6% changed their exercise pattern as compared to 20.8% patients who were irregular and 28.7% did not exercise. A decrease in fasting blood sugar and HbA1c was observed in those with change in exercise pattern as compared to those who did not exercise. [12]

In our study, 34% were doing exercise in control group whereas 38% were doing exercise in intervention group. After intervention of education about importance of exercise through mobile application it was increased to 49%. Many participants in the study adapted to do exercise on daily basis as compared to baseline.

**CONCLUSION**

Mobile application assisted adherence to medication, knowledge and self-care interventions, proved to be effective tool for managing blood glucose level. Participants were poorly and moderately adhered to their medication. Then-after intervention through mobile application, participants showed significant improvement to medication adherence. It also helped to improve the knowledge of diabetes and medication through the application. Imparting knowledge through mobile application is found more convenient and
easily accessible to participants any time. Knowledge improvement was observed higher in interventional group as compared to control group. Self-care in Diabetes was compromised at initial stage and increased after mobile application intervention. In the interventional group overall improvement was enhanced than in the control group.

LIMITATIONS
This study faced following limitations
• The study was performed for a short period of only 4 months which is really a very small duration for adherence assessment in diabetes patients.
• Blood Sugar level was kept as lab investigation other than HbA1c during baseline as well as every follow up. Though HbA1c is more conclusive and can give a more reliable result.
• Patient compliance to use mobile application was relatively a challenge as participants were not willing to open the provided application on regular base.
• Participants in the study were having less to moderate digital literacy and were not ready to communicate and discuss.

The app that was developed also had several limitations.
• The notification provided through the application does not appear on time due to technical problems. This causes the notification feature to be null and void.
• The education material for the patients has a download option. This feature is limited to recall bias due to the unreliability of whether the patient reads it or not.
• This application majorly focuses on Type 1 and Type 2 Diabetes Mellitus. Other co-morbid conditions are not included in the application.
• The features to be amended were not updated in the application due to technical issues and due to lack of time

ACKNOWLEDGEMENT
We owe our deep gratitude to our guide Dr. Sandipkumar P. Bhatt for support and guidance and also for the creation of the DiaMedic application. We are thankful to Dr. Bhavesh Kataria and Mr. Tejas Soni for the application development and making the app a success. We are grateful to Dr. Parth Patel from Hi-Tech Hospital, Sector 3, Gandhinagar, Dr. Dhrumil Patel from Synergy Specialty clinic, Naroda, Ahmedabad, Dr. Jayesh Shah, Sharda Hospital Sector 7 Gandhinagar at respective sites for giving us an opportunity and permitting us to carry out this project and for their kind cooperation in conduct of the study. We are thankful to our institute K.B.I.P.E.R and our Principal Dr. Shrikalp Deshpande for allowing us to do this study and providing us the means to do this project. This project would not have been possible without the blessing of our parents and family. And lastly, we thank all our seniors and all our fellow classmates for supporting us throughout this journey. At last, we humbly extend our thanks to all concerned people who co-operated with us in this regard.

REFERENCES
1. World Health Organization (2023, April 5). Diabetes


How To Cite This Article:

Source of Support: Nil
Conflict of Interest: None declared

Your next submission with BJPMR will reach you the below assets
- Quality Editorial service
- Swift Peer Review
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainement for your research
- Manuscript accessibility in different formats (Pdf, E-pub, Full Text)
- Unceasing customer service

Track the below URL for one-step submission
https://www.bjpmr.org/manuscript-submission/