


Deep Shah¹, Drashti Gajjar¹, Drishti Kapadia¹, Varun Danayak¹, Ritu Soni², Yash Patel³, Mayur Patel³, Jigna Samir Shah² 

¹Institute of Pharmacy, Nirma University, Ahmedabad, Gujarat, India

²Department of Pharmacology, Institute of Pharmacy, Nirma University, Ahmedabad, Gujarat, India

³Swasthya Diabetes Care, All India Institute of Diabetes and Research, Ahmedabad, Gujarat, India

Prevalence of Patient Awareness and Compliance in T2D Patients in the Urban Ahmedabad Region: A Retrospective and Prospective Study

ABSTRACT

Objective: In recent decades there has been a significant rise in diabetes worldwide. This is due to lack of physical activity, unhealthy dietary habits, unawareness, poor medication adherence, and patient non-compliance. The major objective of this research was to determine the diabetes awareness and medication compliance in Ahmedabad.

Materials and methods: In our cross-sectional study, patients with type 2 diabetes (T2D) from different areas of Gujarat were studied to determine their understanding about T2D, its medications, and compliance towards the same. The study was conducted at Swasthya Diabetes Care hospital with a sample size of 320 patients. Follow-up was done at regular intervals to assess the progression of the disease.

Results: It was found that T2D was more prevalent in males as compared to females aged 40–60 years. It

was found that 59.4% of T2D patients adhered to their prescribed medicines, and 40.6% were not compliant. This can raise diabetes-related complications and render the therapy ineffective. Nevertheless, 85% people were aware of the preventive measures for T2D, and 15% were unaware. The people who had awareness of HbA1c had lower mean HbA1c. Also, 74% of patients included exercise in their routine, and 50.67% followed a proper diet. Also, people belonging to urban cities and who were educated were more compliant to exercise and diet. Thus, measures to increase patient compliance should be effectively undertaken.

Conclusions: There is a need to increase awareness of T2D self-management. Secondly, healthcare institutions need to promote education for effective management, control and prevention of diabetes. (Clin Diabetol 2024; 13, 4: 200–207)

Keywords: diabetes mellitus, diabetes, compliance, awareness, medication adherence

Address for correspondence:

Dr. Jigna S. Shah

Professor and Head at Department of Pharmacology, Institute of Pharmacy, Nirma University, Sarkhej — Gandhinagar Highway, Gota, Ahmedabad, Gujarat 382481, India

E-mail: jigna.shah@nirmauni.ac.in, Phone: 917971652716

Clinical Diabetology 2024, 13; 4: 200–207

DOI: 10.5603/cd.100771

Received: 20.05.2024 Accepted: 27.06.2024

Early publication date: 14.08.2024

Introduction

Type 2 diabetes (T2D) is the most widespread metabolic disorder. Glucose metabolism is majorly affected in this condition and hyperglycemia is observed. Type 1 diabetes (T1D) is an autoimmune disorder that results in complete destruction of pancreatic β cells. T2D is major-

ly due to insulin resistance [1]. It affects around 5–10% of patients. As per current demographics, it is predicted that diabetes prevalence will reach 10.2% (578 million) in 2030, and 10.9% (700 million) in 2045. As compared to rural areas (7.2%) and low-income countries (4.0%), the urban regions (10.8%) and high-income countries (10.4%) have higher prevalence rates. 50.1% of patients are oblivious to their condition. According to predictions, 8.0% (454 million) will be suffering from diabetes by 2030, and 8.6% (548 million) by 2045 [2]. In India, there is a significant geographic variation in the prevalence of diabetes, with the southern coastline featuring most of the burden (1 — Andhra Pradesh and Telangana: prevalence, 3.01%) (1864 of 61,948 individuals); (2 — Tamil Nadu and Kerala: prevalence, 4.32%) (3429 of 79,435 individuals); (3 — east Orissa: prevalence, 2.81%) (330 of 11,758 individuals); (4 — Goa: prevalence, 4.43%) [3]. According to the recently released National Family Health Survey (NFHS-5), the prevalence of high random blood glucose (RBG) (above 141 mg/dL) is 14.8% among women and 16.1% among men. This indicates that diabetes is more prevalent in men than in women.

T2D is either due to insufficient production of insulin or increased insulin tolerance by the body. It is the most common form of diabetes, accounting for around 90% of cases of T2D. Another type is gestational DM, which occurs during pregnancy [4]. Because T2D is a metabolic disorder, lifestyle and environmental factors play a significant role in its occurrence [5]. Risk factors of T2D mostly include genetic factors, obesity, sedentary lifestyle, alcohol consumption, diet, sleep disorders, smoking, polypharmacy, comorbidities, and the presence of other metabolic disorders [5]. Improper management of this disease leads to complications like diabetic neuropathy, diabetic nephropathy, diabetic ketoacidosis, diabetic retinopathy, and diabetic foot disorders [5, 6]. The risk factors for diabetes, such as urbanization and poor lifestyle choices, are the major causes behind the increasing prevalence of the disease [7]. Obesity and inappropriate food choices in young people might be the cause for the rising prevalence of diabetes in the younger population [7]. As a result of this increasing prevalence, the mortality rate is also increasing. Diabetes was the 15th most common cause of death; however, it is currently the 9th most common cause of mortality a decade ago. In addition to this, diabetes is also prominent in the young population, which was not the case a decade earlier [7].

Management of diabetes includes pharmacological as well as non-pharmacological approaches. For T1D, insulin analogues are often used. Both long-acting and

short-acting insulin analogues are widely used. For T2D, different drug classes are used, which predominantly include sulfonylureas, biguanides, thiazolidinediones, glucagon-like peptide-1 (GLP-1) agonists, dipeptidyl peptidase 4 (DPP-4) inhibitors, sodium-glucose co-transporter-2 (SGLT-2) inhibitors, and α -glucosidase inhibitors [1]. Non-pharmacological approaches include management of lifestyle factors like diet, lifestyle modification, and exercise. In addition, regular monitoring of the blood glucose levels is essential for effective management of T2D [5]. Thus, we can say that patient awareness and medication compliance are crucial factors for T2D management [5]. Patient non-compliance is primarily observed due to factors like increasing cost of drugs. Additionally, most patients fail to manage lifestyle factors like diet and lack exercise in their routine [5, 8].

The aim of this study was to evaluate the prevalence of patient awareness about T2D and medication compliance. A pretested questionnaire (Suppl. File) was used to collect the data from patients retrospectively and prospectively. Microsoft Excel was used to analyze the results. The demographic, clinical, and medication compliance levels of the patients were expressed using descriptive statistical analysis.

Material and methods

Study design and data source

A hospital-based prospective and retrospective cross-sectional study was conducted from February 2023 to May 2023. The data were collected from the hospital records of the patients at Swasthya Diabetic Care, Ahmedabad, as well as from patients in the surrounding areas. Patients with T2D were enrolled as per the discretion of physician.

Study participants

Any patients attending Swasthya Diabetic care from May 2022 to May 2023 with diabetes were enrolled in the study. Patients with age over 18 years were considered for the study. Patients with comorbidities that include metabolic disorders, diabetic complications, and cardiovascular system disorders were included in the study. Patients with blood glucose more than 140 mg/dL were included in this study. Patients with cancer and pregnant women were excluded from the study. Any patient unwilling to participate in the study was excluded. Data of 320 patients were collected in a pretested, validated Google form from the hospital files as well as from nearby patients. The form was previously validated by data collection from a smaller sample size.

Ethical approval

This study was reviewed by institutional ethics board, and approval for protocol number- IEC/NU/21/IP/1/24th April 2023 was granted.

Data collection variables

Patients were requested to fill out the case report form (CRF) after signing the informed consent form (ICF). Study parameters included blood sugar level, glycated hemoglobin (HbA1c), creatinine, and urine albumin-creatinine ratio (UACR). A case record form was prepared consisting of questions related to their awareness about diabetes, symptoms, medications, and adherence to medications. The patients completed the case record form to provide details concerning their understanding, perspectives, and practices associated with diabetes. These questions were put together to gauge their level of understanding and clarity on the medical condition, its treatment, and the hazards of neglecting prescribed medicine. The information retrieved from these questionnaires enables the medical personnel to better organize the necessary interventions to guarantee that maximum patient compliance is attained.

Statistical analysis

MS Excel was used to analyze data gathered from the pretested and endorsed Google form questions. The demographic, clinical, and medication compliance levels of the patients were expressed through descriptive statistics.

Results

Demographic characteristics

In total 320 patients were enrolled for the study, of whom 100 were enrolled for the prospective study and 220 patients were enrolled for the retrospective study. In the prospective study, there were more male patients (59%) as compared to female patients (41%). Whereas, in retrospective study, the male population comprised 60% and the female population comprised 40%. Most of the individuals suffering from T2D, belonged to the age group 40–60 years. The body mass index (BMI) was also determined. Based on that, it was found that 40% of participants were in the category of normal weight, 3% were underweight, 31% were overweight, and 26% were obese. Patient awareness is usually dependent upon literacy and education, and hence the number of years of education completed by patients was also recorded. From retrospective studies, it was found that most patients studied up to graduation, whereas in prospective studies, it was found that the majority of patients had completed basic education (up to 12th

grade). From the patients, 96% were married, whereas 4% were unmarried. Residential area is also a crucial parameter that determines patient awareness. In our study, around 97% of people resided in urban areas, and 3% people lived in rural areas.

The duration of T2D also varies in patients, which also is a crucial factor, which in turn depends upon many factors. It was observed that most people in the study had had T2D for around 5 years. Disease monitoring involves regularly measuring blood glucose levels and keeping a track of insulin levels. This can keep the symptoms under control and reduce the risk of developing long-term complications. It was observed that most of the people (50%) monitor blood glucose on a weekly basis. Furthermore, genetic predisposition plays a significant role in the occurrence of T2D. The findings of the prospective study demonstrate that 90% patients had a family history of diabetes (Tab. 1).

Patient compliance

For T2D patients, it is necessary to attend regular visits to a hospital for checkups, monitoring of T2D, and treatment. Hence, the patient should be aware of this. It was observed that around 58% of patients did not visit the hospital frequently. It is also necessary for patients to follow the dosage regimen to maintain blood glucose levels. Hence, the steps taken to follow this regimen were also determined.

Diet is also a significant factor in the management of T2D, and hence diet compliance is essential. It was observed in the retrospective study that dietary non-compliance was significant (42–59%). In the prospective study, around 73% of individuals were compliant. In addition, compliance to exercise was also determined on the basis of history shared by patients. Exercise compliance was observed in 74% of patients, and it was associated with a decrease in HbA1c level. It was very interesting to note that a 20% increase in exercise compliance led to a 0.15% decrease in HbA1c level. It was found that around 77% of people immediately took the dose as soon as they recalled the missed dose. However, in diabetes, medication needs to be taken at a specific time; hence, a missed dose should not be taken at another time without consultation. Therefore, this needs to be prevented, and awareness regarding the issue should be created.

Commonly prescribed medications were also determined from analysis of medicine usage. It was observed that metformin was the most prescribed medication whereas glimepiride was the least frequently prescribed medication (Fig. 1).

Additionally, from the prospective studies, it was established that people who were compliant and had

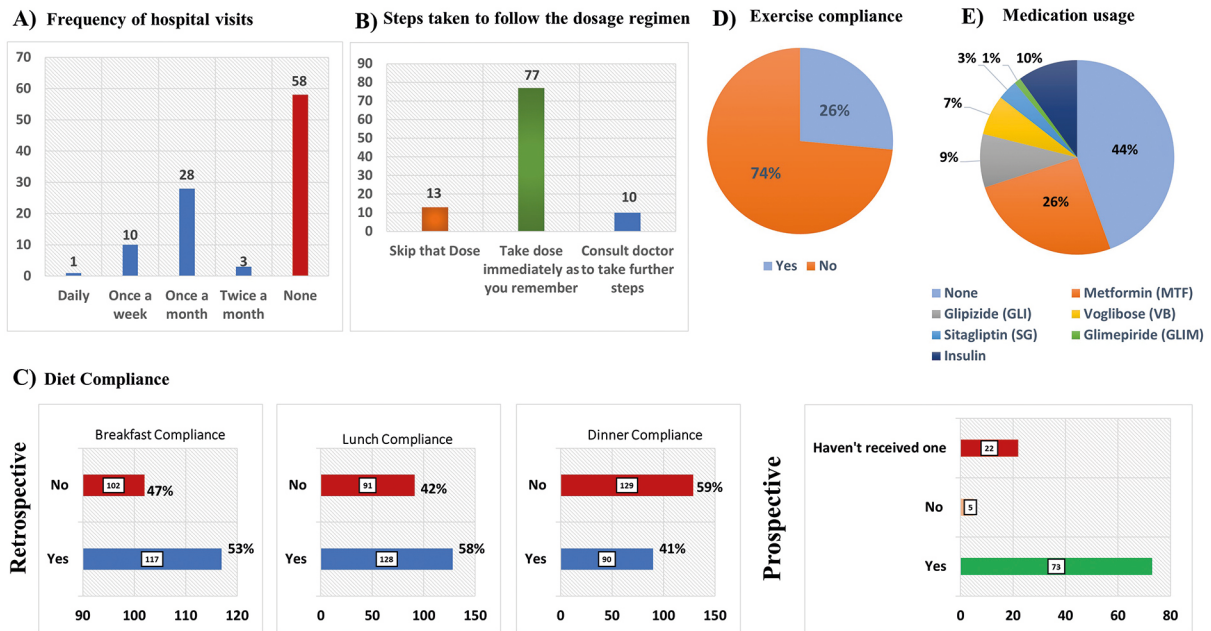


Figure 1. Patient Awareness and Compliance for Both Retrospective and Prospective Studies; **A.** Frequency of hospital visits; **B.** Steps taken to follow the dosage regimen; **C.** Diet compliance; **D.** Exercise compliance; **E.** Medication usage

awareness regarding prevention of, and care during, diabetes belonged to urban cities. This indicates that people with more resources and better socioeconomic status are more aware and more compliant. Other than that, these people had studied at least up to 12th grade, which proves that education is indeed a significant factor in enhancing patient compliance and awareness.

Co-morbidities

Co-morbidities are often seen in patients with T2D. Disorders like hypertension, ischemia, cardiac arterial disease, kidney disease, and obesity are the most common disorders that are present as co-morbidities with T2D. Furthermore, it was found that individuals with hypertension are more likely to have T2D, and hence they should take preventive steps (Fig. 2).

Awareness

Prevention of T2D is possible by maintenance of a healthy lifestyle. However, some people are not aware of the preventive measures. Awareness regarding these preventive measures is also crucial, as was determined in this study. It was observed that around 85% of the people were aware of these preventive measures. Measures to prevent diabetes predominantly include diet, exercise, and medication. It was found that medications were often used, and in combination methods, a combination of diet and medication was often used (Fig. 3).

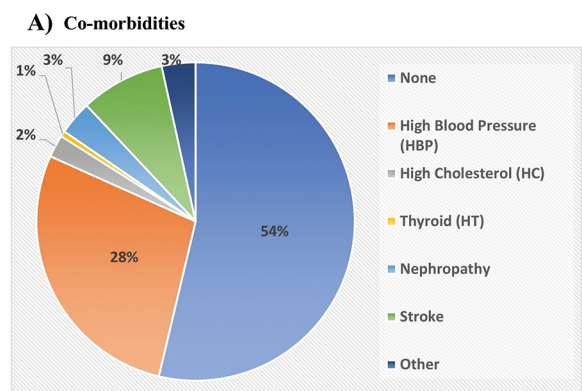
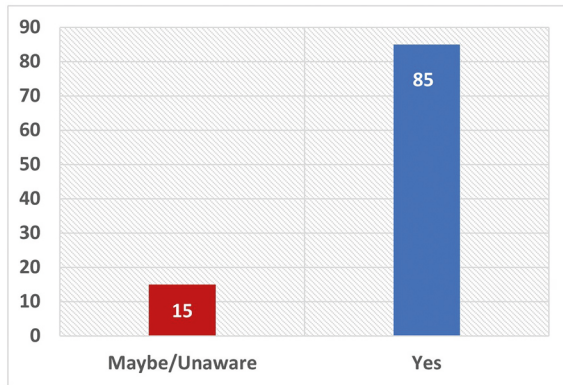


Figure 2. Data Analysis of Complications in Type 2 Diabetes Patients; **A.** Co-morbidities

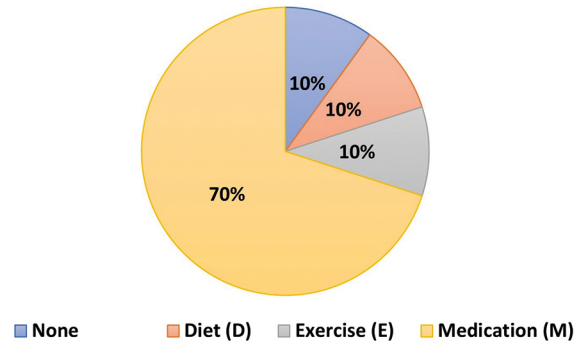
Clinical parameters

The HbA1c level indicates the confinement of blood glucose to erythrocytes. It was observed that HbA1c was slightly higher (90%) in male as compared to female patients (88%). Creatinine accumulation can also be seen in patients with T2D. Creatinine level (normal reference: < 1.35 mg/dL in women and < 1 mg/dL in men) [9] was also slightly higher in females (13%) than in males (9%). The presence of albumin in urine is assessed by the urine protein-creatinine ratio (UACR, normal for male < 25 mg/g and for females < 17 mg/g). Albumin protein is specifically present in blood. Pa-

A) Awareness regarding prevention of diabetes



B) Measures to prevent diabetes



C) Combination measures to prevent diabetes

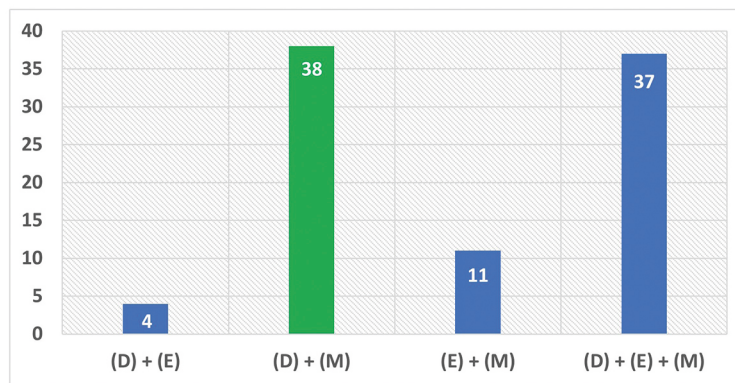


Figure 3. Data Analysis of Awareness in T2D Patients; A. Awareness regarding prevention of diabetes; B. Measures to prevent diabetes; C. Combination measures to prevent diabetes

tients with either type 1 or type 2 diabetes who have suffered from the disorder for at least 5 years should have the amount of urine albumin excretion evaluated annually to detect and monitor kidney impairment. For individuals who undergo continuous change in disease parameter, consistent monitoring may be desirable. The UACR ratio was slightly higher in females (23) than in males (10) (Suppl. Fig. 1).

Discussion

The prevalence of diabetes has significantly increased in almost every part of the world in recent years. This is concerning because an increase in the prevalence of diabetes leads to a spike in both chronic and acute illness among the general population, which leads to a decline in the quality of life, the need for medical services, and increased cost of care. The repercussions of non-adherence to medicine, however, often go unnoticed by patients, their families, and the medical community, unlike more well-known causes of mortality like cancer or heart attacks.

This study aimed to evaluate medication adherence in T2D patients, and to collect patient knowledge on treatment. It was noted from the collected data that 59% of males and 41% of females had diabetes, with the majority aged 40–60 years. Most patients had suffered for diabetes for on an average 5 years. 90% of patients had a family history of diabetes. Normal-weight persons made up 40% of the study’s participants, while overweight people made up 31% and obese people made up 26%. HbA1c levels were more than 6.5 for 90% of males and females, while creatinine levels accounted for 91% and 87% of normal cases, respectively. The normal range of creatinine in males (91%) was found to be higher than in females (87%), whereas an abnormal range was significantly higher in females (13%) as compared to males (9%). Such studies have also been conducted previously. In one such study, 4000 adults were screened in 60 districts. In this study, it was found that the prevalence in females was 1.9%, and it was 1.7% in males. This is contrary to our study, in which it was found that diabetes was

Table 1. Demographic Characteristics of Patients Suffering from Diabetes for Both Retrospective and Prospective Studies

| Parameters | Patient count | |
|-----------------------------|---------------------|-----------------------|
| | Prospective Studies | Retrospective Studies |
| Gender | | |
| Male | 59 (59%) | 132 (60%) |
| Female | 41 (41%) | 87 (40%) |
| Age [years] | | |
| 1–10 | 0 | 1 |
| 11–20 | 0 | 1 |
| 21–30 | 2 | 15 |
| 31–40 | 14 | 37 |
| 41–50 | 29 | 49 |
| 51–60 | 34 | 61 |
| 61–70 | 13 | 43 |
| 71–80 | 6 | 11 |
| 81–90 | 2 | 1 |
| Years of education | | |
| Up to graduation | 24 | 93 |
| Up to post-graduation | 6 | 16 |
| 1 st grade | 0 | 1 |
| 10 th grade | 10 | 39 |
| 12 th grade | 60 | 62 |
| Not specified | 0 | 7 |
| Disease monitoring | | |
| Unaware | 7 | — |
| Weekly | 51 | — |
| Monthly | 24 | — |
| Daily | 18 | — |
| Duration of disease [years] | | |
| 1 | 0 | — |
| 2 | 10 | — |
| 5 | 39 | — |
| 7 | 24 | — |
| 10 | 17 | — |
| 15 | 5 | — |
| 20 | 4 | — |
| BMI | | |
| Underweight | — | 7 (3%) |
| Normal weight | — | 88 (40%) |
| Overweight | — | 67 (31%) |
| Obese | — | 57 (26%) |

more prevalent in males than in females. However, in this study they concluded that there was no significant difference, and the risk of diabetes was similar in the male as well as female population. Other parameters were also reported. Based on BMI analysis, it was found that overweight and obese people had a greater risk

of diabetes than the underweight and normal population [10]. In another study, 1500 T2D patients were screened, and the urinary albumin creatinine ratio and glomerular filtration rate were determined. It was observed that urinary albumin creatinine ration was higher than or equal to 30 mg/g and the glomerular

filtration rate was less than 60 ml/min/1.73 m². This indicates that kidney function was affected in T2D patients, and it was concluded that 40% of T2D patients had chronic kidney disease as a comorbidity [11]. In another study, patients' HbA1c levels were evaluated, and their awareness regarding monitoring of HbA1c was also analyzed. The study consisted of 480 adults, and about 74% people had awareness of HbA1c monitoring in diabetes. It was also found that people who had awareness of this had lower mean HbA1c as compared to people who were unaware. The mean HbA1c was found to be between 8.1 and 9.1%. It was also found that the literacy rate was higher in people who were aware, and they mainly belonged to the urban population [12].

In terms of exercise and diet compliance, 74% of patients included exercise in their routine, compared to 26% who did not. As far as retrospective data are concerned, an average of 50.67% people complied for breakfast, lunch, and dinner guidelines whereas 49.33% did not comply. On the other hand, for the prospective data, approximately 73% of people complied with the diet plan. Most individuals were aware of how to take their prescription medications and the importance of routinely taking them, but more than 53% of men and 63% of women had clinically significant fasting and postprandial glucose levels. Also, it was established that people who had education until at least 12th grade and lived in urban areas were more aware and compliant. The findings of this article highlight the need to enhance access to both preventative and curative health care among groups who are poor. Similar studies have been conducted in the past. A study conducted at a tertiary care hospital in Uttarakhand consisted of 277 patients. It was found that in that study, 56% of participants had poor adherence whereas only 44% had good adherence. It concluded that the quality of life of T2D patients is directly associated with medication adherence [13]. Therefore, awareness and counselling programs should be undertaken on a regular basis to ensure medication adherence and patient compliance. Another study conducted in the Saurashtra region of Gujarat consisted of 178 T2D patients. This study focused on monitoring self-care practices by individuals. Factors like diet and exercise compliance were determined through history shared by the patients. It was concluded that patients with high socio-economic status and higher education tended to have better self-care adherence as compared to people with low socio-economic status [14]. A similar study was conducted in the Anand district of Gujarat. This study included 100 T2D patients and monitored self-care practices associated with exercise, diet compliance, medication adher-

ence, monitoring of blood glucose, foot care, problem solving, and psychosocial adjustment. The medication adherence score of individuals was 88.1%. The overall score associated with all these parameters was 54.41%. This study also concluded that self-care initiatives and programs should be undertaken [15].

Registered medical practitioners along with pharmacists are responsible for spreading awareness about diabetes, emphasizing the importance of a healthy lifestyle and regular check-ups. It is imperative to educate patients about diabetes signs and symptoms, manage them, and encourage early diagnosis and treatment. Also, patients can be guided related to medications that interact with specific foods and drinks, such as alcohol, high-fat dairy products, and fruits and vegetables. Furthermore, to increase awareness related to diabetes, the government should introduce schemes, collaborate with NGOs and companies, and conduct campaigns. Advertising in television, magazines, newspapers, and radio can also generate awareness. Social media is a powerful tool for youths, to raise awareness about diabetes complications. Additionally, an increase in the compliance rate is directly related to literacy, with higher literacy resulting in higher compliance rates.

The small sample size was a limitation of the study. A larger sample size would have enabled us to reliably analyze the findings and predict compliance and adherence rates. Furthermore, the duration of the study could also be increased, so that follow-ups could be included. Another limitation of the study is that only one geographical region was screened for the present study. Screening in a wider region can be beneficial as more diverse datasets can be produced.

Conclusions

Healthcare organizations should support education for efficient diabetes management, control, and prevention, and there is a need to raise awareness and understanding of self-management of diabetes mellitus. A major reason for non-compliance might be an excessively busy lifestyle. Nowadays, people have a very hectic lifestyle, and this can be a major reason for forgetfulness and eventually non-compliance. Also, false information regarding the disease and taking multiple therapies for the same disease condition can lead to patient non-compliance. This can be improved through better access to care, education, and support. Improved access to healthy food, exercise, and lifestyle choices can also help reduce the risk of developing T2D. Finally, these patients can keep on track with their treatment plans by using self-management strategies. Nowadays, smartphones are accessible to everyone, and thus daily reminders of medications may be an effective option

to avoid non-compliance. Moreover, policies regarding these can be implemented. Charts and posters can be circulated in hospitals and schools to enhance compliance and awareness. Moreover, short-duration awareness programs can be curated to reach a large audience either online mode or offline. However, online methods provide better reach.

Article information

Supplementary material

Supplementary materials for this article can be found at https://journals.viamedica.pl/clinical_diabetology/article/view/100771

Data availability statement

The data that support the findings of this study are available on request from the corresponding author.

Informed consent

Patients were enrolled after signing an informed consent form.

Author contributions

DS, DG, DK, VD, YP, MP, and JS conceptualized and planned the study. DS, DG, DK, VD, YP, and JS coordinated and conducted this study. DS, DG, DK, VD, and RS compiled the data and wrote the manuscript. RS revised the manuscript. YP, MP, and JS supervised the project.

Funding

None.

Acknowledgments

We would like to acknowledge Swasthya Diabetic Care Hospital and Dr. Yash Patel for their support in this study. We would also like to acknowledge Institute of Pharmacy, Nirma University, for providing the platform and facilities to conduct this study.

Conflict of interests

The authors declare no conflict of interest.

REFERENCES

- Suryasa I, Rodríguez-Gámez M, Koldoris T. Health and treatment of diabetes mellitus. *International journal of health sciences*. 2021; 5(1), doi: [10.53730/ijhs.v5n1.2864](https://doi.org/10.53730/ijhs.v5n1.2864).
- Saeedi P, Petersohn I, Salpea P, et al. IDF Diabetes Atlas Committee. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9 edition. *Diabetes Res Clin Pract*. 2019; 157: 107843, doi: [10.1016/j.diabres.2019.107843](https://doi.org/10.1016/j.diabres.2019.107843), indexed in Pubmed: [31518657](https://pubmed.ncbi.nlm.nih.gov/31518657/).
- Hernandez AM, Jia P, Kim HY, et al. Geographic Variation and Associated Covariates of Diabetes Prevalence in India. *JAMA Netw Open*. 2020; 3(5): e203865, doi: [10.1001/jamanetworkopen.2020.3865](https://doi.org/10.1001/jamanetworkopen.2020.3865), indexed in Pubmed: [32356884](https://pubmed.ncbi.nlm.nih.gov/32356884/).
- McIntyre HD, Catalano P, Zhang C, et al. Gestational diabetes mellitus. *Nat Rev Dis Primers*. 2019; 5(1): 47, doi: [10.1038/s41572-019-0098-8](https://doi.org/10.1038/s41572-019-0098-8), indexed in Pubmed: [31296866](https://pubmed.ncbi.nlm.nih.gov/31296866/).
- Alam S, Hasan M, Neaz S, et al. Diabetes Mellitus: Insights from Epidemiology, Biochemistry, Risk Factors, Diagnosis, Complications and Comprehensive Management. *Diabetology*. 2021; 2(2): 36–50, doi: [10.3390/diabetology2020004](https://doi.org/10.3390/diabetology2020004).
- Tomic D, Shaw JE, Magliano DJ. The burden and risks of emerging complications of diabetes mellitus. *Nat Rev Endocrinol*. 2022; 18(9): 525–539, doi: [10.1038/s41574-022-00690-7](https://doi.org/10.1038/s41574-022-00690-7), indexed in Pubmed: [35668219](https://pubmed.ncbi.nlm.nih.gov/35668219/).
- Maruthur NM. The growing prevalence of type 2 diabetes: increased incidence or improved survival? *Curr Diab Rep*. 2013; 13(6): 786–794, doi: [10.1007/s11892-013-0426-4](https://doi.org/10.1007/s11892-013-0426-4), indexed in Pubmed: [24072478](https://pubmed.ncbi.nlm.nih.gov/24072478/).
- Taher T, Majed J, Ahmed Y, et al. The Causes of Non-Compliance to Treatment Among Type 2 Diabetes Mellitus Patients. *Journal of Contemporary Studies in Epidemiology and Public Health*. 2021; 2(2): ep21006, doi: [10.30935/jconseph/11276](https://doi.org/10.30935/jconseph/11276).
- Verhave JC, Fesler P, Ribstein J, et al. Estimation of renal function in subjects with normal serum creatinine levels: influence of age and body mass index. *Am J Kidney Dis*. 2005; 46(2): 233–241, doi: [10.1053/j.ajkd.2005.05.011](https://doi.org/10.1053/j.ajkd.2005.05.011), indexed in Pubmed: [16112041](https://pubmed.ncbi.nlm.nih.gov/16112041/).
- Nagarathna R, Bali P, Anand A, et al. Prevalence of Diabetes and Its Determinants in the Young Adults Indian Population-Call for Yoga Intervention. *Front Endocrinol (Lausanne)*. 2020; 11: 507064, doi: [10.3389/fendo.2020.507064](https://doi.org/10.3389/fendo.2020.507064), indexed in Pubmed: [33362708](https://pubmed.ncbi.nlm.nih.gov/33362708/).
- Prasannakumar M, Rajput R, Seshadri K, et al. An observational, cross-sectional study to assess the prevalence of chronic kidney disease in type 2 diabetes patients in India (START -India). *Indian J Endocrinol Metab*. 2015; 19(4): 520–523, doi: [10.4103/2230-8210.157857](https://doi.org/10.4103/2230-8210.157857), indexed in Pubmed: [26180769](https://pubmed.ncbi.nlm.nih.gov/26180769/).
- Kumpatla S, Medempudi S, Manoharan D, et al. Knowledge and Outcome Measure of HbA1c Testing in Asian Indian Patients with Type 2 Diabetes from a Tertiary Care Center. *Indian J Community Med*. 2010; 35(2): 290–293, doi: [10.4103/0970-0218.66858](https://doi.org/10.4103/0970-0218.66858), indexed in Pubmed: [20922109](https://pubmed.ncbi.nlm.nih.gov/20922109/).
- Mishra R, Sharma SK, Verma R, et al. Medication adherence and quality of life among type-2 diabetes mellitus patients in India. *World J Diabetes*. 2021; 12(10): 1740–1749, doi: [10.4239/wjd.v12.i10.1740](https://doi.org/10.4239/wjd.v12.i10.1740), indexed in Pubmed: [34754375](https://pubmed.ncbi.nlm.nih.gov/34754375/).
- Joshi J, Patel P, Gandhi S, et al. Factors influencing adherence to self-care practices among patients of type 2 diabetes mellitus from Saurashtra region of Gujarat: A conclusive research. *J Family Med Prim Care*. 2022; 11(10): 6395–6401, doi: [10.4103/jfmpc.jfmpc_473_22](https://doi.org/10.4103/jfmpc.jfmpc_473_22), indexed in Pubmed: [36618213](https://pubmed.ncbi.nlm.nih.gov/36618213/).
- Raithatha SJ, Shankar SU, Dinesh K. Self-Care Practices among Diabetic Patients in Anand District of Gujarat. *ISRN Family Med*. 2014; 2014: 743791, doi: [10.1155/2014/743791](https://doi.org/10.1155/2014/743791), indexed in Pubmed: [24967330](https://pubmed.ncbi.nlm.nih.gov/24967330/).