

Knowledge and Practice of Diabetics towards Their Disease at Tertiary Care Hospital

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Abstract

Objective: To assess the knowledge and practice of diabetics towards their disease at tertiary care Hospital.

Methods: This is cross sectional study was conducted at department of Diabetic Clinic, Jinnah Postgraduate Medical Centre and Civil Hospital, Karachi from August 2022 to December, 2023. Total 250 diabetic patients of age 18-80 years, either gender, were included in this study. Disabled, blind and patients not willing to participate, were excluded. All relevant features including age, gender, duration of disease, educational status, family history, basic knowledge about diabetes, symptoms, risk factors, complications, prevention, frequency and monitoring of blood glucose, self-exercise practice, weight monitoring, eye checkup, foot care and dietary practice were recorded on a structured questionnaire. SPSS version 10 was used for data analysis.

Results: A total of 250 patients were enrolled in this study 100(40%) were males and 150(60%) were females. Majority were in the age group between 41 and 50 years. 65 (26%) were not aware of the term diabetes. Majority had a fairly good knowledge about symptoms, risk factors, complications and prevention of diabetes however most were unaware of its types, 65% were not practicing exercise, 58% were not getting their eye checkup and majority did not practice foot care.

Conclusion: Despite having satisfactory knowledge, the practice of the patients was not up to the mark. A multidisciplinary approach is required to motivate patients to actively participate in self-management of the disease.

Key Words: Diabetes Mellitus, Knowledge, Practice.

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Introduction

Diabetes mellitus (DM) represents a major threat to global public health, which is rapidly worsening and has the greatest impact on working-age adults in developing countries¹. At least 171

million people worldwide suffer from diabetes. This number is expected to more than double to 366 million by 2030². The epidemic is particularly acute in Southeast Asia, with Pakistan experiencing the highest growth in diabetes. Type 2 DM is the main problem and is thought to account for over 90% of these cases³. WHO estimates that the prevalence of diabetes in Baluchistan 8.6%, NWFP 11.1%, and Sindh provinces 13.9% of Pakistan⁴. This reduce the risk of long-term complications, diabetes mellitus demands continuous medical care, patient self-management, and education⁵. Control of these complications is possible and can lead to reduction in morbidity, mortality and healthcare costs⁶. Proper management of DM requires a multidisciplinary approach, which involves the physician, dietician, surgeon, nurse and chiroprapist and most importantly,

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active participation of the patient and the attendants⁷. It consists of proper explanation to the patient and his/her attendant in a simple and legible manner, about the nature of the disease, its effects on the body, the fact that it is a life-long disorder, treatable but not curable⁸. One reason for poor management of diabetes among individuals could be their total or partial lack of knowledge and awareness about the disease⁹.

Patients with diabetes mellitus often lack sufficient knowledge about their disease and therefore often lack self-management skills. It is not known how much the patient actually knows about his disease. An understanding of the level of awareness is helpful for health educators to plan future programs. The purpose of this study is to gauge patient knowledge and practice, identify areas of deficiency, and use this information to tailor future educational efforts for better diabetes care.

Methodology

This is cross-sectional study conducted on 250 patients who attended for routine visits in Diabetic Clinic, Jinnah Postgraduate Medical Centre and Civil Hospital, Karachi during the time period of August 2022 to December 2023. Patients of any gender, 18 years and above and patients with confirmed diagnosis of diabetes mellitus (diagnosis previously made by a physician, blood reports with FBS > 126 mg/dl or RBS > 140 mg/dl or those taking anti diabetic medications). Disabled, blind and patient not willing to participate were excluded from this study. The questionnaire is divided into three sections: sociodemographic information, knowledge assessment, A 3-point itemized scale of "yes", "No" and "Not sure" was used for responses, and practice assessment. Every question received one mark. The following categories applied to the knowledge score, which varied from 0 to 9: <4 = poor knowledge, 4-6 = average knowledge, and >6 = good knowledge. The total practice score was 36 and categorized as: < 13 = poor, 13-24 = satisfactory, >24 = good.

Patients attending the Diabetic Clinic of Jinnah Postgraduate Medical Centre were selected fulfilling the inclusion and exclusion criteria. An informed

consent was taken and ethical issues and benefits were discussed. Patients were required to answer a total of 35 questions. The questions were read and explained in Urdu. Questions to assess knowledge were divided into five main sections, with each section focusing on the different aspects of diabetes mellitus, namely, basic knowledge about diabetes, symptoms, risk factors, complications, prevention were recorded as 'Yes', 'No' or 'Not sure'. Questions regarding practice of diabetics included frequency and monitoring of blood glucose, self-exercise practice, weight monitoring, eye checkup, foot care and dietary practice.

SPSS version 22 was used for data analysis. Mean \pm standard deviation was used to represent the response variables, which included age and length of diabetes To represent the qualitative response variables, such as educational status, family history of diabetes, participants' general knowledge of diabetes, symptoms, risk factors, complications, and knowledge of diabetes prevention and practice, diabetes monitoring, body weight, eye examination, self-exercises, and food intake exercises, frequencies and percentages were computed. The significance of the proportions of qualitative response variables was compared using the chi-square test. A result was deemed statistically significant if the P value was less than 0.05.

Results

Among the 250 diabetics in the study, 100 (40%) were men and 150 (60%) were women, with a male-to-female ratio of 1:1.5. The mean age of the 250 participants was 47.36 ± 11.29 (range 18 to 80) years. Demographic characteristics such as age, male to female ratio, educational status, disease duration, and practice of participants in foot examination are shown in table I.

Each patient was asked to complete a questionnaire to assess their knowledge about the disease. 117 (46.6%) have average knowledge, 89 (35.6%) have poor knowledge and 44 (17.6%) have good knowledge about their disease. Patients' responses to the knowledge questionnaire are shown in Table 2. When participants were asked whether

diabetes means high urine sugar, 170 (68%) responded yes, 7 (2.8%) no and 65 (26%) had no idea about the term diabetes. Only 44 (17.6%) participants were aware of the main types of diabetes i.e. type-I and type-II while majority (79.6%) were unsure about the main types of diabetes. Majority (72.4%) of the participants were consistent with the statement that diabetes is not contagious, but (61.2%) believed that diabetes is not curable and only 27.6% thought that diabetes is curable (Table-2).

Similarly, a practice assessment questionnaire was used among patients. The majority of the 153 patients (61.2%) reported having regular, satisfactory follow-up appointments. Of the total, 62 (24.8%) have good practice and 35 (14%) have poor practice. When participants were asked about diabetes monitoring practice, the majority (95.2%) relied on laboratory testing, while only 12 (4.8%) used a home glucometer. Most participants (52.4%) reported monitoring their diabetes monthly. When participants were asked about self-exercise practice, 80 (32%) participants responded that they led a sedentary lifestyle, 65 (26%) said they did not exercise but were active, and 55 (22%) exercised 15-30 minutes daily. The majority of participants (58.4%) checked their body weight monthly, but the majority (58%) never consulted an ophthalmologist (Table 3).

Table 1. Demographic profile of diabetic participants (n=250)

Variable	n(%)
Gender Distribution	
· Male	100 (40.0)
· Female	150 (60.0)
Age Distribution (Mean ±SD age 47.36 ± 11.29 years)	
· <21 Years	1 (0.4)
· 21 To 30 Years	18 (7.2)
· 31 To 40 Years	57 (22.8)
· 41 To 50 Years	91 (36.4)
· 51 To 60 Years	59 (23.6)
· 61 To 70 Years	19 (7.6)
· 71 To 80 Years	5 (2.0)
Education Status	
· Illiterate	126 (50.4)
· Upto 5 Years	21 (8.4)
· > 5 To 8 Years	40 (16)
· > 8 To 10 Years	35 (14)
· > 10 To 12 Years	8 (3.2)
· > 12 To 16 Years	20 (16)
Duration Of Diabetes	

· Upto 1 Years	15 (6)
· >1 To 5 Years	66 (26.4)
· > 5 To 10 Years	77 (30.8)
· >10 To 15 Years	48 (19.2)
· >15 To 20 Years	31 (12.4)
· >20 Years	13 (5.2)

Family History Of Diabetes

· Yes	137 (55)
· No	113 (45)

Table 2. Knowledge of the Diabetic Participants

Questionnaire	Yes n(%)	No n(%)	No Sure n(%)
General Knowledge Of The Participants On Diabetes			
Diabetes Means High Urine Sugar	170(68)*	15 (6)	65 (26)
Main Types Of Diabetes: Type I & Type II	44 (17.6)	7 (2.8)	199 (79.6)*
Diabetes Is Contagious	13 (5.2)	181 (72.4)*	56 (22.4)
Diabetes Is Curable	69 (27.6)	153 (61.2)*	28 (11.2)
Infection Is Likely To Increase Blood Sugar Levels	130 (52)*	39 (15.6)	81 (32.4)
Eating Too Much Sugar Is A Cause Of Diabetes	207 (82.8)*	30 (12)	13 (5.2)
If I Am Diabetic My Children Have A Higher Chance Of Being Diabetic	186 (74.4)*	19 (7.6)	45 (18)
Cuts And Abrasions Heal Slowly On Diabetics	232 (92.8)*	6 (2.4)	12 (4.8)
Knowledge of The Participants About Symptoms Of Diabetes			
Excessive Thirst	243 (97.2)*	2 (0.8)	5 (2)
Hunger	224 (89.6)*	7 (2.8)	19 (7.6)
Frequent Urination	241 (96.4)*	3 (1.2)	6 (2.4)
Weight Loss	202 (80.8)*	13 (5.2)	35 (14)
Tiredness	242 (96.8)*	1 (0.4%)	7 (2.8%)
Blurred Vision	244 (97.6)*	1 (0.4%)	5 (2%)
Knowledge of The Participants About Risk Factors Of Diabetes			
Obesity	209 (83.6)*	15 (6)	26 (10.4)
Sedentary Lifestyle	199 (79.6)*	12 (4.8)	39 (15.6)
Positive Family History	208 (83.2)*	11 (4.4)	31 (12.4)
Aging	181 (72.4)*	20 (8)	49 (19.6)
Knowledge of The Participants About Complications Of Diabetes			
Blindness	237 (94.8)*	1 (0.4)	12 (4.8)
Stroke	234 (93.6)*	3 (1.2)	13 (5.2)
Kidney Failure	241 (96.4)*	1 (0.4)	8 (3.2)
Hypertension/ Mi	234 (93.6)*	4 (1.6)	12 (4.8)
Foot Problem	243 (97.2)*	4 (1.6)	3 (1.2)
Loss Of Sensation In Limbs	242 (96.8)*	3 (1.2)	5 (2)
Knowledge of The Participants About Prevention Of Diabetes			
Regular Exercise	232 (92.8)*	4 (1.6%)	14 (5.6)
Quit Smoking	132 (52.8)*	14 (5.6)	104 (41.6)
Healthy Balanced Diet	229 (91.6)*	6 (2.4)	15 (6)
Good Weight Control	228 (91.2)*	5 (2)	17 (6.8)

*Shows statistically significantly high proportions at p<0.001

Table 3. Practice of the diabetic participants

Variable	Statisticsn(%)	P Value
Practice To blood sugar Monitoring		
· Home Glucometer	12 (4.8)	<0.001*
· Laboratory Testing	238 (95.2)*	
Self –Exercise Practice Of The Participants		
· Sedentary Lifestyle	80 (32)*	<0.001*
· No Exercise But Active	65 (26)	
· Less Than 15 Minutes A Day	15 (6)	
· 15-30 Minutes A Day	55 (22)	
· 30-60 Minutes A Day	33 (13.2)	
· One Hour A Day	2 (0.8)	
Practice Of The Participants Towards Monitoring Of Body Weight		
· Monthly	146 (58.4)*	<0.001*
· Twice A Month	80 (32)	
· Once In 3 Months	13 (5.2)	
· Never	11 (4.4)	
Practice Of The Participants Towards Eye Check Up		
· Once In A Year	74 (29.6)	<0.001*
· Once In 3 Years	24 (9.6)	
· Once In 5 Years	4 (1.6)	
· Once In 10 Years	3 (1.2)	
· Never	145 (58)*	
Practice of the participants towards their feet inspection		
· Yes	100(40)	<0.001*
· No	150(60)*	
Dietary Practice Of The Participants Towards Fruits		
· Once A Day	52 (20.8)	<0.001*
· > Once A Day	1 (0.4)	
· Once A Week	59 (23.6)	
· > Once A Week	72 (28.8)*	
· Never	66 (26.4)	
Dietary Practice of The Participants Towards Vegetables		
· Once A Day	145 (58)*	<0.001*
· > Once A Day	6 (2.4)	
· Once A Week	7 (2.8)	
· > Once A Week	92 (36.8)	
Dietary Practice of The Participants Towards Sugar/ Sweets		
· Once A Day	16 (6.4)	<0.001*
· Once A Week	40 (16)	
· > Once A Week	15 (6)	
· Never	179 (71.6)*	
Dietary Practice of The Participants Towards Fried Food		
· Once A Day	7 (2.8)	P<0.001*
· Once A Week	64 (25.6)	
· > Once A Week	36 (14.4)	

Discussion

To highlight the patient's knowledge of the disease regarding its pathophysiological and nutritional aspects, its treatment as well as physical activity, foot care, self-control, hypoglycemia, chronic complications and prevention of diabetes^{10,11}. This evaluation had two main goals, the first was to diagnose the patients' knowledge regarding their disease in terms of types of diabetes, symptoms,

risk factors and complications of diabetes mellitus and second concerned the assessment of the practice of these patients towards monitoring of blood glucose, self-exercise practice, weight monitoring, eye checkup, foot care and dietary practice.

This procedure is in agreement with one of the components of a study done by SK Gupta et al¹², in which the authors made strategy for assessment of patient's knowledge and practice before attending awareness program. The authors re-evaluate the same parameters for the same patient group post-intervention and report that gathering information during both the pre- and post-intervention stages is necessary for an accurate assessment of the results of a diabetes education program. Therefore, my research study in Pakistan will become a foundation stone for the future research workers in which they will be able to add the evaluation on pre-intervention and post-intervention stages through designing and implementing the educational programs for the diabetics.

To gauge the effects of knowledge on practice among diabetic patients, participants of the present study were asked whether diabetes meant high urine sugar, 170 (68%) responded yes, 7 (2.8%) no and 65 (26%) had no idea about the term diabetes. Only 44 (17.6%) participants were aware of main types of diabetes. Majority (72.4%) considered diabetes as non-contagious, (61.2%) believed that diabetes is not curable. Majority (82.8%) considered that eating too much sugar is a cause of diabetes, contrary (12%) considered factors other than eating too much sugar. The global study assessed participants on six dimensions of their understanding of diabetes, including their understanding of the disease itself, its symptoms, possible complications, methods of prevention, and diet and exercise considerations. Over fifty percent (57%) of the respondents revealed that they were aware of the nature of diabetes¹³.

Regarding the general aspects of diabetes - concept, physiopathology and treatment - there was although not so desirable knowledge but somewhat satisfactory knowledge of the participants, which is comparable with other studies¹⁴. Some authors have also found a significant difference in all measures assessing patients' knowledge of aspects related to diabetes and nutrition. However, a study from Malaysia found that knowledge, attitude and practice were rated highly^{15,16}. The variations in the literacy rates of the study participants may account for the discrepancies in the results between various studies. It is commonly known that patient participation in diabetes management is necessary for improved disease control¹⁷.

In terms of education, the study found that 61 participants 24.4%, had either primary or elementary education, which is consistent with the study on the prevalence in Brazil. Nearly half of the sample, or 50.4%, had no education¹⁸.

In a study that compared knowledge levels before and after the educational program was implemented, group education was found to be effective in raising knowledge about self-monitoring capillary glucose¹⁹. A large study suggested that self-monitoring of blood glucose can play an important role in improving metabolic control when it is integral to a broader educational strategy to promote patient autonomy. No association could be found in any other patient, regardless of the type of treatment²⁰.

It is important to understand that the diabetic's knowledge of the disease is the basis for diabetes self-management, but gaining knowledge does not necessarily mean a change in behavior²¹. However, majority (58%) of the participants described that they eat vegetables once a day compared to 92 (36.8%) participants who were eating vegetables more than once a week. This might be due to non-affordability and awareness about the required calories for a diabetic patient. A limitation of the study was that we did not evaluate the socio-economic status or income per capita so that we could make some inference about the compliance to the treatment and nutritional aspects. One study proved that

general attitude towards self-care and diabetes was positive with most of the respondents (95%) willing to make changes for diet, exercise and maintaining suitable weight. This study demonstrated that this willingness is not transferable to actual practice²². Knowledge of the participants about prevention of diabetes in the present study indicated a need for regular exercise by 92.8% of the participants followed by healthy balance diet by 91.6%, good weight control by 91.2% and quit smoking by 52.8% participants.

Awareness programs need to be established on the importance of glycemic control, exercise and prevention of complications. Diabetes knowledge and self-management skills should be reviewed regularly. Certain programs such as exercise and self-monitoring programs should be organized. A tailored program with gradual introduction of exercises is recommended, taking into account the age of the individual. A weight loss program with dietary changes is also recommended for overweight people, while a weight maintenance program is recommended for people with normal body weight. A continuous self-monitoring system should be implemented for diabetics. This allows them to continually monitor their blood sugar levels and manage their diet accordingly²³. Studies in a similar context, but with a larger scope and much larger sample size, are recommended to confirm the results of this study and to further investigate other relevant factors, particularly factors influencing practice and perception.

Conclusion

The study showed that diabetics' knowledge of symptoms, risk factors, complications and prevention was quite satisfactory, but most patients were unaware of the type of diabetes. Despite satisfactory knowledge, the patients' practice did not meet the requirements. Efforts must be made to educate patients about a healthy lifestyle. Patients should be advised to have regular check-ups, exercise and a balanced diet. They also need to be educated about the importance of self-monitoring of blood glucose (SMBG) in controlling their disease and preventing complications. In addition to pharmacolog-

ical treatment, a multidisciplinary approach is required to motivate and support patients to actively participate in self-management of the disease.

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References

- Tomic D, Shaw JE, Magliano DJ. The burden and risks of emerging complications of diabetes mellitus. *Nature Reviews Endocrinology*. 2022;18(9):525-39. [DOI: 10.1038/s41574-022-00690-7].
- Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes care*. 2004;27(5):1047-53. [DOI: 10.2337/diacare.27.5.1047].
- Meo SA, Zia I, Bukhari IA, Arain SA. Type 2 diabetes mellitus in Pakistan: current prevalence and future forecast. *J. Pakistan Med. Assoc.* 2016;66(12):1637–42. Available from: <https://pubmed.ncbi.nlm.nih.gov/27924966/>. Accessed on 25th August 2024.
- Azeem S, Khan U, Liaquat A. The increasing rate of diabetes in Pakistan: A silent killer. *Annals of medicine and surgery*. 2022;79:1-2. [DOI: 10.1016/j.amsu.2022.103901].
- American Diabetes Association. Standards of medical care for patients with diabetes mellitus. *Diabetes care*. 2002;25(1):s33-49. [DOI: 10.2337/diacare.26.2007.s33].
- Harding JL, Pavkov ME, Magliano DJ, Shaw JE, Gregg EW. Global trends in diabetes complications: a review of current evidence. *Diabetologia*. 2019;62:3-16. [DOI: 10.1007/s00125-018-4711-2].
- Cairns SR, Sjöström ES. Dietitians' perspectives on challenges and prospects for group-based education to adults with type 1 diabetes—a qualitative study. *BMC Endocrine Disorders*. 2022;22(1):249. [DOI: 10.1186/s12902-022-01165-6].
- Toor AA, Nigh-e-Mumtaz S, Syed R, Yousuf M, Syeda A. Surgical safety practices in Pakistan. *Breast*. 2013;8(7.7):7-9. Available from: <https://pubmed.ncbi.nlm.nih.gov/23865137/>. Accessed on 25th August 2024.
- Hall CE, Hall AB, Kok G, Mallya J, Courtright P. A needs assessment of people living with diabetes and diabetic retinopathy. *BMC research notes*. 2016;9:1-4. [DOI: 10.1186/s13104-016-1870-4].
- Nguyen VB, Thi KH, Nguyen TX, Pham NT, Nguyen VV, Van Le C. Diabetes self-management and its associated factors among patients with diabetes in central Vietnam: A cross-sectional study. *PLoS one*. 2022;17(7):1-13. [DOI: 10.1371/journal.pone.0270901].
- Antar SA, Ashour NA, Sharaky M, Khattab M, Ashour NA, Zaid RT, et al. Diabetes mellitus: Classification, mediators, and complications; A gate to identify potential targets for the development of new effective treatments. *Biomedicine & Pharmacotherapy*. 2023;168:1-25. [DOI: 10.1016/j.biopha.2023.115734].
- Gupta SK, Lakshmi PV, Rastogi A, Kaur M. Protocol: Development and evaluation of self-care intervention to improve self-care practices among people living with type 2 diabetes mellitus: a mixed-methods study protocol. *BMJ Open*. 2021;11(7):12-5. [DOI: 10.1136/bmjopen-2020-046825].
- Abdulrahman M, Husain ZS, Abdouli KA, Kazim MN, Ahmad FS, Carrick FR. Association between knowledge, awareness, and practice of patients with type 2 diabetes with socio-economic status, adherence to medication and disease complications. *diabetes research and clinical practice*. 2020;163:1081-24. [DOI: 10.1016/j.diabres.2020.108124].
- Sharma PK, Rajpal N, Upadhyay S, Shaha D, Deo N. Status of diabetes control and knowledge about diabetes in patients. *Endocrinologia, diabetes y nutricion*. 2021;68(10):716-27. [DOI: 10.1016/j.endien.2021.12.003].
- Coleman SE, Caswell N. Diabetes and eating disorders: an exploration of Diabulimia. *BMC psychology*. 2020;8:1-7. [DOI: 10.1186/s40359-020-00468-4].
- Lim SC, Mustapha FI, Aagaard-Hansen J, Calopietro M, Aris T, Bjerre-Christensen U. Impact of continuing medical education for primary healthcare providers in Malaysia on diabetes knowledge, attitudes, skills and clinical practices. *Medical education online*. 2020;25(1):1710330. [DOI: 10.1080/10872981.2019.1710330].
- Ojjeabu WA, Bello SI, Arute JE. Evaluation of pharmacists' educational and counselling impact on patients' clinical outcomes in a diabetic setting. *Journal of Diabetology*. 2017;8(1):7-11. [DOI: 10.4103/jod.jod_5_17].
- do Valle Nascimento TM, Resnicow K, Nery M, Brentani A, Kaselitz E, Agrawal P, et al. A pilot study of a Community Health Agent-led type 2 diabetes self-management program using Motivational Interviewing-based approaches in a public primary care center in São Paulo, Brazil. *BMC health services research*. 2017;17:1-10. [DOI: 10.1186/s12913-016-1968-3].
- de Vera-Gómez PR, Mateo-Rodríguez C, Vivas-López C, Serrano-Olmedo I, Méndez-Muros M, Morales-Portillo C, et al. Effectiveness of a flash glucose monitoring systems implementation program through a group and telematic educational intervention in adults with type 1 diabetes.

- Endocrinología, Diabetes Nutrición (English ed.). 2022 Nov 1;69(9):657-68. [DOI: 10.1016/j.endien.2022.11.002].
20. Manios Y, Lambrinou CP, Mavrogianni C, Cardon G, Lindström J, Iotova V, et al. Lifestyle changes observed among adults participating in a family- and community-based intervention for diabetes prevention in Europe: the 1st year results of the Feel4Diabetes-study. *Nutrients*. 2020;12(7):1949-52. [DOI: 10.3390/nu12071949].
21. van Puffelen AL, Rijken M, Heijmans MJ, Nijpels G, Schellevis FG. Diacourse Study Group. Effectiveness of a self-management support program for type 2 diabetes patients in the first years of illness: Results from a randomized controlled trial. *PLoS One*. 2019;14(6):1-15. [DOI: 10.1371/journal.pone.0218242].
22. Ahmad F, Joshi SH. Self-Care Practices and Their Role in the Control of Diabetes: A Narrative Review. *Cureus*. 2023;15(7):23-5. [DOI: 10.7759/cureus.41409].
23. Du Y, Dennis B, Rhodes SL, Sia M, Ko J, Jiwani R, et al. Technology-assisted self-monitoring of lifestyle behaviors and health indicators in diabetes: qualitative study. *JMIR diabetes*. 2020;5(3):1-12. [DOI: 10.2196/21183].



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