Electronic Journal of General Medicine
2024, 21(1), em565
e-ISSN: 2516-3507
https://www.ejgm.co.uk/

MODESTUM

Original Article

OPEN ACCESS

The nonadherence to prescriptions among type 2 diabetes patients, and its determining factors

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Citation: Karymsakov A, Foster F, Toleubekova L, Yegembayeva N, Gaipov A, Aljofan M. The nonadherence to prescriptions among type 2 diabetes patients, and its determining factors. Electron J Gen Med. 2024;21(1):em565. https://doi.org/10.29333/ejgm/14094

ARTICLE INFO

Received: 24 Apr. 2023

Accepted: 08 Dec. 2023

ABSTRACT

Aim: The aim is to clarify the prevalence of nonadherence to antidiabetic therapies among type 2 diabetes mellitus (T2DM) patients and identify its causes.

Methods: A three-part questionnaire (general background, Knowledge-Attitude-Practice section, and non-adherence reasons) was developed. In total 324 diabetic patients were surveyed via telephone. The evaluation of patient adherence included both direct questions on adherence and a summary of patient responses to non-adherence comments. The analysis was performed on StataCorp Stata 14.2, and included descriptive analysis, simple and multivariate logistic regression.

Findings: Among the sociodemographic variables, age group, work level, and alcohol consumption may influence medication adherence. The comorbidity status of patients was also of relevance. Both variables had stronger relationships with adherence to anti-diabetic treatments compared to those with no comorbidities or no additional medicines. A strength of the study is that it addresses various medical diseases and attitudes about them, as well as a wide range of causes for non-adherence to non-diabetic medications.

Keywords: diabetes, adherence, compliance, T2DM

INTRODUCTION

Drug adherence is the degree to which a patient follows and strictly adheres to medical recommendations, such as medication schedule, dose, and frequency [1]. When a patient takes prescribed medications at the doses and times indicated by a healthcare professional and with the patient's agreement, they are considered compliant [2, 3].

Patients are typically required to strictly adhere to prescribed medical treatment to obtain the desired medical outcomes. From the perspective of disease treatment, the patient's inability to completely comply to the prescribed pharmaceutical regimen may certainly have severe and harmful effects. World Health Organization (WHO) reports that roughly 50.0% of patients do not take their recommended drugs [4]. This percentage can be significantly higher in underdeveloped nations due to a variety of reasons, including patient literacy, the prescription of complex medications, and the duration of the sickness [4]. For the latter, there is evidence that individuals with chronic illnesses struggle to adhere to their prescribed treatment regimen [5]. For example, it was observed that the adherence rate for medications intended to be taken over an extended period fell by almost 50.0% [6]. According to [7], disease duration is a significant factor that can influence drug adherence. It was reported that the nonadherence rate was 53.0% for patients with a disease duration of more than one year and 1.0% for patients with a sickness duration of less than one month [7].

Type 2 diabetes mellitus (T2DM), a chronic metabolic condition characterized by high glucose levels in the blood, is projected to affect 642 million patients worldwide by 2040 [8, 9]. Although the number of diabetes patients in Kazakhstan, a developing landlocked country in central Asia, is unclear, it is believed to be comparable to the global incidence of 12.5% among individuals over 50 [10].

The rate and prevalence of nonadherence to antidiabetic medication in Kazakhstan are unknown and have not been studied. Thus, the purpose of the present study is to assess the rate and prevalence of nonadherence to antidiabetic therapies among T2DM patients, as well as the factors that contribute to this phenomenon. Determining the prevalence of adherence and the factors that influence it can assist practitioners provide patients with better healthcare and more successful treatment regimens.

STUDY DESIGN

After reviewing relevant literature, a questionnaire with three parts (general background, KAP section, and reasons for non-adherence) was developed. The questionnaire was piloted

with 22 randomly selected individuals to validate it. Eligible patients were interviewed in person, but due to the pandemic, some patients were interviewed over the phone. Patients' adherence was evaluated using both direct questions about adherence and a summary of their responses to non-adherence statements.

Statistical Evaluation

StataCorp Stata 14.2 software was used for statistical analysis in this study. Initially, descriptive analysis of the given responses was performed, with means, medians, standard deviations, and frequencies calculated. The strength of the association variables was assessed using simple logistic regression. To control for the presence of confounders, multivariate analysis was also performed using logistic regression. The p>|z| value was checked in each analysis to determine the statistical significance of the results.

Patient Qualifying Requirements

The inclusion criteria for the trial were consenting individuals older than 18 years with confirmed T2DM. Patients in significant distress, newly diagnosed individuals, and patients with apparent psychiatric disorders were excluded from the study.

Study Variables

Dependent variables

Dependent variables are non-adherence to prescriptions.

Independent variables

Independent variables are socio-demographic factors, medication-related factors, morbidity-related factors, and patient-provider relationship.

RESULTS

Socio-Demographic Features of Population

324 diabetic patients were questioned, where 164 (59.6%) were female, 262 (98.9%) lived in the city, 194 (80.2%) were married, aged 60 to 69, had a bachelor's degree, and did not smoke or drink alcohol (**Table 1**).

Awareness of Diabetes

Patients' awareness of the condition and treatment was classified as "full knowledge" when they provided all correct responses, and "minimal knowledge" when they provided only erroneous responses or expressly said they did not know. "Relatively adequate" and "relatively insufficient" refer to

Table 1. Summary of demographic variables analyzed in the study

Gender		Number of respondents		Percentage (%)	
Male		113			
Female		164			
Residence location		Number of respondents		Percentage (%)	
In the city		262		98.9	
In a village		2		0.8	
Other option		1		0.4	
Marital status		Number of respondents		Percentage (%)	
Married		194		79.51	
Not married		17		6.97	
Divorced		4		1.64	
Widowed		28		11.48	
Other		1		0.41	
Age	Number	Mean	Std dev	Min	Max
	267	59.08	12.175	23	83
Age group		Number of respondents		Percentage (%)	
Less than 40 years old		18		6.74	
40-49 years old		39		14.61	
50-59 years old		58		21.72	
60-69 years old		100		37.45	
Older than 70 years old		52		19.48	
Education		Number of respondents		Percentage (%)	
Primary school		0		0	
Secondary school		22		16.02	
Middle specialized education		35		16.99	
Bachelor		114		55.35	
Higher than Bachelor		24		11.65	
Employment		Number of respondents		Percentage (%)	
Not employed		33		12.60	
Fully employed		112		42.75	
Partially employed		12		4.58	
Student/pupil		1		0.38	
Pensioner/retired		104		39.69	
Smoking		Number of respondents		Percentage (%)	
No		230		88.46	
Half a pack or less daily		15		5.76	
Half a pack to a pack daily		15		5.77	
More than one pack daily		0		0	

Table 1 (continued). Summary of demographic variables analyzed in the study

Alcohol	Number of respondents	Percentage (%)
No	185	72.27
Less than once a week	54	21.09
1-2 times per week	13	5.08
3-4 times per week	2	0.78
5-7 times per week	1	0.39
Presence of family members with diabetes	Number of respondents	Percentage (%)
No	125	51.9
One parent	60	24.9
Both parents	3	1.2
Siblings	51	21.2
Grandparents	12	5
Don't know	16	6.6

Table 2. Summary of KAP section

Knowledge on symptoms of diabetes	Number of respondents	Percentage (%)
Full	67	27.46
Rather good	69	28.28
Rather insufficient	50	20.49
Minimal	58	23.77
Knowledge of what diet increases blood glucose	Number of respondents	Percentage (%)
Full	156	61.18
Sufficient	64	25.10
Minimal	35	13.72
Knowledge of types of medication against T2DM	Number of respondents	Percentage (%)
Full	91	38.72
Partial	93	39.58
Minimal	50	21.4
Knowledge of measures to lower blood glucose levels	Number of respondents	Percentage (%)
Full	125	49.8
Partial	61	24.3
Minimal	65	25.9
Reported adherence of the respondent	Number of respondents	Percentage (%)
Full	154	56.62
Partial	90	33.09
Minimal	28	10.29

patients who provided more (but not all) or fewer correct answers alongside the wrong ones.

According to patient responses, the explicit rate of adherence to anti-diabetic medicines is 56.6% for full adherence, 10.3% for non-adherence, and 33.0% for partial adherence. Responses such as "adherent but not as prescribed" and "adherent but occasionally skip or forget" were used to measure partial adherence (**Table 2**).

Attitudes & Habits of Respondents Towards Antidiabetic Medications

Among respondents with comorbidities, hypertension is the most prevalent (60.3%). Thus, nearly three-quarters of respondents (73.3%) reported using prescriptions other than anti-diabetic agents, including 36.6% who take vitamins and 27.3% who use herbal products for therapeutic purposes (**Table 3**).

Table 3. Comorbidities and non-diabetic medication use

Other morbidities	Number of respondents** (total = 239)	Percentage (%)
Blood hypertension	144	60.3
Hypercholesterolemia	22	9.2
Disorders of cardiovascular system	47	19.7
Oncological conditions	7	2.9
Goiter	18	7.2
Hypothyroidism	8	3.2
Other	39	15.6
None	44	18.4
Non-diabetic medication use	Number of respondents	Percentage (%)
Yes	170	73.28
No	62	26.72
Vitamin use	Number of respondents	Percentage (%)
Yes	78	36.62
No	135	63.38
Biologically active additive use	Number of respondents	Percentage (%)
Yes	60	27.27
No	160	72.73

Table 4. Reasons for non-adherence and associated response rates in percent

Statement #1		**My medications make me sick** (total response number = 262)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
147	56.11%	47	17.94%	21	8.02%	23	8.78%	24	9.16%
Statement #2		**My medications are not effective** (total response number = 263)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
129	49.05%	59	22.43%	40	15.21%	23	8.75%	12	4.56%
Statement #3		**Missing medications does not harm** (total response number = 259)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
81	31.27%	55	21.24%	50	19.31%	57	22.01%	16	6.18%
Statement #4		**I do not need to take medications if I feel better** (total response number = 254)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
155	61.02%	45	17.72%	14	5.51%	22	8.66%	18	7.09%
Statement #5		**Effect of medications does not outweigh the risk of taking them** (total response number = 255)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
137	53.73%	52	20.39%	34	13.33%	18	7.06%	14	5.49%
Statement #6		**Side effects of the drugs stop me from taking medicines** (total response number = 259)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
169	65.25%	37	14.29%	16	6.18%	16	6.18%	21	8.11%
Statement #7		**I do not need to take as much medication as it has been prescribed to me** (total response number = 253)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
122	48.22%	58	22.92%	33	13.04%	26	10.28%	14	5.53%
Statement #8		**I decrease number of prescribed doses by combining it with other methods of treatment** (total response number = 245)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
157	64.08%	42	17.14%	32	13.06%	9	3.67%	5	2.04%
Statement #9		**Sometimes I forget to take medications** (total response number = 250)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
120	48%	44	17.6%	16	6.4%	52	20.8%	18	7.2%
Statement #10		**Costs of my medications are overwhelming** (total response number = 255)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
13	5.10%	21	8.24%	145	56.86%	40	15.69%	36	14.12%
Statement #11		**My medications are inconvenient to take** (total response number = 243)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
140	57.61%	63	25.93%	18	7.41%	16	6.58%	6	2.47%
Statement #12		**Some of my doctors lack expertise** (total response number = 242)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
94	38.84%	61	25.21%	39	16.12%	26	10.74%	22	9.09%
Statement #13		**My lifestyle does not allow me to take medications** (total response number = 241)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
147	61.00%	59	24.48%	18	7.47%	13	5.39%	4	1.66%
Statement #14		**It is too uncomfortable/difficult to acquire new doses when I run out of them** (total response number = 246)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
132	53.66%	52	21.14%	24	9.76%	22	8.94%	16	6.50%
Statement #15		**When I run out of my drugs, I do not seek them** (total response number = 250)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
175	70.00%	44	17.60%	10	4.00%	11	4.40%	10	4.00%
Statement #16		**Hospital gives the drugs with delays** (total response number = 243)							
Strongly disagree		Rather disagree		Not sure		Rather agree		Strongly agree	
112	46.09%	28	11.52%	24	9.88%	37	15.23%	42	17.28%

Influencing Factors for Nonadherence

Statements were formulated so that "strongly disagree" range of replies showed that the statement in question is not a reason for a certain patient's non-adherence, whereas "strongly agree" range might be a reason for a patient to omit drugs. Medication cost was the lone exception, as many patients get their medications through the hospital without having to purchase them, and hence tended to respond, "not sure." The healthcare system, notably delays in medicine availability from the hospital, was also indicated as a contributing factor to inadequate adherence. However, this delay appeared to depend on when the survey was conducted. For instance, respondents surveyed prior to the New Year's holiday tended to report no problems with hospital drug discharge delays, whereas respondents surveyed after the holiday tended to complain about the lengthy absence of their medications. Overall, the expense of medications appears to be the most influential factor in nonadherence (**Table 4**).

Bivariable Tests

Using StataCorp Stata 14.2 to evaluate various determinants of adherence demonstrates that various factors behave differently in relation to medical adherence. For instance, study of age (split into decades) reveals a statistically significant correlation between age groups "60-69" and "70-99" and commitment to religious practices (odds ratio [OR] are 0.23 and 0.19, respectively). The link between adherence and gender and between adherence and education level is not statistically significant. There was no statistically significant correlation between adherence and smoking, however

Table 5. Bivariate analysis of the independent variable and possible effect modifiers

Predictor	# adherent	# non-adherent	OR	St.error	Z	P>z	95% CI
Gender							
Male	61	48					
Female	91	70	0.98	0.24	-0.09	0.93	0.60-1.60
Marital st.							
Married	107	86					
Not married	6	10	2.07	1.11	0.22	0.83	0.72-5.93
Widowed	17	10	0.73	0.31	-0.74	0.462	0.32-1.68
Divorced	2	2	1.24	1.26	1.36	0.174	0.17-9.01
Age group							
20-39	5	13					
40-49	20	19	0.36	0.22	-1.63	0.102	0.11-1.22
50-59	27	29	0.41	0.24	-1.50	0.134	0.13-1.31
60-69	61	37	0.23	.013	-2.57	0.010	0.08-0.71
70-79	33	16	0.19	0.11	-2.76	0.006	0.06-0.61
Education							
Secondary sch	21	12					
Specialized	25	10	0.7	0.36	-0.69	0.49	0.25-1.94
Bachelor	61	51	1.44	0.59	0.89	0.37	0.65-3.20
Master or high	10	14	2.45	1.35	1.63	0.10	0.83-7.20
Employment							
Retired	66	36					
Unemployed	21	9	0.78	0.35	-0.54	0.59	0.33-1.89
Full employed	52	60	2.11	0.59	2.67	0.01	1.22-3.67
Partially empl.	6	6	1.83	1.12	0.99	0.32	0.55-6.10
School	0	1	1				
Smoking							
No smoking	128	98					
1-10 daily	8	5	0.81	0.48	-0.35	0.73	0.26-2.57
11-20 daily	8	7	1.14	0.61	0.25	0.80	0.40-3.26
Alcohol							
None	110	72					
Less than once per week	28	25	1.36	0.43	0.99	0.32	0.74-2.52
1-2 per week	3	10	5.09	3.44	2.41	0.02	1.36-19.13
3-4 per week	0	2	-	-	-	-	-
5-7 per week	0	1	-	-	-	-	-

Table 6. Odds Ratios for reasons in relationship to non-adherence

Odds Ratios for Statements	Strongly disagree	Rather disagree	Not sure	Rather agree	Strongly agree
Statement #1	1	N/A	3.28	N/A	5.91
Statement #2	1	2.56	4.56	4.11	3.42
Statement #3	1	N/A	2.61	7.89	29.87
Statement #4	1	4.68	14.31	10.41	N/A
Statement #5	1	3.12	3.19	4.71	N/A
Statement #6	1	3.44	N/A	3.65	6.57
Statement #7	1	2.04	3.99	8.42	11.38
Statement #8	1	3.21	9.16	3.82	N/A
Statement #9	1	N/A	11.35	11.28	41.26
Statement #10	1	N/A	N/A	N/A	N/A
Statement #11	1	3.86	5.83	9.55	6.36
Statement #12	1	2.97	3.85	2.57	5.32
Statement #13	1	5.72	73.67	23.83	13
Statement #14	1	2.35	11.75	2.81	8.50
Statement #15	1	3.92	11.29	28.22	6.59
Statement #16	1	2.20	4.56	N/A	5.08

"N/A" was put in cells where statistical significance was not reached as analysed in Stata software

drinking alcohol one-two times per week raises the likelihood of non-adherence by 5.09. The chances ratio for having a comorbidity and being non-adherent is 0.43, whereas OR for using non-diabetic medication and being non-adherent is 0.33. The only statistically significant link between employment levels and non-adherence is between full employment and non-adherence (OR=2.12). **Table 5** summarizes the bivariate analysis. Significantly, the initial classification of adherence as "complete," "partial," and "minimum" was revised to "adherent" and "non-adherent." The last category included both minimal and partial compliance. Importantly, the Reliability of the scale score utilizing the internal-consistency reliability assessment based on Cronbach's alpha is 0.8488, indicating that the obtained values are reliable.

Logistic Regression Analysis

Table 6 illustrates the analysis of the logistic regression that examines factors associated with anti-diabetic drug

adherence or non-adherence. The higher the patient's agreement, the more likely it is that he or she will not adhere to the recommended treatment. It should be noted, however, that the response rate was so low in many instances, notably in the "agree" spectrum, that OR estimates were rather high. Many responses came within the range of "disagree," with "strongly disagree" earning the most votes.

DISCUSSION

Medical non-adherence is one of the most significant challenges in public health. Not only does it have negative consequences on people' health, but it also increases the cost of health care. This is particularly more damaging in the case of chronic medical diseases, as patients' adherence to therapy tends to diminish dramatically over very brief intervals [11]. Consequently, addressing this issue and contributing to the resolution of medical non-adherence is an important objective.

It is well-established that patients' adherence to anti-diabetic medicine is strongly correlated with decreased incidences of diabetic complications [12]. Simultaneously, poor, or non-adherence to medication is a leading cause of uncontrolled diabetes and may lead to the complications associated with it [13]. Considering this, examining the rates of non-adherence and the cause for this feature is a vital step in the prevention of complex diabetes. In this study, an effort was made to shed light on potential variables for medical non-adherence as well as general non-adherence rates.

The reported medication adherence rate was 56.6%, with the remainder being either non- or partially-adherent to antidiabetics. According to our knowledge, no comparable research has been conducted in the Republic of Kazakhstan, hence no comparative studies are available. In general, the unsatisfactory rate of adherence suggests that there may be a multitude of circumstances that limit appropriate drug compliance. These may include patients' sociodemographic characteristics, illiteracy of the significance of controlling diabetes, and the patient-provider relationship. In the present study, the authors attempted to evaluate all these factors. Even though, at the time of the report, the desired 422 responses had not been acquired, 280 responses had been received, which, with a confidence level of 90% and an error margin of 5%, was adequate to make reasonable conclusions.

Among the sociodemographic variables, age group, work level, and alcohol consumption may be associated with better or worse medication adherence. Consequently, those over the age of 60 are less likely to be non-adherent, those who are fully employed have lower rates of adherence, and those who use alcohol one-two times per week are at a greater risk of non-adherence. Notably, neither education levels nor gender revealed such relationships.

In addition to non-antidiabetic medicines, the comorbidity status of patients was also of relevance. Both variables had stronger relationships with adherence to anti-diabetic treatments compared to those with no comorbidities or no additional medicines. There was no statistically significant link between diabetes in the family and rates of nonadherence.

Table 5 presents ORs for antidiabetic therapy adherence for each of the questionnaire items (see **Appendix A**). Each response other than "strongly disagree" is associated with ostensibly high ORs. These tendencies may be explained by the relatively low response rates for the offered answer choices. As anticipated, self-identified adherent respondents tend to respond with "strongly disagree" to all issues. Overall, the statistics indicate that 17.7% of surveyed patients believe their medications decrease their well-being, 29.9% believe their medications are too expensive, 19.9% do not believe their medications have been correctly prescribed, and 32.7% of patients report having difficulties acquiring medications on time due to hospital-specific factors. Other factors are seen less frequently and are included in **Table 3**.

Since such analysis of non-adherence is rare and might arguably be the only one to the moment of writing in the Republic of Kazakhstan, it may be useful for medical practitioners to better comprehend their patients and develop more efficient and successful therapy strategies. Among the study's other merits is the relatively large sample size, which provides for a more accurate depiction of how a typical patient with the given condition may present. Another strength of the study is that it addresses various medical diseases and attitudes about them, as well as a wide range of causes for non-adherence to non-diabetic medications. Kazakhstan's polyclinics and hospitals vary greatly from one another, making it impossible for the study to accurately represent the condition throughout the country. Another potential issue with the study may be that it does not reflect the bilingualism prevalent in the Republic of Kazakhstan, so overlooking a potentially significant factor of non-adherence. In addition, the constructed study questionnaire does not fully reflect the diversity of possible medications available to patients; in some instances, patients purchase medications with the same active ingredient but under a different brand name, which makes their responses to surveys more complicated. In addition to this, the study omits the odd discovery that the same active ingredient sold under different brand names generates varied reactions in individuals. Due to the nature of the study, it may be susceptible to recollection bias on the part of patients as well as a tendency to provide less-than-honest responses. Lastly, the study is unable to track how patients feel about various drugs in particular: in many circumstances, patients are adherent to some treatments while being resentful of other medication options; yet the study generalizes the attitude towards all the available medications.

Because the socioeconomic position in Kazakhstan is not uniformly distributed, the current study could be broadened by analyzing more cities and hospitals within cities. Another possible route for the study would be a targeted review of the most used pharmaceuticals in Kazakhstan to forecast if a particular drug under a particular brand name will be effective or ineffective. Finally, it remains to be investigated whether the current worldwide situation regarding COVID-19 may have an impact on patient adherence rates.

Study Limitations

The current study was conducted in Astana, the capital city of Kazakhstan, which does not necessarily reflect the general practice amongst diabetic patients in the entire country. The second drawback is that we did not investigate the antidiabetic medications used, or their side effects as factors for non-adherence, which are beyond the scope of this study.

CONCLUSIONS

In conclusion, this is the first study in the country to investigate medication adherence rate to antidiabetic drugs. The study shows there is a very low rate of adherence to antidiabetic medications amongst the studied participants, comparable to WHO predicted rate for developing countries. There are several factors that appear to negatively influence medication adherence, including older age, full-time employment, and alcohol consumptions.

Author contributions: All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Ethical statement: The authors stated that the research was approved by the Nazarbayev University School of Medicine Institutional Research Ethics Committee, on December 11, 2019. During the data collection, no names, addresses, affiliations or other sensitive information of patients were required, so no personal patient information was gathered. Every patient was explicitly asked whether they agreed to proceed with questions from the survey. The authors further stated that, in the case of written survey, additional consent form was signed. In the case of phone-call survey, vocal agreement was ensured before the survey was done.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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APPENDIX A

Full Version of the Questionnaire Filled out by the Patients

General information

Gender:

□ Male □ Female

Marital status:

□ Married □ Not married

Ethnicity:

□ Kazakh □ Russian □ Uzbek □ Ukrainian □ Other: ……

Age group:

□ 18-29 □ 30-39 □ 40-49 □ 50-59 □ Older than 60 years

Number of children (age less than 12) at home:

□ None □ 1-2 □ 3-4 □ More than 4

Education:

□ Elementary school □ High school □ College □ Bachelor □ Master or higher

Employment:

□ Unemployed/retired □ Housewife/freelance □ Part-time employment □ Full-time employment

Smoking:

□ None □ Less than half a pack a day □ Half to one pack a day □ More than one pack a day

……

Alcohol:

□ None □ Once a week or less □ Only on weekends □ 3-5 times a week □ Everyday

Do you have relatives diagnosed with diabetes?

□ Grandparents □ Siblings □ Parents □ Cousins, aunts, or uncles □ None

Disease and medication knowledge

This section observes your attitude and understanding in regards to diabetes. There are no right or wrong answers to these questions. Feel free to answer "Don't know" in case you do not know.

Disease knowledge:

What are the symptoms of type 2 diabetes?

□ Increased urination □ Low blood pressure □ Increased thirst and hunger □ Leg swelling
□ Increased tiredness □ Slow healing of wounds □ I don't know

What kinds of food increase blood sugar?

□ Carbohydrates (rice, bread, noodles, sweets) □ Fat (oil, butter, nuts) □ Protein (meat, fish, eggs)
□ Fiber (fruits, vegetables) □ I don't know

What are types of treatment for diabetes?

□ Antibiotics □ Blood transfusion □ Insulin substitutes □ Diet change □ I don't know

What can be done to reduce blood sugar?

□ Plan diet □ Exercise regularly □ Take medication □ All of them □ I don't know

If your family or friends were diagnosed with type 2 diabetes mellitus, would they seek *medical* treatment?

□ Definitely yes □ Definitely no □ Rather yes □ Rather no □ I don't know

Would you advise them seek *medical* treatment?

□ Definitely yes □ Definitely no □ Rather yes □ Rather no □ I don't know

Medications used:

Do you use your antidiabetic medications?

□ Always and as prescribed □ Mainly as prescribed, sometimes out of schedule □ Mainly as prescribed, sometimes skip
□ Yes, but mainly not as prescribed □ I generally don't take antidiabetic medications
□ Else (please describe): ……

Please, describe your antidiabetic medications that you use:

What is the type?

□ Tablet □ Insulin □ Tablet and insulin □ Else ……

What tablets do you take?

□ Glipizide (Diamicrone) □ Glibenclamid (Daonil) □ Glimepiride (Amaryl) □ Glyburide □ Rosiglitazone (Avendia) □ Metformin
□ Acarbose (Glucobay) □ I don't know □ Else……

What is the type of insulin that you take?

□ Long acting □ Intermediate acting □ Short acting □ I don't know

What is the name of insulin that you take?

□ Novomix □ Mixtard □ Novorapid (Lispro) □ Lantus (Glargine) □ Actrapid □ Insultard
□ Else……

Do you suffer from any other comorbidities?

□ Yes □ No

If yes:

□ Blood pressure □ Cholesterol □ Heart problems □ Cancer □ Infections

Are you currently taking medications for them?

□ Yes □ No

If yes, please list: ……

Are you currently taking vitamin supplements?

□ Yes □ No

Are you currently taking herbal medications?

□ Yes □ No

Medication adherence

The following table presents with statements about possible reasons not to take medicines. Please, fill the table in and, should you have other suggestions, add them in the end of the list:

No	Statement	Strongly Agree	Rather agree	Not Sure	Rather disagree	Strongly Disagree
1	My medications make me sick	□	□	□	□	□
2	My medications are not effective	□	□	□	□	□
3	Missing medications does not harm	□	□	□	□	□
4	I do not need to take medications if I feel better	□	□	□	□	□
5	Effect of medications does not outweigh the risk of taking them	□	□	□	□	□
6	Side effects of the drugs stop me from taking medicines	□	□	□	□	□
7	I do not need to take as much medication as it has been prescribed to me	□	□	□	□	□
8	I decrease number of prescribed doses by combining it with other methods of treatment	□	□	□	□	□
9	Sometimes I forget to take medications	□	□	□	□	□
10	Costs of my medications are overwhelming	□	□	□	□	□
11	My medications are inconvenient to take	□	□	□	□	□
12	Some of my doctors lack expertise	□	□	□	□	□
13	My lifestyle does not allow me to take medications	□	□	□	□	□
14	It is too uncomfortable/difficult to acquire new doses when I run out of them	□	□	□	□	□
15	When I run out of my drugs, I do not seek them	□	□	□	□	□
16	Other reasons (please include here): …… ……					