Original Research Article

Predictors of anti-diabetic medication non-compliance among patients accessing health care at Volta River Authority Hospital at Akosombo of Ghana.

Abstract

Background: Diabetes mellitus is a metabolic chronic disease affecting a majority of adults with associated complications. The non-compliance to the anti-diabetic medication has become a global challenge to achieving optimal glucose control among Diabetes Type 2 patients. This study, therefore, sought to determine the predictors of anti-diabetic medication non-compliance among patients accessing health care at Volta River Authority Hospital in Akosombo of Ghana.

Methods: A quantitative study and cross-sectional design employed a simple random sampling technique to recruit 220 diabetes type 2 patients by administering a structured questionnaire face to face to gather data. Data were analysed with the help of Stata 16. A descriptive and inferential statistic was conducted to determine the relationship between the dependent and independent variables at a 95% confidence interval and a P-value of less than 0.05 was considered statically significant.

Results: The study found that non-adherence to anti-diabetic medication was 45.5%. Most of the participants had inadequate (52.3%) self-care practices. Age of participants (40-49) years [AOR=0.024(0.003-0.178), P=0.0001], Female [AOR=0.224(0.082-0.612), P=0.004] were less likely to influence non-compliance. Being Single [AOR=13(6.399-16.616), P=0.001] and comorbidity [AOR=0.156(0.053-0.458), P=0.00] were also associated with non-compliance.

Conclusion: The study concluded that a significant proportion of diabetes type 2 patients do not comply with anti-diabetic medication and this was influenced by inadequate self-care practices, age, sex, comorbidity and being single. The study recommended the intensification of awareness creation on complications of non-complying to anti-diabetic medication and education on self-care practices through mass media. Further studies are required to identify the possible predictors of inadequate self-care practices that influence anti-diabetic medication non-compliance.

Keyword: Diabetes type 2, Medication, Non-compliance, Volta River Authority Hospital

Introduction

Diabetes mellitus comes in a variety of forms, each with its own set of symptoms (Taye, 2021, Connel, 2020; Lee, 2020), and as such affects a sizable portion of the global population (Okoronkwo, 2014). The two forms of diabetes that are most commonly known are type 1 diabetes mellitus, or insulin-dependent diabetes mellitus and type 2 diabetes mellitus, or non-insulin-dependent diabetes mellitus. Type 1 diabetes is caused by the loss of beta cells in the pancreatic islets of Langerhans, while Type 2 diabetes is brought on by insulin resistance owing to a lack of insulin receptors (Rukiya, 2022, Connel, 2020). Diabetes type 2 is linked to the emergence of insulin resistance and hyperglycemia, which together affect the ability of numerous body organs and physiological systems to operate abnormally (Toms et al., 2016).

The most prevalent and possibly fatal acute complication of diabetes mellitus, diabetic ketoacidosis, is quickly turning into a life-threatening illness. Diabetic ketoacidosis has been

linked to uncontrolled diabetes, which increases the risk of neurological morbidity and death. This association is mostly explained by hyperglycemia, ketonemia, dehydration, weight loss, polyuria, polydipsia, vomiting, weakness, and changes in mental state are among the symptoms that patients with diabetic ketoacidosis experience (Taye et al., 2021). As life expectancy increased, so has the prevalence of non-communicable illnesses including diabetes mellitus is also on the rise (Akram et al., 2020). Therefore diabetes mellitus as a chronic illness requires long-term management which defines medication compliance as the degree of conformity between a conduct and a medical prescription (Raharinavalona, 2021; Gali, 2020).

Diabetes mellitus is one of the top four non-communicable diseases on the United Nations' list of chronic metabolic illnesses (Connel, 2020). Contributing factors such as ageing, fast urbanization, and a growing obesogenic environment, among other genetic and lifestyle-related factors have all contributed to an increase in diabetes type 2 prevalence over decades (Faisal et al., 2022; Chen, et al., 2020). To manage and control type 2 diabetes it is required that, lifestyle changes, such as increasing physical activity, losing weight, controlling one's diet, quitting smoking, and adhering to pharmaceutical medications to improve metabolism are necessary (Machado et al., 2020). Again, behavior changes are a critical step in the prevention and treatment of the disease. However, it is unquestionably that the way patients adapt their lifestyle to new circumstances by adhering to medication is a determinate of whether or not treatment will be successful in reducing complications that lead to increased morbidity and mortality associated with diabetes (Machado et al., 2020; Toms et al., 2016).

Diabetic medication non-compliance is common internationally, making diabetes management problematic (Gali et al., 2020). Therefore it is estimated that by 2045, there will be 700 million individuals with diabetes worldwide and a 51% rise from today's 463 million cases as a result of anti-diabetic medication non-compliance (Xu et al., 2020). As a result, an estimated 4.6 million people die yearly from diabetes, hence contributing to the top ten causes of disability and mortality globally (Rukiya et al., 2022). Diabetes affects sixteen million people in Sub-Saharan Africa and by 2045, 41 million people are projected to also develop diabetes which could affect the rate of non-compliance to anti-diabetic medication hence a majority of diabetics experience severe complications which affect daily economic activities (Asati, 2021).

In Ghana, diabetes accounts for 2.5% of all Ghanaian fatalities as a result of poor glycemic control (Wolde et al., 2020). As such a significant cause of disability in Ghana is diabetic foot ulcers, which had affected most economic activities of diabetic patients (Fosuhemaa et al., 2021). In addition, about 66.5% of diabetic patients in Ghana do not comply with their medication prescription as prescribed making it difficult for glycemic control (Kretchy, 2020). There is a paucity of data concerning anti-diabetic medication non-compliance in the Akosombo Volta River Authority Hospital, making Physicians and other healthcare practitioners encounter considerable hurdles in managing patients with diabetes type 2. This study therefore aimed at determining the predictors of ant-diabetic medication non-compliance among type 2 diabetes patients accessing healthcare in the Volta River Authority Hospital.

Materials and Methods

Study design

This was a quantitative study that employed a descriptive cross-sectional survey (Health facility-based) to assess the predictors of anti-diabetic type 2 medication non-compliance among patients at Volta River Authority Hospital in Ghana.

Study population

The study included diabetes type 2 patients who were certified by a qualified clinician to be type two diabetic patients in their health record and received anti-diabetic medications at the hospital and also residents of the district. The study included diabetic patients who had been diagnosed with diabetes type 2 above 18 years and had consented to receive medication at the facility. The study excluded participants who were critically ill, unconscious, mentally challenged and unwilling to participate in the study.

Sample size

The study employed Yamane formula $n = \frac{N}{1+N(e)^2}$ in estimating the required sample size of 220 taking into consideration a 10% unresponsive rate.

Sampling technique

To ensure every eligible participant had an equal chance of being recruited, hence reducing selection bias a simple random sampling technique was employed in recruiting qualified participants.

Data collection tool and technique

Data were gathered using a structured questionnaire. The questionnaire's design was based on the objectives of the study. The questionnaire was made up of three sections: Section (A) Sociodemographic Information This component gathered data on the demographics of the patients, such as their sex, age, marital status, and level of education, religion, employment, place of residence, family size, and history of diabetes in the family. Section (B): Comprised eleven questions that measured respondents' non-adherence to anti-diabetic medication, which was used to gauge the severity of non-adherence. Self-care habits and anti-diabetic medication adherence, Section (C) was made up of ten questions which were used to gather information on the self-care behaviors that influence medication non-adherence. The investigator and two (2) research assistants, who had received sufficient training in the overall study carried out the data collection. To preserve secrecy and anonymity, each respondent was questioned face-to-face independently. Patients who could read were helped to self-administer, and those who couldn't be helped by having the questionnaire translated into the local dialect (Ashanti Twi and English). The data collection process was for four weeks and ended when the required sample size was met.

Data management and analysis

Questionnaires after being collected were thoroughly checked through to ensure all questions were accurately answered and errors corrected to ensure completion before entering them into the Stata Version 16 for rigorous data analysis. Data were coded and entered into the Stata software. Descriptive statistics were conducted at the Univariate and data was presented in frequencies using tables and graphs. Means and standard deviation were conducted for continuous variables that were normally distributed. Inferential statistics were conducted to establish the association between the dependent and the independent variables at a 95% confidence interval and a p-value <0.05 was considered statistically significant.

Ethical approval

Permission was sought from the authorities of the Hospital. Again an informed consent form was read and explained to participants to voluntarily agree to participate in the study. Participants were assured of confidentiality, anonymity, and privacy and made to understand that participation in the study was voluntary and that they can withdraw from the study at any time without affecting any services provided to them.

Results

Table 1: Socio-demographic characteristics of participants

Variable	Category	Frequency	Percentage (%)
Age (years)	59±9		
	29-39	7	3.2
	40-49	29	13.2
	50-59	73	33.2
	60-69	78	35.5
	70-79	33	15.0
Sex			
	Male	60	27.3
	Female	160	72.7
Marital Status			
	Married	139	63.2
	Single	48	21.8
	Widow	33	15.0
Residency			
	Rural	114	51.8
	Peri-urban	106	48.2
Religion			
	Christian	211	95.9
	Islamic	9	4.1
Education			
	Non-formal education	21	9.5
	Basic education	82	37.3
	Secondary education	82	37.3
	Tertiary education	35	15.9
Years of diagnosis			
	< 1year	1	0.5
	2-3 years	30	13.6
	4-6 Years	66	30.0
	>6 years	123	55.9
Employment status			
	Employed	55	25.0
	Unemployed	152	69.1
	Retiree	13	5.9
Health insurance			
	Uninsured	6	2.7
	Insured and active	202	91.8
	Insured but inactive	12	5.5
Family history			
	Yes	145	66.0
	No	75	34.0

Comorbidity			
	Yes	182	82.7
	No	38	17.3
Diabetes complication			
	Yes	90	40.1
	No	130	59.1
Home base management of diabetes			
	Yes	123	55.9
	No	97	44.1
Knowledge of diabetes management			
	Yes	102	46.4
	No	118	53.6
Alcohol consumption			
	Yes	31	14.1
	No	189	85.9
Tobacco use or smoking			
	Yes	9	4.1
	No	211	95.9

The study recruited 220 participants and there was a 100% response rate. The mean age of the participants was 59±9 (29-75) years. About 78 (35.5%) of the participants were between the ages 60 years and 69 years, 73(33.2%) were between 50 years and 59 years, and 33(15.0%) were aged 70 years to 79 years. Most 160 (72.7%) of the participants were females whilst 60 (27.3%) were males. About 139(63.2%) of the participants were married, 48(21.8%) were single whilst 33(15.0%) were widowed. About 114 (51.8%) of the participants resided in rural areas whilst 106(48.2%) lived in Peri-urban settings. Concerning participants level of education, 82(37.3%), 82(37.3%) had attained basic and secondary education respectively whilst 35(15.9%) had tertiary education. With regards to participants' years of being diagnosed with diabetes, 123(55.9%) had been diagnosed with diabetes for more than six years, 66 (30.0%) for four to six years, and 30 (13.6%) for a period of one to three years. Most 152(69.1%) of the participants were unemployed, 55 (25.0%) were employed whilst 13 (5.9%) were retirees. The majority 202 (91.8%) of the participants had active health insurance, 12 (5.5%) were present but inactive whilst 6 (2.7%) had not registered for the health insurance. Most 145 (66.0%) of the participants had a family history of diabetes whilst 75 (34.5%) had no family history of diabetes. Most 182 (82.7%) of the participants indicated they had comorbidities whilst 38 (17.3%) said otherwise. In addition, about 90 (40.9%) of participants had diabetes complications whilst 130 (59.1%) indicated the presence of no diabetic complications. Most 123 (55.9%) of the participants practice home management of diabetes control whilst 97 (44.1%) do not. About 118 (53.6%) of participants did not know diabetes management whilst 102 (46.4%) knew about diabetes management. Most 189 (85.9%) of the participants do not consume alcohol whilst 31 (14.1%) do take in alcoholic drinks. The majority 211 (95.9%) of the participants do not smoke or use tobacco, whilst 9 (4.1%) indicated otherwise (Table 1).

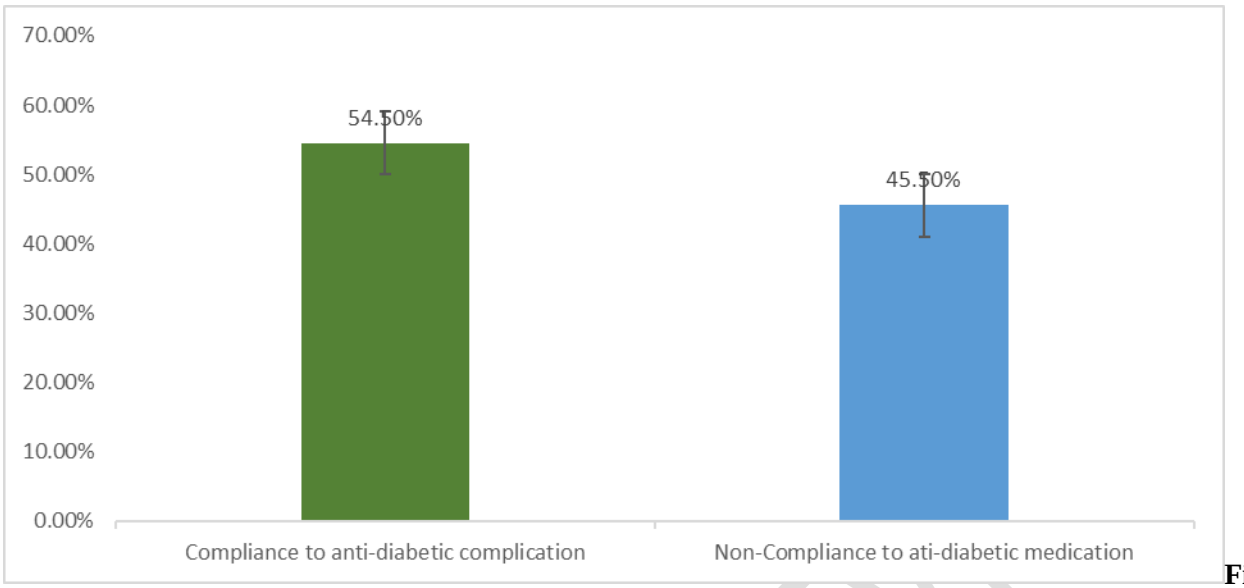

Figure 1: Distribution of anti-diabetic medication of participants

About 120(54.5%) of the participants comply with anti-diabetic medication whilst 100(45.5%) do not comply with anti-diabetic medication (Figure 1)

Table 2: Distribution of Diabetes Self-care Practices among participants

	Uncertain n(%)	Disagree n(%)	Agree n(%)	Mean SD
I visit the hospital regularly according to doctor's appointments.	80(36.4)	0(0.0)	140(63.6)	2.64±0.48
I take meals regularly every day	92(41.8)	0(0.0)	128(58.2)	2.58±0.49
I eat a well-balanced diet using a list of food exchange	137(62.3)	0(0.0)	83(37.7)	2.37±0.49
I take food containing dietary fibre like grain, vegetables, fruits	154(70.0)	0(0.0)	83(37.7)	2.30±0.46
I set a limit on taking sugar and processed foods	107(48.6)	2(0.9)	111(50.5)	2.49±0.52
I do a self-blood sugar test more frequently	173(78.6)	0(0.0)	47(21.4)	2.21±0.41
I control the size of meals and exercise to burn excess calories	169(76.8)	0(0.0)	51(23.2)	2.23±0.42
I carry food like sweet drinks just in case of hypoglycemia	148(67.3)	1(0.5)	71(32.3)	2.31±0.48
I try to maintain weight by measuring my weight regularly	156(70.9)	0(0.0)	64(29.1)	2.29±0.46
I try to acquire information on diabetes control by attending diabetes medication	131(59.5)	0(0.0)	89(40.5)	2.40±0.49

SD: Standard deviation

About 140 (63.6) of the participants agreed of visiting the hospital regularly per the doctor's appointment whilst 80 (36.4) were uncertain. About 128 (58.2%) everyday take their meals regularly whilst 92 (41.8%) were uncertain. Most 137 (62.3%) of the participants were uncertain about eating a well-balanced diet whilst 83 (37.7%) agreed to eat a well-balanced diet. Most 154 (70.0%) of the participants were uncertain of eating foods containing fibre, fruits and vegetables whilst 83 (37.7%) eat foods with fibre and vegetables. About 111 (50.5%) of the participants agreed on setting the limit to sugar and processed foods whilst 107 (48.6%) were undecided. Most 173 (78.6%) of the patients were uncertain of

doing a self-blood glucose test frequently whilst 47 (21.4%) of the patients indicated engaging in self-blood glucose checks frequently. About 169 (76.8%) of the patients were unsure of controlling meals and exercising to burn calories every day whilst 51(23.2%) agreed to controlling meals and exercising every day to burn calories. Most 148 (67.3%) of the patients were unsure of carrying foods like sweet drinks just in case of low blood glucose whilst 71 (32.3%) of the patients were sure of carrying foods such as sweet drinks in case of hypoglycemia. Most 156 (70.9%) of the patients indicated they were uncertain about maintaining weight by measuring their weight every day whilst 64 (29.1%) patients agreed to maintain their weight by their regular weight measurement. About 131(59.5%) of the participants were uncertain about acquiring information on diabetes control whilst 89 (40.5%) participants agreed to solicit information on diabetes control (Table 2).

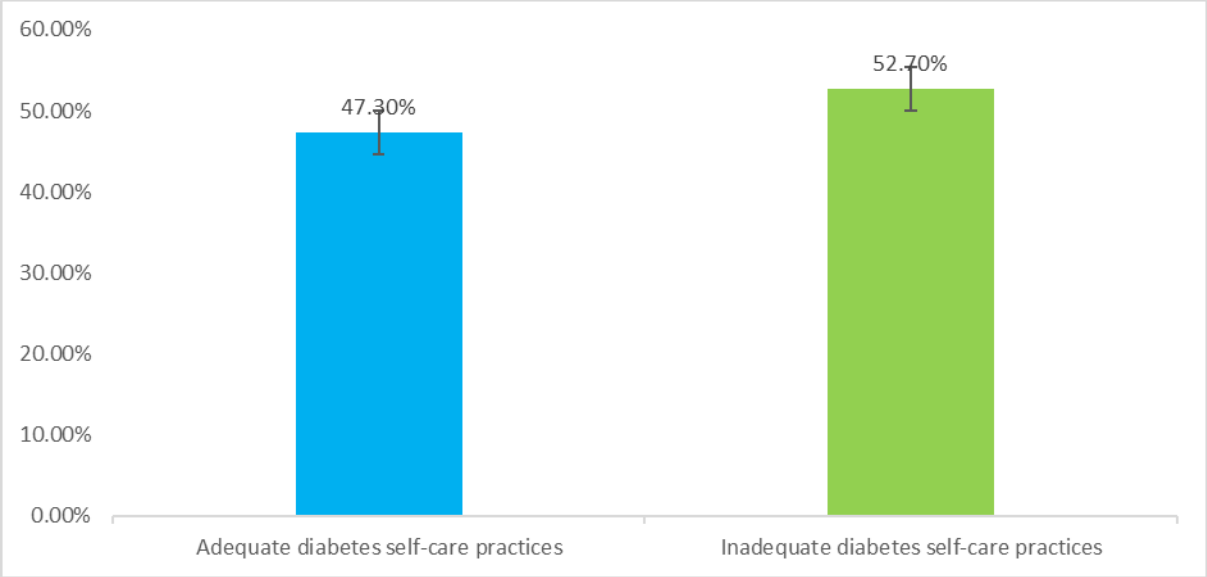

Figure 2: Diabetes self-care practices among participants on anti-diabetic medication

About 116 (52.7%) of the participants were not engaged in practicing diabetic self-care practices whilst 104 (47.3%) were involved in practicing diabetes self-care aside from their medication (Figure 2).

Hypothesis Testing

A Paired sample T-Test failed to reveal a statistically reliable relationship between non-compliance to anti-diabetic medication [Mean=1.9014, Standard deviation=0.47] and [Diabetes Self –Care Practices =2.385, standard Deviation=0.261], T (219) =13.577, P=0.0001 at alpha level=0.05]. This means that the study failed to reject the alternate hypothesis that diabetes self-care practices do not influence medication non-compliance and reject the null hypothesis, that diabetes self-care practices influence anti-diabetic medication non-compliance.

Table 3: Association between sociodemographic characteristics and anti-diabetic medication

Variable	ANTI-DIABETIC MEDICATION		X^2(P-value)
	Compliance n (%)	Non-Compliance n (%)	
Age (years)			10.58(0.032)*
29-39	3(2.5)	4(4.0)	
40-49	23(19.2)	6(6.0)	
50-59	41(34.2)	32(32.0)	
60-69	35(29.2)	43(43.0)	
70-79	18(15.0)	15(15.0)	

Sex			10.63(.0001)*
Male	22(18.3)	38(38.0)	
Female	98(81.7)	62(62.0)	
Marital status			34.66(.0001)*
Married	80(66.7)	59(59.0)	
Single	11(9.2)	37(37.0)	
Widow	29(24.2)	4(4.0)	
Residency			2.49(0.115)
Rural	52(43.3)	54(54.0)	
Peri-urban	68(56.7)	46(46.0)	
Religion			1.76(0.192)
Christian	117(97.5)	94(94.0)	
Islam	3(2.5)	6(6.0)	
Education			6.05(0.109)
Non-formal education	8(6.7)	13(13.0)	
Basic education	49(40.8)	33(33.0)	
Secondary education	40(33.3)	42(42.0)	
Tertiary education	23(19.2)	12(12.0)	
Years of diagnosis of diabetes			1.16(0.076)
<1 year	1(0.8)	0(0.0)	
1-3 years	17(14.2)	13(13.0)	
4-6 years	34(28.3)	32(32.0)	
>6 years	68(56.7)	55(55.0)	
Employment			2.61(0.271)
Employed	35(29.2)	20(20.0)	
Unemployed	79(65.8)	73(73.0)	
Retiree	6(5.0)	7(7.0)	
Health insurance			8.46(0.015)*
Not insured	0(0.0)	6(6.0)	
Insured and active	115(95.8)	87(87.0)	
Insured but inactive	5(4.2(	7(7.0)	
Family History			5.10(0.024)*
Yes	87(72.5)	58(58.0)	
No	33(27.5)	42(42.0)	
Comorbidity			7.66(0.006)*
Yes	107(89.2)	75(75.0)	
No	13(10.8)	25(25.0)	
Diabetes complications			11.08(0.001)*
Yes	37(38.0)	53(53.0)	
No	83(69.2)	47(47)	

Diabetes home management			2.76(0.097)
Yes	61(50.8)	62(62.0)	
No	59(49.2)	38(38.0)	
Knowledge of diabetes management			2.99(0.084)
Yes	62(51.7)	40(40.0)	
No	58(48.3)	60(60.0)	
Alcohol consumption			25.24(.0001)*
Yes	4(3.3)	27(27.0)	
No	116(96.7)	73(73.0)	
Tobacco use/smoking			1.4(0.095)
Yes	5(4.2)	4(4.0)	
No	115(95.8)	96(96.0)	

***(p-value<0.05), X^2 (Chi-square)**

Pearson Chi-square set at 95% confidence interval was applied to determine the association between the dependent variable and the socio-demographic characteristics of participants. Participants' age was 10.58 times associated with anti-diabetic medication non-compliance (X^2 =10.58, P=0.032) and the association was found to be statistically significant. Also, participants' sex was 10.63 times associated with medication non-compliance and this was significant statistically (X^2 =10.63, P=0.001). The marital status of participants was 34.66 times associated with medication non-compliance (X^2 =34.66, P=0.0001) and this was significant. Statistically, the insurance status of participants established an 8.46 times association with medication non-compliance (X^2 =8.46, P=0.015). In addition, participants' history of diabetes was 5.10 times significantly associated with medication non-compliance (X^2 =5.10, P=0.024), whilst diabetes with comorbidity was found to be 7.66 times associated with medication non-compliance (X^2 =7.66, P=0.006). The participants with diabetic complications were also found to be statistically associated with medication non-compliance. More so, a significant statistical association was established between participants' consumption of alcohol and medication non-compliance, however, the education of participants was 6 times associated with medication non-compliance but such was not significantly associated. (Table 3).

Table 4: Relationship between sociodemographic factors and medication non-compliance

Variable	COR(95%CI)	P-Value	AOR(95%CI)	P-Value
Age (years)				
29-39	0.196(0.034-1.121)	0.067	0.332(0.030-3.664)	0.37
40-49	0.585(0.122-2.804)	0.503	0.024(0.003-0.178)	0.0001*
50-59	0.921(0.193-4.394)	0.918	1.165(0.362-3.746)	0.798
60-69	0.625(0.120-3.242)	0.576	1.883(0.559-5.920)	0.279
70-79	Reference		Reference	
Sex				
Male	Reference		Reference	
Female	0.366(0.198-0.677)	0.001*	0.224(0.082-0.612)	0.004*
Marital status				
Married	5.347(1.783-16.033)	0.003*	3.05(0.879-10.610)	0.079
Single	24.0(7.034-84.55)	0.0001*	13(6.399-16.616)	0.001*

Widow	Reference		Reference	
Family history				
Yes	0.524(0.298-0.921)	0.025*	0.434(0.183-1.029)	0.058
No	Reference		Reference	
Comorbidity present				
Yes	0.364(0.175-0.758)	0.007*	0.156(0.053-0.458)	0.001*
No	Reference		Reference	
Complications present				
Yes	2.530(1.457-4.392)	0.001*	1.230(0.565-1.18)	0.599
No	Reference		Reference	
Alcohol consumption				
Yes	10.726(3.606-31.90)	0.0001*	2.514(0.565-11.188)	0.226
No	Reference		Reference	

***: p-value <0.05, statistically significant, COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval.**

At the Pearson Chi-square (Bivariate model) set at a 95% confidence level, all significant variables were included in the multivariate model to control for confounders and to determine the odds of a relationship between the dependent and the independent variables. After controlling for confounding variables in the multivariate model, participants whose ages fell between 40 years and 49 years were less likely to non-comply to anti-diabetic medication and such a relationship was statistically significant [AOR=0.024 (95%CI=0.003-0.178), P=0.0001]. In addition, female participants had decreased odds of complying with anti-diabetic medication non-compliance and such association was significant statistically [AOR=0.244(95%CI=0.082-0.612), P=0.004]. Moreover, single participants were more likely to non-comply with anti-diabetic medication and such relationship was statistically significant in the multivariate model [AOR=13.0(95%CI=6.399-16.616), P=0.001]. Also, participants with comorbidities were less likely to non-comply with anti-diabetic medication non-compliance and such a relationship was statistically significant [AOR=0.156 (95%CI=0.053-0.458), P=0.001].

Discussion

To achieve optimal control of diabetes, the rate at which patients comply with their medication is very necessary (Raharinavalona, 2021). This present study found that participants' compliance with anti-diabetic medication was 54.5% while that of non-compliance was estimated to be 45.5%. In addition, it was revealed that socio-demographic factors such as age (40-49) years, being female, single and not married and the presence of comorbidity indicated a significant relationship to participants' non-compliance to medication. Moreover, the study found that about 52.7% of the participants had inadequate self-care practices for managing diabetes compared to 47.3% of participants with adequate self-care practices.

This current study found that the prevalence of anti-diabetic medication non-adherence among participants diagnosed with type 2 diabetes mellitus was 45.5%. Comparing the outcome of this present study to a cross-sectional study conducted in China, it was discovered that, of the 63.1% of diabetic patients who were on medications, 36.9% were non-complying with their anti-diabetic medication. This finding is lower than the prevalence established in this study and as such does not support the outcome of the present study (Taitel, 2021). It is also revealed that about 20% of diabetes type 2 patients do not comply with their anti-diabetic medication and this disagrees with this current study discovery (Gooptu,

2021) Additionally, in Pakistan available body of knowledge had established that, about 41.3% of diabetes type ~~two~~ 2 patients do not adhere to their prescribed medication. Though not the same as this current study finding but closer and as such support the outcome of this new study (Hyassat, 2021). Again, evidence had indicated that anti-diabetic medication non-compliance was found to be 33.0% among patients who fail to adhere to their medication and this is not in line with the outcome of this present study (Basu, 2018). Moreover, in India, the report of a cross-sectional survey had denoted that, the majority of diabetic type 2 patients do not comply with their medication and that a significant relationship exists between non-compliance to anti-diabetic medication and lack of family support and this finding does not agree well with the outcome of this recent study (Angadi, 2019).

A cross-sectional study conducted in Ethiopia indicated that about 72.0% of type 2 diabetes patients do not adhere to their medication which is higher than the prevalence established for this study and as such do not agree with this present study finding (Bekele, 2021). Moreover, a similar cross-sectional survey conducted in Ethiopia disclosed that non-adherence to anti-diabetic medication was 58.3% and this does not support the findings of this present study (Gull, 2020). In Ethiopia, the outcome of a descriptive cross-sectional study conducted to determine anti-diabetic medication non-compliance established a moderate non-compliance to anti-diabetic medication. Comparing the study findings to the outcome found in this new study demonstrated that, the findings do not support each other (Widayanti, 2021). Again in Cameroun, it is reported by a cross-sectional study that, about 55.4% of type 2 diabetes patients do not comply with their medication and this does not agree with this recent study report (Aminde et al., 2019). Moreover, in Rwanda, the available body of evidence has indicated that about 53.5% of diabetes patients do not comply with their medication and as such has poor diabetes medication management. This also does not correlate well with the present prevalence established for this study(Murwanashyaka, 2022). Furtherance to the above, poor medication compliance of 49% had been recorded among diabetes patients in Tunisia and this fall in line with this study's findings (Belhabib et al., 2018). Adding to established studies on the prevalence of poor medication compliance among diabetes. Literature has found that about 34.0% of non-compliance to anti-diabetic therapy had been revealed. Compared to the outcome of this study it could be realized that they do not agree well (Getachew, 2020). A study by Almogbel (2021) found that about 50% of type diabetics do not comply with their medication, and this correlates well with the findings of this present study.

A descriptive cross-sectional study indicated that about 84.5% of diabetic type ~~two~~ 2 patients do adhere to their anti-diabetic therapy. This translated to about 15.5% of diagnosed patients not adhering to their anti-diabetic medication and as such suffering serious diabetic non-adherence complications. Comparing the previous study report to the current outcome of this study, there is inconsistency in the outcome of both studies and as such does not agree with each other (Adongo et al., 2020). Similarly available evidence on anti-diabetic medication non-compliance revealed that about 66.5% of diabetic patients do not comply with their prescribed medication. This finding is above the current finding of 44.5% and as such does not agree with this current research (Boima, & Appiah, 2020). Again, the outcome of a cross-sectional study conducted to determine the factors influencing non-compliance of anti-diabetic medication in Accra, it was discovered that the prevalence of anti-diabetic medication non-compliance among type 2 diabetes patients was 66.5% and this does not relate well with the outcome of this current study (Abdul-Tawab, 2019). Similarly, a related cross-sectional survey conducted to identify the non-adherence to anti-diabetic therapy among diabetic patients accessing health in the health facility in Tema, revealed that about 34.7% non-compliance to therapy existed among patients. This also does not correlate well with this new study outcome (Afriyie, G. 2019). Moreover, according to the report of a systematic review and meta-analysis conducted in Ghana, the findings have indicated that the prevalence of anti-diabetic medication non-adherence stands between 35.6% and 97%. Comparing these findings to the present study, it could be noticed that the prevalence of 45.5% non-compliance to anti-diabetic medication falls within what is established by the systematic review report and as such correlates well with this study report (Asiedu-danso, 2021).

A meta-analysis and systematic review conducted in Ethiopia indicated that diabetes patients in Ethiopia had inadequate self-care practices of 49.9% which is lower than the outcome established in this recent study. Therefore the findings of these two studies do not correlate with each other and what could have accounted for the difference or non-correlation could be ascribed to the differences in the study designs and the different sources of data used for the study (Weldegiorgis, 2021). Adding to the above study conducted in Ethiopia, available knowledge had estimated that, approximately, about 60.7% of diabetes type 2 patients practice good self-care management for diabetes prevention coupled with their medication adherence. However, the finding is higher than the outcome reported in this new study and as such does not fall in line with the current outcome (Dedefo, 2019). In Ghana, a descriptive health facility-based cross-sectional study demonstrated that the majority of people with diabetes had good self-care practices such as good meal planning, intake of an appropriate amount of foods and good healthy eating habits. This finding does not associate well with the outcome established for this present study (Opoku-Addai, 2022)

This present study established that, non-compliance with anti-diabetic medication is less likely to occur within the age group of 40 years to 49 years. A similar study conducted by Olesen, (2020) established that non-compliance with anti-diabetic medication is predominantly found among the young age group and as such this finding does not support the outcome of this current study. Additionally, it is also found in the literature that, non-compliance to anti-diabetic medication is mostly associated with old age and this agrees well with the outcome of this new study (Alodhaib et al., 2021). Again, available literature revealed that anti-diabetic medication non-adherence is ascribed to younger patients and this finding does not support the outcome of this current study (Spedea, 2021). Similarly, in a cross-sectional study conducted in Uganda, it was found that diabetes patients above the age of sixty years had established an increased likelihood of non-complying to their anti-diabetic medication and comparing these findings to the outcome generated for this study it could be noticed that, the previous findings do not correlate well with the outcome of the new study (Yadesa, 2022).

With regards to the influence of sex on anti-diabetic medication non-compliance, this current study unearths that, females were less likely to non-comply with anti-diabetic medication and such was statistically significant. The available body of knowledge indicated that female diabetic patients were more likely to miss their anti-diabetic medication than men and such findings support the outcome of this new study (Xie, 2020). In a related cross-sectional study conducted in China, it was found that females are more likely to non-adhere to anti-diabetic medication than men and this supports the outcome of this study (Chen, 2020). Available evidence had also revealed that age and sex had a significant relationship to anti-diabetic medication non-adherence and this also supports the outcome of this current study (Demoz et al., 2020). In addition, it was reported by a cross-sectional survey conducted in Poland that, adults aged 65 years and above do not comply with their medication and therefore suffer complications. However, this study revealed that adult diabetic patients between the ages of 40 years and 49 years established a significant association with anti-diabetic medication non-compliance and as such do not relate well (Bonikowska & Szwamel, 2022).

In Ethiopia, it was found that a cross-sectional study had established a significant relationship between the presence of diabetic comorbidity and medication non-adherence. This finding agrees well with the outcome of this current study (Demoz et al., 2020). In Ghana, available evidence had indicated that non-compliance with anti-diabetic medication has a positive relationship to a younger age. This means that the younger population who are diabetic do not comply with the medication and this does not agree with the findings of this current study (Adongo et al, 2020). Similarly, a cross-sectional study by Afriyie, (2019) demonstrated factors such as age, sex, education and presence of comorbidities established a significant relationship to anti-diabetic medication. The study further revealed that participants above forty years of age are likely to miss their medication and this supports the outcome of this current study, non-adherence to anti-diabetic medication.

When type 2 diabetes patients refuse to comply with their anti-diabetic medication, they begin to record a high prevalence of non-adherence to therapy and experience poor glycemic control with subsequent complications (Gull et al., 2020). Complications such as the increased risk of cardiovascular diseases and renal damage are more common among non-adherence to medication after related morbidities and mortalities (Denicolò, 2021). Moreover, non-adherence to anti-diabetic therapy compromise the safety and effectiveness of treatment which has both direct and indirect cost on the individual and the healthcare system (Demoz et al., 2020). Again, increased and prolong non-adherence to medication contributes to the risk of blindness, kidney diseases, and delayed wound healing with subsequent lower limb amputation (Denicolò et al., 2021; Gebeyehu, 2019). Aside from all these associated complications ascribed to non-adherence to anti-diabetic medication, available evidence had indicated that non-adherence to medication significantly contributes to nervous system damage (neuropathy) leading to the cerebrovascular accident (stroke), Gangrene and peripheral neuropathy with decreased sexual function (Gebeyehu et al., 2019; Manzoor, 2018).

Conclusions

This recent research sought to identify the predictors of anti-diabetic medication non-compliance among type 2 diabetic patients accessing healthcare at the Volta River Authority Hospital, Ghana. The present study concluded that close to half of the participants were not complying with their anti-diabetic medication regimen at the hospital and this has an effect on glycemic control which could result in diabetic-related complications such as renal damage, retinopathy, and neuropathy among others. Additionally, it was concluded that diabetes self-care practices were inadequate. That is more than half the participants on medication at the hospital do not practice adequate self-care to manage their condition amidst their medication. Their inability to practice adequate self-care amidst medication has serious consequences on increasing their risk of diabetic-related complications and sometimes untimely death due to multiple organ failure as a result of poor glycemic control with subsequent organ malfunction. Moreover, it was also concluded that socio-demographic factors such as age group 40-49 years and being female were protective against diabetes complications resulting from non-compliance. However, the single and not married participants had an increased risk of non-complying with anti-diabetic medication at the facility. Again, the presence of diabetic comorbidity was found to be protective against complications arising out of anti-diabetic medication non-adherence. This means participants with other medical-related conditions were less likely to non-comply with their medication. Hence their ability to avert associated complications of non-compliance to prescribed medications. In line with the conclusions drawn from the study, the following recommendations were made;

Healthcare authorities at the hospital should also embark on intensive education continuously on diabetes self-care practices that would help diabetic patients manage their condition amidst the anti-diabetic medication provided to them. Effective counselling and advice coupled with regular follow-up should be rendered to diabetic patients amidst the medications given to them at the hospital. The study is also recommended for further study to identify the factors that influence diabetes self-care practices at the hospital so that, a holistic view can be drawn to better comprehend the challenges of anti-diabetic medication non-compliance at the hospital.

Availability of data and materials

Data and materials for the study are available upon request from the authors

Conflict of interest – None [Please make a conflict of-interest statement]

Acknowledgements – Please acknowledge any individual or group of individuals who have supported you in your study who need to be thanked

References

Abdul-Tawab, A. (2019). Factors associated with non-adherence to anti-diabetic medication among diabetic patients in some selected polyclinics in the Ablekuma Sub-Metropolitan, Accra, Ghana. *Ugspace.ug.edu.gh/handle*/123456789/36369

Abebe, K., N., Shegena, E. A., Stephen, O. P., Namugambe, S., & Yadesa, T. M. (2022). Prevalence and factors associated with inappropriate anti-diabetic medication therapy among type 2 diabetes mellitus patients at the medical and surgical wards of Mbarara Regional Referral Hospital, Uganda. *Plos one 70*, 1–18. https://doi.org/10.1371/.0270108

Adongo, R., A., V. B., Bavo, T., A., Afaya, A., Hamid, T. A. (2020). Medication adherence and self-care behaviours among patients with type 2 diabetes mellitus in Ghana. *Plos one 68*, 1–14. https://doi.org/10.1371/journal.pone.0237710

Afriyie, G. (2019). Non-Adherence to Medication and Associated Factors among Type 2 Diabetes Mellitus Patients Attending Tema General Hospital (Doctoral dissertation, *University of Ghana).*

Akram, F., Azam, N., Mansoor, E., Minallah, A., Maroof, S., & Haider, A. (2020). Factors affecting lifestyle adaptation/consistency among cases of type 2 diabetes mellitus in urban Pakistan. *Pakistan Armed Forces Medical Journal*, *70*(1), 86-90

Alodhaib, G., Alhusaynan, I., Mirza, A., & Almogbel, Y. (2021). Qualitative Exploration of Barriers to Medication Adherence Among Patients with Uncontrolled Diabetes in Saudi Arabia. *Pharmacy*, *9*(1), 16. - include last page

Aminde, L. N., Tindong, M., Ngwasiri, C. A., Aminde, J. A., Njim, T., Fondong, A. A., & Takah, N. F. (2019). Adherence to anti-diabetic medication and factors associated with non-adherence among patients with type-2 diabetes mellitus in two regional hospitals in Cameroon. *BMC endocrine disorders*, *19*(1), 1-9.

Anurupa, M. S., Aditya, A., & Angadi, N. (2019). A study of medication adherence and self-care practices among type-2 diabetes patients in Davangere. *National Journal of Community Medicine*, *10*(01), 12-16.

Asati, J. (2021). *F*actors Affecting Medical Nutritional Therapy among Type 2 Diabetes Patients at Kenyatta National Hospital, Nairobi, Kenya. Retrieved from http://ir.*jkuat.ac.ke/handle*/123456789/5517

Asiedu-Danso, M., Kretchy, I. A., Sekyi, J. K., & Koduah, A. (2021). Adherence to antidiabetic medications among women with gestational diabetes. *Journal of Diabetes Research*. [include volume edition and the pages please]

Basu, S., Garg, S., Sharma, N., Singh, M. M., & Garg, S. (2018). Adherence to self-care practices, glycemic status and influencing factors in diabetes patients in a tertiary care hospital in Delhi. *World Journal of Diabetes*, *9*(5), 72–79. https://doi.org/10.4239/wjd.v9.i5.72

Belhabib, G., Lahyani, M., Mhiri, A., Gloulou, O., Sahli, J., & Chouchane, N. (2018). Evaluation of factors for therapeutic adherence in diabetic patients. *Le Pharmacien Hospitalier et Clinicien*, *53*(2), 159-167.

Bekele, H., Asefa, A., Getachew, B., & Belete, A. M. (2020). Barriers and strategies to lifestyle and dietary pattern interventions for prevention and management of type-2 diabetes in Africa, systematic review. *Journal of Diabetes Research*, [include volume edition and the pages please]

Bonikowska, I., Szwamel, K., & Uchmanowicz, I. (2022). Adherence to Medication in Older Adults with Type 2 Diabetes Living in Lubuskie Voivodeship in Poland: Association with Frailty Syndrome. *Journal of Clinical Medicine*, *11*(6), 1707 - include the last page].

A. T., Hivert, M. F., Lee, C. G., & Franks, P. W. (2020). Precision medicine in diabetes: a consensus report from the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes care*, *43*(7), 1617-1635.

Connel, B. A. (2020). Medication adherence and predictors of adherence with Type-2 diabetes mellitus patients in Ghana - A systematic review. *University of Ghana* (10805757), 1–42.

Dedefo, M. G., Ejeta, B. M., Wakjira, G. B., & Mekonen, G. F. (2019). Self-care practices regarding diabetes among diabetic patients in West Ethiopia. *BMC Research Notes*, 1–7. https://doi.org/10.1186/s13104-019-4258-4

Demoz, G. T., Wahdey, S., Bahrey, D., Kahsay, H., Woldu, G., Niriayo, Y. L., & Collier, A. (2020). Predictors of poor adherence to antidiabetic therapy in patients with type 2 diabetes : a cross-sectional study insight from Ethiopia. *Diabetology & Metabolic Syndrome*, 1–8. https://doi.org/10.1186/s13098-020-00567-7

Denicolò, S., Perco, P., Thöni, S., & Mayer, G. (2021). Journal of Diabetes and Its Complications Non-adherence to antidiabetic and cardiovascular drugs in type 2 diabetes mellitus and its association with renal and cardiovascular outcomes : A narrative review. *Journal of Diabetes and Its Complications*, *35*(7), 107931. https://doi.org/10.1016/j.jdiacomp.2021.107931

Eleazu, C. O., Eleazu, K. C., Chukwuma, S. C., Okoronkwo, J., & Emelike, C. U. (2014). Effect of Livingstone potato (Plectranthus esculenthus NE Br) on hyperglycemia, antioxidant activity and lipid metabolism of streptozotocin-induced diabetic rats. *Toxicology Reports*, *1*, 674-681

Fosuhemaa, I., B., Dare, S., Oduro, B. A., Baffour, K., Hinneh, T. K., & Nally, J. E. (2021). Patients ' knowledge of diabetes foot complications and self-management practices in Ghana : A phenomenological study. 1–15. *journal. pone*. https://doi.org/10.1371/ 0256417

Fouad, M., Salem, I., Elhefnawy, K., Raafat, N., & Faisal, A. (2020). MicroRNA-21 as an early marker of nephropathy in patients with type 1 diabetes. *Indian journal of nephrology*, *30*(1), 21. [include the last page]

Gabler, M., Picker, N., Geier, S., & Ley, L. (2021). Guideline Adherence and Associated Outcomes in the Treatment of Type 2 Diabetes Mellitus Patients With an Incident Cardiovascular Comorbidity : An Analysis Based on a Large German Claims Dataset. *Diabetes Therapy*, *12*(4), 1209–1226. https://doi.org/10.1007/s13300-021-01024-y

Gebeyehu, K., Abebe, T., & Woretaw, A. (2019). Prevalence of anti-diabetic medication adherence and

determinant factors in Ethiopia : A systemic review and meta-analysis, 2019. *International Journal of Africa Nursing Sciences*, *11*(July), 100167. https://doi.org/10.1016/j.ijans.2019.100167

Gooptu, A., Taitel, M., Laiteerapong, N., & V. G. (2021). Association between medication Non-adherence and increases in hypertension and type 2 diabetes medications. In *Healthcare* 9(8): 976 include the last page). MDPI.

Gull, M., Hussain, R., Bukhari, M. H., Bibi, J., & Mughal, A. (2020). Knowledge About Complications of Diabetes Mellitus and its Association with Treatment Compliance Among Type 2 Diabetics Visiting a Public Sector Diabetes Clinic. *Journal of Rawalpindi Medical College*, *24*(1), 32-36.

Gali, A., & Muraraiah, S. (2020). Assessment of Factors Influencing Adherence to Antidiabetic Drugs among Patients with Type 2 Diabetes Mellitus at a Tertiary Care Hospital in India. *Pharmacology and Clinical Pharmacy Research*, *5*(1), 7 include last page. https://doi.org/10.15416/pcpr.v5i1.26507

Kassu, R. A., G. B., & Bekele, M. (2021). The magnitude and associated factors of poor medication adherence among diabetic and hypertensive patients visiting public health facilities in Ethiopia during the COVID-19 pandemic. *journal.pone*.1–13. https://doi.org/10.1371/ 0249222

Jarab, A. S., Badinjki, M., & Hyassat, D. (2021). Exploring variables associated with medication non-adherence in patients with type 2 diabetes mellitus. *journal. pone*. 1–11. https://doi.org/10.1371/0256666

Kretchy, I. A., Koduah, A., Ohene-Agyei, T., Boima, V., & Appiah, B. (2020). The association between diabetes-related distress and medication adherence in adult patients with type 2 diabetes mellitus: a cross-sectional study. *Journal of diabetes research*, [include volume edition and the pages please]

Machado, V., Botelho, J., Proença, L., Alves, R., Oliveira, M. J., Amaro, L., & Mendes, J. J. (2020). Periodontal status, perceived stress, diabetes mellitus and oral hygiene care on quality of life: A structural equation modelling analysis. *BMC Oral Health*, *20*(1), 1-11.

Manzoor, S., Aziz, M., & Sheikh, A. S. (2018). *I*dentification and Characterization of Candida on CHROMAgar ™ in Pregnant Women of Multan, *Pakistan Journal of Women's s Health Care*. 7(2). [include the pages] https://doi.org/10.4172/2167-0420.1000424

Murwanashyaka, J. D. D., Ndagijimana, A., Biracyaza, E., & Sunday, F. X. (2022). Non-adherence to medication and associated factors among type 2 diabetes patients at Clinique Medicale Fraternite, Rwanda : a cross-sectional study. *BMC Endocrine Disorders*, 1–14. https://doi.org/10.1186/s12902-022-01133-0

Ingersgaard, M. V., Andersen, T. H., Norgaard, O., Grabowski, D., & Olesen, K. (2020). Reasons for nonadherence to statins–a systematic review of reviews. *Patient preference and adherence*, *14*, 675 - include the last page.

Opoku-addai, K., Korsah, K. A., Patience, G., (2022). Nutritional self-care practices and skills of patients with diabetes mellitus : A study at a tertiary hospital in Ghana. *journal.pone* 1–17. https://doi.org/10.1371/.0265608

Raharinavalona, S. A., Razanamparany, T., Ralamboson, S., & Rakotomalala, P. (2021). Factors of Non-adherence to Antidiabetic Drugs in Type 2 Diabetics , Antananarivo Madagascar. *International Journal of Diabetes and Endocrinology*, *6*(4), 125–130. https://doi.org/10.11648/j.ijde.20210604.11

Spadea, T., Onorati, R., Baratta, F., Pignata, I., Parente, M., Pannacci, L., & Brusa, P. (2021). Monitoring adherence to pharmacological therapy and follow-up examinations among patients with type 2 diabetes in community pharmacies. Results from an experience in Italy. *PloS one*, *16*(9), e0256478.

Taye, G. M., Bacha, A. J., Taye, F. A., Bule, M. H., & Tefera, G. M. (2021). Diabetic ketoacidosis management and treatment outcome at the medical ward of Shashemene Referral Hospital, Ethiopia: a retrospective study. *Clinical Medicine Insights: Endocrinology and Diabetes*, *14*, [include the pages] 11795514211004957.

Weldegiorgis, T., A., Dessie, G., & Workineh, Y. (2021). Non-adherence to self-care and associated factors among diabetes adult population in Ethiopia : A systemic review with meta-analysis. *journal. pone*. *91*, 1–23. https://doi.org/10.1371/ 0245862

Widayanti, A. W., Sigalingging, K. K., Dewi, F. P., & Widyakusuma, N. N. (2021). Issues Affecting Medication-Taking Behavior of People with Type 2 Diabetes in Indonesia: A Qualitative Study. *Patient preference and adherence*, *15*, 989 include the last page.

Wolde, H. F., Derso, T., Biks, G. A., Yitayal, M., Ayele, T. A., Gelaye, K. A., & Atnafu, A. (2020). The high hidden burden of diabetes mellitus among adults aged 18 years and above in urban Northwest Ethiopia. *Journal of diabetes research*, [include volume edition and the pages please]

.

Xu, N., Xie, S., Chen, Y., Li, J., & Sun, L. (2020). Factors influencing medication non-adherence among Chinese older adults with diabetes mellitus. *International Journal of Environmental Research and Public Health*, *17*(17), 1–10. https://doi.org/10.3390/ijerph17176012