Alshayban DM, Kurdi S, Joseph R, Al Alshehri SJ, Alsharani MS, Garwan YM, Alshaiban M. Predictors of adherence to diabetes medications: multicentre study from the Eastern Province, Saudi Arabia. Pharmacy Practice 2023 Oct-Dec;21(4):2860.
https://doi.org/10.18549/PharmPract.2023.4.2860

Original Research

Predictors of adherence to diabetes medicationss: multicentre study from the Eastern Province, Saudi Arabia

Dhfer Mahdi Alshayban, Sawsan Kurdi, Royes Joseph, Shaher Zafer Al Alshehri, Mohammed S. Alsharani, Yusuf M. Garwan, Mohammed Alshaiban

Received (first version): 11-Apr-2023 Accepted: 16-May-2023 Published online: 18-Oct-2023

Abstract

Background: The prevalence of diabetes mellitus disease (DM) is growing rapidly across the world, however the rate of increment is considerably high in Arab countries, which increases in them the risks of developing microvascular (e.g., retinopathy, nephropathy, and neuropathy) and macrovascular diseases (e.g., cardiovascular diseases and cerebrovascular disease). Better Adherence to diabetes medications play important role in achieving better health outcomes and preventing the complications of the disease. However, there are different factors that might affect the adherences. The aim of the study was to evaluate the predicators of the level of adherence of type 2 DM patients in the Eastern Province, KSA. **Methodology:** 376 participants were randomly selected from two hospitals in the Eastern Province, Saudi Arabia, and adherence towards anti-diabetic drugs was measured using the General Medication Adherence Scale (GMAS). **Results:** The participants included equal proportion of males and females, 79% with older than 50 years, 46% with an education of primary school or lower, and 43% with monthly income of 5000 SAR or lower. Among the participants, 22% did not have any diabetes related complications, 38% were on oral medication as well as insulin injection for diabetes and 10% had history of hospitalisation due to diabetes. Importantly, 37% (138/376) of participants were reported partial or lower adherence level, and only 42% (160/376) of participants reported high level of adherence. The degree of adherence was also lower among participants had Random blood glucose level (RBG) of 200 mg/dl or more compared to participants with RBG of 200 mg/dl or lower (p-value<0.001). **Conclusion:** This study identified several predictors to medication adherence in diabetics although some of them were not statistically significant. Educational interventions regarding the importance of adherence and consequences of non-adherence could promote better adherence in the population of Eastern province in Saudi Arabia.

Keywords: adherence; diabetes mellitus; GMAS; Saudi Arabia

Dhfer Mahdi ALSHAYBAN. Department of Pharmacy Practice, College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, P.O.BOX 1982, Dammam, 31441, Saudi Arabia.
Sawsan KURDI*. Department of Pharmacy Practice, College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, P.O.BOX 1982, Dammam, 31441, Saudi Arabia. smkurdi@iau.edu.sa
Royes JOSEPH. Department of Pharmacy Practice, College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, P.O.BOX 1982, Dammam, 31441, Saudi Arabia.
Shaher Zafer AL ALSHEHRI. King Fahad Hospital of the University-Imam Abdulrahman Bin Faisal University, P.O.BOX 1982, Dammam, 31441, Saudi Arabia.
Mohammed S. ALSHARANI. Emergency and Critical Care Department, King Fahad Hospital of the University-Imam Abdulrahman Bin Faisal University, P.O.BOX 1982, Dammam, 31441, Saudi Arabia.
Yusuf M. GARWAN. Department of Pharmacy Practice, College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, P.O.BOX 1982, Dammam, 31441, Saudi Arabia.
Mohammed ALSHAIBAN. King Khaled Hospital, Najran, Ministry of Health, Saudi Arabia.

INTRODUCTION

Diabetes mellitus (DM) is a highly disseminated, chronic disease resulting from insufficient insulin production from pancreatic cells or underutilization of insulin.[1] The American Diabetes Association (ADA) in 1997 classified DM as type 1, type 2, gestational, and other types.[2] In 2014, WHO estimated that 422 million people above 18 years have diabetes and expected to reach 642 million by 2040.[3] Al Dawish et al., 2015 reported that 25% of the adult population has diabetes, and the percentage is projected to double by 2030.[4] This alarming rise in DM prevalence and its associated complications render DM as an emerging global health concern.[5] The WHO states that the prevalence of diabetes in the Kingdom of Saudi Arabia is the second highest among Middle Eastern countries.[6]

DM dramatically enhances the risk of developing microvascular (e.g., retinopathy, nephropathy, and neuropathy) and macrovascular diseases (e.g., cardiovascular diseases and cerebrovascular disease), which are fatal and increase the risk of mortality.[7] Morbidity & mortality related to diabetes is creating challenges on economic, social, and other aspects that seriously affect the lives of individuals, families, businesses, and the entire society.[8]

Adherence can be defined as the patient›s behavior in sticking to the medical advice.[9] Adherence in terms of taking medication, making lifestyle changes, undergoing medical examinations, and keeping appointments with physicians can help achieve the treatment's therapeutic goals.[10] Different

barriers can affect patients' adherence and lead to non-adherence status. Some of them are patient-centered, like demographic and psychological factors.[10,11] Others can be either therapy-related factors like complex treatment regimens or medication side effects, or healthcare system-related factors such as insufficient or confusing information provided by their healthcare providers.[12,13]

Patients' adherence tends to reduce with time. Patients with chronic diseases adhere less to their long-term medications than those on short-term medications.[10, 14] Type 2 diabetes patients show low adherence rates to their drug regimens; however, this varies widely between populations.[15] Poor adherence to anti-diabetes medications alters the effectiveness of treatment and contributes to suboptimal glycaemic control. This adversely affects the patient condition, and severe health complications arise, compromising patients' quality of life with an escalation in mortality.[13] Effective patient counselling regarding their disease and treatment regimens can improve patient adherence.[15] Our study aimed to assess the impact of socio-demographic and clinical characteristics on medication adherence of type 2 DM patients in the Eastern Province, KSA. Knowing the predictors might help policymakers to determine the appropriate interventions to enhance adherence to type 2 diabetes medications.

METHODOLOGY

Study setting and subjects

A questionnaire-based cross-sectional study was designed. The questionnaire's Arabic and English versions were made available offline and online. Patients, who visited the outpatient clinics at two major hospitals in the Eastern Province of Saudi Arabia, were approached through systematic sampling. A number of fifth-year graduate students who were trained for data collection using a structured questionnaire visited the clinics once weekly from November 2017 to April 2018. Systematically selected eligible patients were explained the purpose of the study, requested to provide their consent to participate in the study and invited to fill out the questionnaire either offline or online. Any T2DM patients were eligible if they had T2DM for at least one year, were residents of Saudi Arabia, aged 18 years or older, and could respond to the questionnaire in Arabic or English with minimal support. Ethical approval was obtained from the Institutional Review Board at Imam Abdulrahman bin Faisal University (IRB-2019-05-391).

Sample size calculation was carried out assuming that a minimum of 50% of T2DM patients are expected to show a moderate-high level of medication adherence. The study required a sample size of 385 participants to detect the prevalence with a 95% confidence level and a 5% margin of error. During the study period, 490 eligible patients were approached, and 376 (response rate = 77%) completed the questionnaire.

Data Collection

The data collection was carried out using a structured questionnaire with two parts. The first part consists of participants' socio-demographic and clinical characteristics, including age, gender, academic qualification, monthly income level, the number of diabetes-related complications, type of diabetes medications, and history of hospitalization due to diabetes. The second part used a standardized and validated questionnaire called the 'General Medication Adherence Scale (GMAS)' to assess adherence towards anti-diabetic drugs.[16] The GMAS is a validated questionnaire in Saudi patients with chronic disease and showed a good reliability index (Cronbach's $\alpha = 0.865$).[16] The tool consists of 11 items over three dimensions: patient's intentional or unintentional behavior-related non-adherence (five items), disease and pills burden-related non-adherence (four items), and cost-related non-adherence (two items). Participants were asked to rate these items on a 4-point Likert scale from 0 (=always) to 3 (=never). The sum scores 0-33 represent an overall medication adherence, with the higher score indicating a higher adherence level. An overall score of 30–33, 27–29, 17–26, 11–16, and less than 11 were regarded as high, good, partial, low, and poor overall medication adherence, respectively.

Statistical analysis

Data were summarised using descriptive statistics – mean and standard deviation (SD) for continuous variables and frequency and percentage for categorical variables. Participants' characteristics were summarized using frequencies and percentages. The mean and SD of the GMAS overall score were provided, in addition to the percentage of patients in each level of adherence. Chi-square test and multiple regression models were used to assess socio-demographic and clinical factors' association with adherence. The outcome variable for the chi-square test and multiple logistic regression was a binary variable indicating 'partial or lower adherence level' or 'not.' The logistic regression model reported the adjusted odds ratio (AOR) and 95% confidence interval (CI). As a sensitivity analysis, a multiple linear regression with the overall GMAS score as the outcome variable. Least-square estimate of mean difference and 95% CI were reported from the linear regression model. The normality of the outcome variable was examined through a Q-Q plot and Shapiro-Wilk test of standardized residuals. Statistical significance was assessed against a 5

RESULTS

Participants' socio-demographic and clinical characteristics of 376 participants were detailed in Table 1 (second column). The participants included equal proportion of males and females, 79% with older than 50 years, 46% with an education of primary school or lower, and 43% with monthly income of 5000sar or lower. Among the participants, 22% did not have any diabetes related complications, 38% were on oral medication as well as insulin injection for diabetes and 10% had history of hospitalisation due to diabetes. Thirteen % of participants had RBG of 300 mg/dl or more.

Adherence level using GMAS

Figure 1 shows the item-specific response to GMAS. The

Table 1. Adherence level by socio-demographic and clinical characteristics of participants

Factors			GMAS overall score		
		Total (%)	Mean (SD)	n (%) with score<=26[#]	p-value
Gender					
	Male	186 (49.5%)	27.1 (6.4)	64 (34.4%)	0.361
	Female	190 (50.5%)	27.4 (4.7)	74 (38.9%)	
Age					
	<50 years	78 (20.7%)	25.6 (6)	38 (48.7%)	0.011
	>50 years	296 (78.7%)	27.8 (5.4)	98 (33.1%)	
Education status					
	Primary or lower	174 (46.3%)	27.6 (5.2)	64 (36.8%)	0.641
	High/Secondary	128 (34%)	27 (6.1)	50 (39.1%)	
	College graduate	74 (19.7%)	27.1 (5.7)	24 (32.4%)	
Monthly family income					
	Less than 5000 SAR	162 (43.1%)	27 (6.1)	64 (39.5%)	0.692
	5000 to 10000 SAR	98 (26.1%)	27.2 (4.5)	34 (34.7%)	
	More than 10000 SAR	112 (29.8%)	27.8 (5.8)	40 (35.7%)	
Number of diabetes related complications					
	Nil	82 (21.8%)	25.9 (7.8)	34 (41.5%)	0.409
	One	120 (31.9%)	27.4 (4.8)	46 (38.3%)	
	More than one	174 (46.3%)	27.9 (4.8)	58 (33.3%)	
Anti-diabetic medication type					
	Insulin injection or combination	144 (38.3%)	27.2 (5.4)	56 (38.9%)	0.422
	Only oral medication	230 (61.2%)	27.4 (5.7)	80 (34.8%)	
Random blood glucose level (mg/dl)					
	< 200	194 (51.6%)	28.1 (5.9)	46 (23.7%)	<0.001
	200 to 299	134 (35.6%)	26.7 (4.9)	62 (46.3%)	
	> 300	48 (12.8%)	25.5 (5.9)	30 (62.5%)	
Hospital admission during last year due to diabetes					
	No	340 (90.4%)	27.7 (4.8)	120 (35.3%)	0.082
	Yes	36 (9.6%)	23.7 (10.1)	18 (50%)	

[#]score<=26 indicates partial or low-poor adherence

average overall adherence score was 27.3 (SD:5.6) on a 0–33 scale. Figure 2 shows the degree of overall adherence among diabetes patients. Importantly, 37% (138/376) of participants were reported partial or lower adherence level, and only 42% (160/376) of participants reported high level of adherence.

Predictors of partial or lower adherence level

The difference in adherence level between patients' characteristics was reported in Table 1. The univariate analysis showed that significantly lower level of adherence among aged less than 50 years compared to patients older than 50 years (p-value=0.011). In addition, the degree of adherence was also lower among participants who had RBG of 200 mg/dl or more compared to participants with RBG of 200 mg/dl or lower (p-value<0.001).

Table 2 (column 3) presents the AOR and 95% CI from a logistic regression model where the outcome variable indicates 'partial or lower adherence level' or 'not.' Table 2 (column 4) presents the least-square estimate (95% CI) from the linear regression model, where the overall GMAS score was the outcome variable. The estimate quantified the adjusted mean difference in adherence score between a group and the corresponding reference group. The negative difference indicates lower adherence for a group compared to the reference group, whereas the positive difference indicates a higher adherence for the group. The results from both regression models showed that patients older than 50 years were more likely to adhere to their medications. The AOR (95% CI) for the age group >50 years was 1.76 (1.01, 3.04). The adjusted mean difference in GMAS score (95% CI) for the age group >50 years in reference to aged < 50 years was -1.96 (-3.36, -0.56). In addition, the odds of having low adherence among the patients with RBG in between 200-300 mg/dl and >300 mg/dl were more than

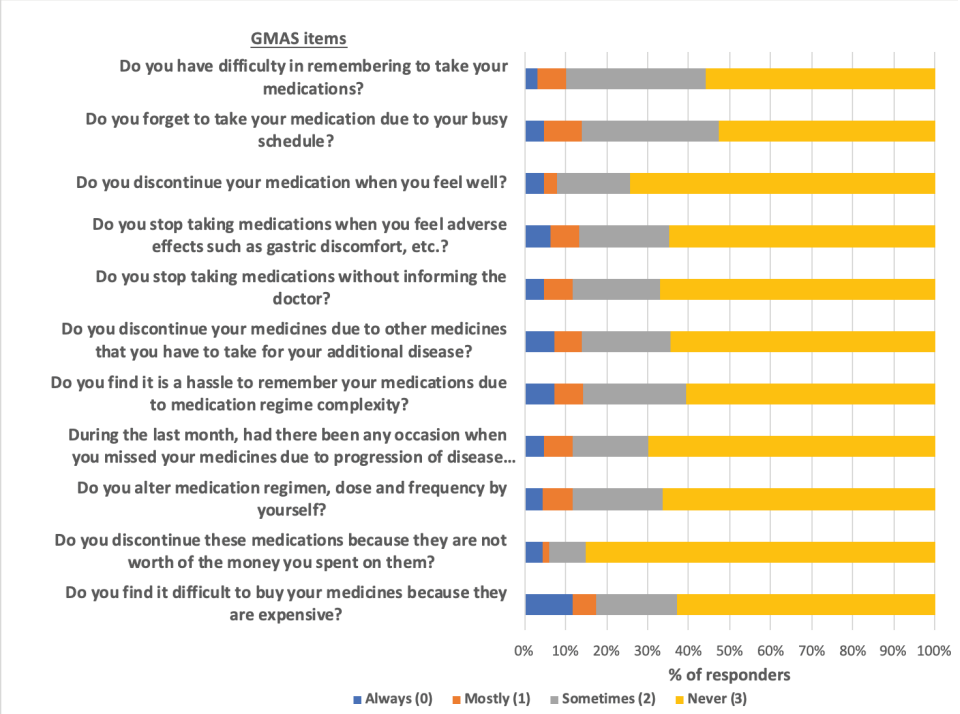

Figure 1. Item-specific response to adherence scale

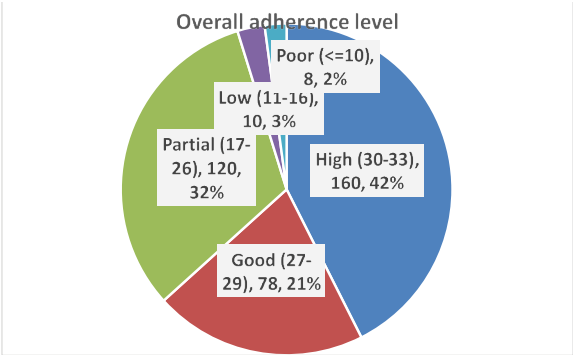

Figure 2. Degree of adherence

Table 2. Predictors of low medication adherence – regression modelling

		Logistic modelling[1]		Continuous modelling[2]	
		Adjusted odds ratio (95% CI)	**p-value**	**LS mean difference (95% CI)**	**p-value**
Age					
	<50 years	Reference		Reference	
	>50 years	1.76 (1.01, 3.04)	0.044	-1.96 (-3.36, -0.56)	0.006
Anti-diabetic medication type					
	Insulin injection or combination	Reference		Reference	
	Only oral medication	1.68 (0.98, 2.87)	0.060	-0.66 (-1.97, 0.65)	0.324
Random blood glucose level (mg/dl)					
	< 200	Reference		Reference	
	200 to 299	3.42 (2.01, 5.83)	<0.001	-1.65 (-2.97, -0.34)	0.014
	> 300	7.28 (3.38, 15.72)	<0.001	-2.82 (-4.73, -0.91)	0.004

[1]outcome was defined as partial or lower adherence level (i.e. GMAS score26); [2]outcome was the GMAS overall score; LS – least square; CI – confidence interval

threefold [AOR: 3.42 (2.01, 5.83)] and sevenfold [AOR: 7.28 (3.38, 15.72)] compared to the group with RBG <200 mg/dl, respectively. The corresponding adjusted mean differences (95% CI) were -1.65 (-2.97, -0.34) and -2.82 (-4.73, -0.91), respectively.

DISCUSSION

Documenting medication adherence is a crucial evaluating parameter when determining treatment success. We conducted this study to determine medication adherence to antidiabetic medications and their predictors in Saudi patients with type 2 diabetes mellitus. Overall, 62% of patients appeared good-high adherence to antidiabetic medicines. However, more than a third of patients had partial-to-poor adherence. Previous figures for satisfactory medication adherence were reported to be 23% and 32.1% in Jazan and AlHassa regions of Saudi Arabia, respectively.[17,18] However, both studies did not use a validated measure to document medication adherence. Our study used a novel medication adherence measuring tool validated in the Saudi population, which is a strength of our study.

The present study showed that some patient demographic and other factors were linked with changes in adherence to diabetes treatments. Gender, age, education level, monthly income, type of medications, and RBG were some of these factors. Only the age factor was statistically significantly associated with higher adherence, as older patients had higher treatment adherence. These results may be explained by the fact that the older population usually has more severe diseases, which makes them more committed to their medications.[19] Several studies have reported that adherence increases with age, supporting our results.[20-23] In contrast, other studies found that younger patients were more likely to be adherent than older patients.[24]

One of the notable occurrences in our study was the significant association of adherence score with random blood glucose levels. It was observed that patients with elevated random blood glucose levels seem to have lower adherence scores which were found consistently in several studies.[25-29] This is logical as non-adherence to antidiabetic medicines would cause blood glucose to rise, resulting in a hyperglycaemic state.

Similarly, patients on oral hypoglycaemic medicines appeared more adherent than those on combined oral and injectable insulins or insulin alone. Available literature suggests that gender acted as an independent predictor of adherence in Saudi patients; however, there was no significant association of gender with adherence in our study.16, [30-36] Studies conducted in Saudi patients have reported that patients have better adherence suffered from fewer complications.[18] In our study, it was observed that most patients with better adherence scores had no diabetes-related hospital admission in the last year.

While this research provided several essential points regarding the predictors of the level of adherence, it has some limitations. The first limitation was that we could not obtain information about the patient's hemoglobin A1c (HbA1c) because many patients could not recall it while collecting the data. HbA1c is considered a critical predictor for long-term glycaemic control and might provide strong evidence for patient adherence to medications for the past three months. The second limitation is that our data were collected only from hospitals in the Eastern province, which might indicate that the sample population cannot represent the Saudi population. Therefore, the findings of our study cannot be generalized to larger populations.

CONCLUSION

Our study highlighted that less than half of Saudi patients with type 2 diabetes mellitus adhered highly to their medication regimen. Moreover, our study identified the predictors for adherence to type 2 diabetes medications. The age of patients acted as an independent predictor of adherence, while no such association was seen in the patient's education level. Patients with better adherence scores had better treatment outcomes. The study's findings suggest that educating patients about the importance of adherence and the repercussions of non-adherence could promote better adherence in this population.

References

1. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4*4 million participants. Lancet 2016; published online April http://dx.doi.org/10.1016/S0140-6736(16)00618-8
2. Kharroubi AT. Diabetes mellitus: The epidemic of the century. World Journal of Diabetes. 2015;6(6):850. https://doi.org/10.4239/wjd.v6.i6.850
3. Chatterjee S, Khunti K, Davies MJ. Type 2 diabetes. The Lancet. 2017;389(10085):2239-51.
4. Al Dawish MA, Robert AA, Braham R, et al. Diabetes Mellitus in Saudi Arabia: A Review of the Recent Literature. Curr Diabetes Rev. 2015. https://doi.org/10.2174/1573399811666150724095130
5. Meo SA1, Usmani AM, Qalbani E. Prevalence of type 2 diabetes in the Arab world: impact of GDP and energy consumption. Eur Rev Med Pharmacol Sci. 2017;21(6):1303-1312.
6. Robert A, Dawish MA, Braham R, et al. Type 2 Diabetes Mellitus in Saudi Arabia: Major Challenges and Possible Solutions. Current Diabetes Reviews. 2016;13(1):59-64. https://doi.org/10.2174/1573399812666160126142605
7. Fukuda H, Mizobe M. Impact of nonadherence on complication risks and healthcare costs in patients newly-diagnosed with diabetes. Diabetes Res Clin Pract. 2017;123:55-62. https://doi.org/10.1016/j.diabres.2016.11.007
8. Seuring T, Archangelidi O, Suhrcke M. The Economic Costs of Type 2 Diabetes: A Global Systematic Review. Pharmacoeconomics. 2015;33(8):811-831. https://doi.org/10.1007/s40273-015-0268-9

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

9. García-Pérez LE, Álvarez M, Dilla T, et al. Adherence to Therapies in Patients with Type 2 Diabetes. Diabetes Therapy. 2013;4(2):175-94. http://doi.org/10.1007/s13300-013-0034-y
10. Ataur R Khan, Zaki N, Al-Abdul Lateef, et al. Factors contributing to non-compliance among diabetics attending primary health centers in the Al Hasa district of Saudi Arabia. J Family Community Med. 2012;19(1):26-32. https://doi.org/10.4103/2230-8229.94008
11. Jing J, Sklar GE, Min Sen Oh V, et al. Factors affecting therapeutic compliance: A review from the patient's perspective. Ther Clin Risk Manag. 2008;4:269-286.
12. Lewis A. Non-compliance: A $100bn problem. [Last accessed on 2011 Aug 01]; Remington Rep. 1997 5:14–5. [Last cited on 2010 Nov 20]. Available from: http://www.qu.edu.qa/pharmacy/documents/MEMS_Seminar_29Sep09-Semin
13. Sunya-Lee Antoine, Dawid Pieper, Tim Mathes, et al. Improving the adherence of type 2 diabetes mellitus patients with pharmacy care: a systematic review of randomized controlled trials. BMC Endocrine Disorders. 2014;14(1):53. http://www.biomedcentral.com/1472-6823/14/53
14. Al-Shammari SA, Khoja T, Al-Yamani MJ. Compliance with short-term antibiotic therapy among patients attending primary health center in Riyadh, Saudi Arabia. J Royal Soc Promot Health. 1995;115:231-234. https://doi.org/10.1177/146642409511500407
15. Khaled Heissam, Zeinab Abuamer, Nahed El-Dahshan. Patterns and obstacles to oral antidiabetic medications adherence among type 2 diabetics in Ismailia, Egypt: a cross section study. Pan African Medical Journal. 2015;20:177. https://doi.org/10.11604/pamj.2015.20.177.4025
16. Naqvi AA, AlShayban DM, Ghori SA, et al. Validation of the General Medication Adherence Scale in Saudi Patients with Chronic Diseases. Front Pharmacol. 2019;10:633. https://doi.org/10.3389/fphar.2019.00633
17. Alhazmi T, Sharahili J, Khurmi S, et al. Drug Compliance among Type 2 Diabetic patients in Jazan Region, Saudi Arabia. Int J Adv Res. 2017;5(1):966-974. https://doi.org/10.21474/ijar01/2838
18. Khan AR, Al-Abdul Lateef ZN, Al Aithan MA, et al. Factors contributing to non-compliance among diabetics attending primary health centers in the Al Hasa district of Saudi Arabia. J Family Community Med. 2012;19(1):26-32. https://doi.org/10.4103/2230-8229.94008
19. Janz NK, Becker MH. The health belief model: a decade later. Health Educ Q. 1984;11:1-47. https://doi.org/10.1177/109019818401100101
20. Kim, Seung Jae. Impact of number of medications and age on adherence to antihypertensive medications: a nationwide population-based study. Medicine 98. 2019. https://doi.org/10.1097/md.0000000000017825
21. Hashmi SK, Afridi MB, Abbas K, et al. Factors associated with adherence to anti-hypertensive treatment in Pakistan. PLoS One. 2007;2:e280. https://doi.org/10.1371/journal.pone.0000280
22. Marentette MA, Gerth WC, Billings DK, et al. Antihypertensive persistence and drug class. Can J Cardiol. 2002;18:649-56.
23. Shaya FT, Du D, Gbarayor CM, et al. Predictors of compliance with antihypertensive therapy in a high-risk medicaid population. J Natl Med Assoc. 2009;101:34-9. https://doi.org/10.1016/s0027-9684(15)30808-7
24. Rodriguez F, Cannon CP, Steg PG, et al. Predictors of long-term adherence to evidence-based cardiovascular disease medications in outpatients with stable atherothrombotic disease: findings from the REACH Registry. Clin Cardiol. 2013;36:721-727. https://doi.org/10.1002/clc.22217
25. Demoz GT, Gebremariam A, Yifter H, et al. Predictors of poor glycemic control among patients with type 2 diabetes on follow-up care at a tertiary healthcare setting in Ethiopia. BMC Res Notes. 2019;12:207. https://doi.org/10.1186/s13104-019-4248-6
26. Demoz, Gebre Teklemariam, et al. Predictors of poor adherence to antidiabetic therapy in patients with type 2 diabetes: a cross-sectional study insight from Ethiopia. Diabetology & Metabolic Syndrome. 2020;1-8. https://doi.org/10.1186/s13098-020-00567-7
27. Al Hamid A, Aslanpour Z, Aljadhey H, et al. Hospitalisation resulting from medicine-related problems in adult patients with cardiovascular dis- eases and diabetes in the United Kingdom and Saudi Arabia. Int J Environ Res Public Health. 2016;13:479. https://doi.org/10.3390/ijerph13050479
28. Ali Khan, Khan Ullah. Ahmad. Pharmacotherapy evaluation of diabetic patients in ward of general medicine, northwest general hospital & research centre, a case study from Khyber Pakhtunkhwa, Pakistan. Phar- macol Online. 2015;1:104-108.
29. Van Roozendaal BW, Krass I. Development of an evidence-based checklist for the detection of drug related problems.
30. Khayyat SM, Khayyat SM, HyatAlhazmi RS, et al. Predictors of Medication Adherence and Blood Pressure Control among Saudi Hypertensive Patients Attending Primary Care Clinics: A Cross-Sectional Study. PLoS One. 2017;12(1):e0171255. https://doi.org/10.1371/journal.pone.0171255
31. Ahmed NO, Abugalambo S, Almethen GH. Adherence to oral hypoglycemic medication among patients with diabetes in Saudi Arabia. Int J Health Sci (Qassim). 2017;11(3):45-49.
32. Al-Sowielem LS, Elzubier AG. Compliance and knowledge of hypertensive patients attending PHC centers in Al-Khobar, Saudi Arabia. Eastern Mediterranean Health Journal. 1998;4(2):301-307. https://doi.org/10.26719/1998.4.2.301
33. Mahmoud MIH. Compliance with treatment of patients with hypertension in Almadinah Almunawwarah: A community-based study. Journal of Taibah University Medical Sciences. 2012;7(2):92-98. https://doi.org/10.1016/j.jtumed.2012.11.004

34. Khalil SA, Elzubier AG. Drug compliance among hypertensive patients in Tabuk, Saudi Arabia. J Hypertens. 1997;15(5):561-5. https://doi.org/10.1097/00004872-199715050-00013
35. Alhewiti A. Adherence to Long-Term Therapies and Beliefs about Medications. Int J Family Med. 2014;479596. https://doi.org/10.1155/2014/479596
36. Candy DK. Determinants of medication adherence and blood pressure control among hypertensive patients in Hong Kong: a cross-sectional study. International Journal of Cardiology. 2015;182(1):250-257. https://doi.org/10.1016/j.ijcard.2014.12.064

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)