Prevalence and Determinants of Drug Adherence in Type 2 Diabetes Mellitus Patients

Tuho Konsultasi Mendrofa[1]; Ermi Girsang[1*)]; Sri Lestari Ramadhani Nasution[1]; Chrismis Novalinda Ginting[1]

[1.] Faculty of Medicine, Universitas Prima Indonesia

ARTICLE INFO

ABSTRACT

Compliance with type 2 patients with DM in taking medication is an important key in maintaining blood glycemic levels and preventing complications. This study was conducted to determine the prevalence and to investigate the determinants of medication adherence in type 2 patients with DM. A total of 250 types 2 patients with DM who visited Pulau Tello Health Center, South Nias Regency, were involved in this cross-sectional study. Collecting data using questionnaires and patient medical records. The results showed that the motivational variables (p= <0.001; PR= 2; 95%CI 1.560-2.668), family support (p= <0.001; PR = 4.2; 95%CI 2.827-6.496), individual coping (p = <0.001; PR=1.9; 95%CI 1.409-2.267), and income (p= <0.001; PR=1.7; 95%CI 1.346-2.258) were associated with medication adherence in type 2 patients with DM. family is the dominant variable that influences medication adherence in type 2 patients with DM. Patients with DM who does not adhere to medication are 7.8 times more likely to have poor support than patients who adhere to medication.

ABSTRAK

Kepatuhan pasien DM tipe 2 dalam mengonsumsi obat menjadi kunci penting dalam menjaga glikemik darah dan pencegahan komplikasi. Studi ini dilakukan untuk mengetahui prevalensi dan menyelidiki determinan kepatuhan minum obat pada pasien DM tipe 2. Sebanyak 250 orang pasien DM tipe 2 yang berkunjung di Puskesmas Pulau Tello, Kabupaten Nias Selatan dilibatkan dalam studi cross-sectional ini. Pengumpulan data menggunakan kuesioner dan rekam medis pasien. Hasil penelitian menunjukkan bahwa variable motivasi (p= <0,001; PR= 2; 95%CI 1,560-2,668), dukungan keluarga (p= <0,001; PR = 4,2; 95%CI 2,827-6,496), koping individu (p= <0,001; PR=1,9; 95%CI 1,409-2,267), dan pendapatan (p= <0,001; PR= 1,7; 95%CI 1,346-2,258) berhubungan dengan kepatuhan minum obat pasien DM tipe 2. Dukungan keluarga merupakan variabel yang dominan berpengaruh terhadap kepatuhan minum obat pada pasien DM tipe 2. Pasien DM yang tidak patuh minum obat 7,8 kali kecenderungannya memiliki dukungan yang kurang baik dibanding dengan pasien yang patuh minum obat.

INTRODUCTION

Diabetes mellitus (DM) is a chronic disease that can affect the patient's quality of life and can improve poor health quality for the surrounding individuals, this is due to a lack of insulin production by the pancreas or insulin that is not used by the body (Kassahun et al., 2016). Therefore, it must be an important concern to support better public health (Olorunfemi & Ojewole, 2019). Lifestyle is a factor that influences the occurrence of DM in individuals due to lack of

exercise, unhealthy eating patterns, to obesity (Ferreira & Castleberry, 2019). This bad lifestyle can cause complications of infectious and non-communicable diseases and hamper the productivity of daily life because DM does not only affect adults or the elderly, but teenagers are also very potentially affected by the disease (Jannoo & Khan, 2019).

In 2012, it was reported that more than 77% of morbidity and 88% of mortality occurred in developing countries due to DM (Kassahun et al., 2016; IDF, 2016; Harries et al., 2013). Global projections for type 2 diabetes show that by 2040, the prevalence of type 2 diabetes in adults is expected to increase to 10.4% (Ogurtsova et al., 2017). The prevalence of diabetes mellitus (DM) in Southeast Asia in 2015 was 415 million adults and is expected to increase in 2016 to around 642 million people (World Health Organization, 2016). World Health Organization (WHO) states that patients with DM in China do not have good glycemic control and nearly 110 million (10%) of all adults in China live with DM (Gu et al., 2017). Furthermore, in Indonesia, the prevalence of DM in 2013 reached 1.5% and increased to 2% in 2018, which occurred in the age group of 15 years and over. Based on the type of DM treatment, it shows that there are 75% of patients with oral antidiabetic drugs (OAD), 11% with OAD and insulin, 9% of patients who are not treated and 5% with insulin injections (Kementerian Kesehatan RI, 2018).

Risk factors for DM complications can occur due to lifestyle such as consuming alcohol, smoking, lack of physical activity, poor diet, and having a history of hypertension (Kassahun et al., 2016). However, these complications can be reduced by maintaining adherence to medication with good glycemic control. Adherence to taking medication should receive attention from health services to increase a higher level of health (Gu et al., 2017). Poor medication adherence can have serious health burdens such as increased mortality, decreased glycemic control, hospitalization, and complications of communicable and non-communicable diseases (Olorunfemi & Ojewole, 2019). In addition, the cost of inpatient medical intervention costs will be greater than the cost of drugs consumed properly without hospitalization (Mohd et al., 2016). Therefore, medication adherence in type 2 patients with DM is an important factor in preventing complications.

Recently, a lot of literature has developed around the theme of medication adherence in type 2 patients with DM. Previous studies have shown that DM medication adherence should be maximized (Lin et al., 2017; Vervloet et al., 2012). Social support and motivation are important factors for patients with DM, namely encouraging them to always take medication according to the doctor's recommendations (Gu et al., 2017), even the help of family, relatives, to the treating doctor can improve medication adherence in patients with DM. Because they feel stress, depression, and pain due to the disease (Maeda et al., 2013; Gu et al., 2017). In addition, individual coping can also contribute to patients with DM in maintaining and adjusting medication adherence (Murakami et al., 2020). Therefore, the patient's belief and understanding of the drugs they are taking can improve the patient's health condition, but one of the main obstacles is that if the drugs are not taken regularly, the risk that will occur is worse than their current condition. further improve diabetes medication adherence (Arifin et al., 2020; Olorunfemi & Ojewole, 2019). In addition, a study in Japan suggests that the government provides social welfare assistance for those with low socioeconomic status because it can minimize the link between low socioeconomic status and low medication adherence, although there is no direct link to low income (Park et al., 2018).

Previous studies affecting medication adherence in diabetes mellitus (DM) patients showed that economic factors (β=0.109; 95% CI 0.03,-0.19) affected patients with DM in the United States and South Korea not to take medication according to prescriptions. recommended because of the inability to buy the drug and 4.4% of them are classified as elderly (Park et al., 2018; Pednekar et al., 2020; Sharma et al., 2019). In Southwest Ethiopia, respondents with a low level of knowledge (44.9%), moderate level of knowledge (20.1%), and high level of knowledge (34.9%) and those who practice good self-care or medication adherence (AOR = 0.5, 95% CI: 0.3-0.9) tend to patients with low knowledge (Kassahun et al., 2016). In addition, over 2 years patients with DM increased by 0.4 (95% CI 0.2-0.5) and they were also more likely to be hospitalized because of non-adherence to take DM drugs (OR 2.6.95% CI 1.7 to 3.8) or outpatient visits (OR 2.4,95% CI 1.7 to 3.4) (Lin et al., 2017; Pednekar et al., 2020; Jannoo & Mamode Khan, 2019). Therefore, the effect of motivation by reminding patients with DM via SMS was influential in increasing drug adherence significantly (p <0.05) of 11.33 ± 8.47 (Adikusuma & Qiyaam, 2018). In addition, social support and family support are reinforcing factors that influence the formation of behavior (Adikusuma & Qiyaam, 2018), and even act as motivators that can encourage patients to continue to think positively about their disease and comply with the treatment recommended by health workers (Almira et al., 2019).

Furthermore, although various studies have identified the factors that influence medication adherence in patients with DM, the results of these studies have not been consistent, even unclear and there is a lot of uncertainty about the dominant factors affecting medication adherence in type 2 patients with DM. The phenomenon that occurs at the Tello Island Health Center, Pulau-Pulau Batu Subdistrict, South Nias Regency, is that there are still many patients with DM who do not know the function of regularly taking DM drugs and the side effects if they are not obedient in taking medication, even many patients with DM often forget to take their medication. Unable to buy drugs regularly and the habit of taking drugs that are not under the prescriptions given by doctors and other medical teams. Therefore, this study was conducted to determine the prevalence and to investigate the determinants of medication adherence in type 2 patients with DM.

METHOD

Research Design

This study is a quantitative study with a cross-sectional design, where observations were made only once and measurements were conducted simultaneously at the time of the study to know the prevalence and determinants of drug adherence in patients with diabetes mellitus. Furthermore, this research was conducted at the Tello Island Health Center, Pulau-Pulau Batu District, South Nias Regency in April 2021. Then, the variables studied in this study were the variables of motivation, family support, socioeconomic, individual coping, and adherence to taking diabetes mellitus medication.

Population

The subjects of this study were all patients who visited the Tello Island Health Center and had been diagnosed with diabetes as many as 250 people. The study sample size was used as the total sampling, namely, 250 patients with diabetes mellitus.

Data Collection

Data collection was conducted directly by distributing questionnaires to respondents containing questions related to factors that influence drug adherence in patients with DM that included a motivational questionnaire consisting of 11 statements with answer choices strongly agree (4), agree (3), does not agree (2) and strongly disagree (1), so the lowest score is 11 and the highest score is 44. Furthermore, the family support variable questionnaire contains 10 statements with answer choices namely always (4), often (3), rarely (2), and never (1), so the lowest score is 10 and the highest score is 40. Then, the personal coping questionnaire consists of 25 statements with answer choices, namely always (5), often (4), sometimes (3), rarely (2), and never (1), so the lowest score is 25 and the highest score is 125. The medication adherence questionnaire in patients with DM also consists of 8 questions with answer choices yes (1) and n is not (0), so the lowest score is 0 and the highest score is 8. In this study also before the respondents answered the questionnaire, all respondents were given informed consent to state their availability to be involved in this study.

Data Analysis

Research data processing begins with the process of examining data obtained from the field after researching the form of a list of questions or respondents' answers to questionnaires answered by respondents during the study. Next, provide an answer code to the questionnaire answered by the respondent during the research. Then, transferring the respondent's answers by using the Microsoft Office Excel program, and followed by transferring the data into a computer program package. Next, check the data again entered into the computer program to determine whether the data entered contain errors or not. Then, the data are compiled in the form of graphs, frequency distribution tables, and cross tables (Hulu & Sinaga, 2019).

The analysis of research data began by calculating the frequency distribution of demographic data for diabetes mellitus patients including (age, sex, occupation, education, and length of being affected by type 2 diabetes), as well as variables of motivation, family support, individual coping, income, and medication adherence of patients with DM. Furthermore, bivariate analysis was conducted to determine the effect of independent variables (motivation, family support, individual coping, income) on medication adherence in patients with DM, and to calculate the value of the PR association measure (prevalence ratio) using the Chi-Square test (α=0.05). Furthermore, multivariate analysis was conducted to determine the dominant variables influencing medication adherence in patients with DM using binary logistic regression test.

RESULT AND DISCUSSION

This study on the factors that influence adherence in patients with DM involved 250 diabetes mellitus patients who visited the Tello Health Center. In this study, all respondents were willing to fill out a consent form and were involved until the data collection was completed. The results of the study showed that the characteristics of the respondents obtained from the calculation of the frequency distribution, namely most patients with diabetes mellitus have an age of 51-56 years by 38%, followed by an age of 46-50 years by 34.8%, ages 40-45 years by 15.2% and age 57-62 years by 12% (Figure 1). From the respondent's age, which is dominated by the age of 51-56 years, it can affect patients not to take medication because at that age they begin experiencing a decrease in memory. According to Awodele & Osuolale (2015), there is a strong relationship between age and medication adherence. The patient's memory, hearing, and vision will decline with age, causing the patient to refuse to take medication, thus requiring family assistance or supervision.

Based on gender, 54.4% of respondents were female and 45.6% were male. In terms of gender, adherence to medication for DM sufferers is not always consistent between male and female sexes so that their blood sugar levels are uncontrolled. The results of the study by Widodo et al. (2016) showed that patients with DM with uncontrolled blood sugar levels were more experienced by women, namely as many as 32 people (66.7%). However, when compared to women, men have a 0.688-fold greater chance of controlling blood sugar levels. Furthermore, Janitra & Sandika (2018) states that women are more to develop diabetes than men because the hormone estrogen makes them more susceptible to fat. Obesity, as a result of an unhealthy lifestyle, is a risk factor for diabetes.

Then, most patients with DM work as farmers by 38.8%. Thus, as a result of the respondent's work as a farmer, it affects their behavior to not comply with taking DM drugs. From the results of field observations, it can be seen that more respondents who work as farmers are busy with dragging rubber and rice fields and do not bring DM drugs when they go to the mastermind so that the tendency to consume DM drugs is low. This finding conforms to the study by Jimmy et al. (2014), who found that patients with heavier work schedules had a higher tendency to violate the rules in taking drugs.

From the latest education level, most patients with DM have primary education as much as 26.8%, followed by high school education as much as 22%, undergraduate education as much as 19.6%, junior high school as much as 16% and diploma education as much as 15.6%. Level of education can affect knowledge the better and easier to find and receive information about something and related to information about DM treatment. From the results of the study, the education level of patients with DM varied greatly, but most patients with DM were in the elementary education category so that it affected their behavior in consuming DM drugs to be less compliant due to their lack of understanding in consuming. However, the results of this study differ from the research conducted by Liberty et al. (2018) who found that 42.9% of patients with type 2 DM with uncontrolled glycemic control had junior high school education and that the respondent's education was not significant for glycemic control in patients with type 2 diabetes mellitus.

Furthermore, type 2 patients with DM had the most length of treatment > 3 years as much as 66.4%. The research results of Gu et al. (2017) also described the long duration of diabetes, namely, more than half of patients had diabetes for 6-15 years, 41.39 percent had diabetes for less than 6 years, and 7.85 percent had diabetes for more than 15 years. The duration of having DM is also significant for medication adherence so that it can affect the glycemic status of the patient. The results of the Bestari study (2020) showed that most patients had type 2 diabetes for more than 5 years. In this study, it was stated that because diabetes mellitus cannot be cured, but can be managed for life, so the duration of the disease is determined by how well a person can regulate his blood sugar levels.
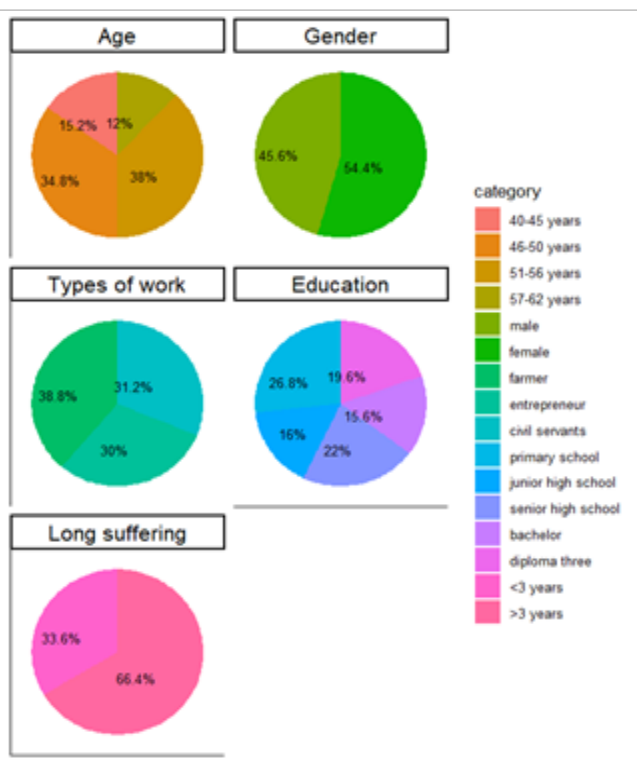
Figure 1 Characteristics of patients with DM

Table 1 shows that the results of the calculation of the frequency distribution of motivational variables, most of the respondents have low motivation as much as 62.8%. Furthermore, most of the family support is not good as 64.8%. Then, most of the individual coping was categorized as less good as much as 59.6%, and the respondent's income was mostly Rp. 2,000,000. Furthermore, the majority of DM patients did not comply with taking medication as much as 64%.

Table 1
Distribution of frequency of motivation, family support, individual coping, income, and drug compliance (n=250)

Variable	n	%
Motivation		
Low	157	62,8
High	93	37,2
Family support		
Not good	162	64,8
Good	88	35,2
Individual coping		
Not good	149	59,6
Good	101	40,4
Income		
$\leq$ Rp.2.000.000	164	65,6
> Rp.2.000.000	86	34,4
Compliance with taking medication		
Not obey	160	64
Obey	90	36

Table 2
Bivariate test results

Variable	Compliance with taking medication						p	PR	95%CI	
	Not obey		Obey		Total					
	n	%	n	%	n	%			Lower	Upper
Motivation										
Low	124	79	33	21	157	100	<0,001	2,04	1,560	2,668
High	36	38,7	57	61,3	93	100				
Family support										
Not good	142	87,7	20	12,3	162	100	<0,001	4,3	2,827	6,496
Good	18	20,5	70	79,5	88	100				
Individual coping										
Not good	116	77,9	33	22,1	149	100	<0,001	1,8	1,409	2,267
Good	44	43,6	57	56,4	101	100				
Income										
Rp. $\leq$2.000.000	123	75	41	25	164	100	<0,001	1,7	1,346	2,258
Rp. >2.000.000	37	43	49	57	86	100				

In this study, bivariate analysis was also carried out using the Chi-Square test to determine the effect of motivation, family support, individual coping and income on medication adherence in DM patients (Table 2). The results showed that the motivational variable had a significant effect on medication adherence in patients with DM (p = <0.001; PR = 2; 95% CI 1.560-2.668). Patients with DM who does not adhere to medication are twice as likely to have low motivation compared to patients who adhere to medication. The low motivation of type 2 patients with DM can be seen from the results of the calculation of the frequency distribution in Table 1, namely, the motivation of type 2 patients with DM, most of the respondents have low motivation as much as 62.8%. Patients who have low motivation because they do not realize the importance of taking type 2 DM drugs during the treatment period, so there are still many of them who are less compliant and delay in taking prescription drugs provided by puskesmas (health center), even from some respondents stated that they more reduce the frequency of drug consumption. Basically, motivated patients will conduct activities to maintain health that can affect medication adherence in diabetes mellitus patients (Almira et al., 2019). Previous research has shown that patients with DM who get good motivation through SMS and can consult, have a significant effect on adherence to taking DM medication significantly (p=<0.05; Cl 11.33 ± 8.47) (Adikusuma & Qiyaam, 2018). Patients who have good motivation will have a good level of adherence to taking DM medication and the spirit to

recover, but the presence or absence of motivation depends on the awareness of the patient with DM itself (Ningrum, 2018). Additionally, health workers also have an important role in motivating patients with DM by providing informational, emotional, instrumental support, and appreciation or appreciation support if the patient with DM is eager to recover by taking the medication regularly until he recovers from his illness (Permatasari et al., 2020).

Furthermore, family support had a significant effect on medication adherence in patients with DM (p = <0.001; PR = 4.2; 95% CI 2.827-6.496). patients with DM who do not adhere to medication are 4.2 times more likely to have poor support than patients who adhere to medication. Poor family support, as can be seen from the results of respondents' answers to the questionnaires they have answered that most families do not remind DM sufferers to control, take medication, and physical exercise. Then, the family does not have the time and facilities for treatment and does not accompany and pay attention to the patient is undergoing treatment. Thus, family support is crucial for patients with DM to comply with type 2 DM drug consumption. However, the higher the quality of life of patients with DM, the better the family support. For patients with type 2 diabetes, family support is considered beneficial in performing maintenance tasks such as monitoring blood sugar regularly and taking medication. People with type 2 diabetes who is always cared for by family members will feel more comfortable and safe, thereby increasing motivation to recover (Meidikayanti & Wahyuni, 2017). A previous study conducted by Arif (2019), showed that more than half (54.3%) of patients who adhered to the DM medication were due to family factors reminding them to take medication on time and pay attention to it with the aim of the patient recovering. The research of Gu et al. (2017) concluded that patients with DM who have support from their family and closest relatives are more likely to recover faster than those without family support and social integration.

Then, individual coping had a significant effect on medication adherence in patients with DM (p = <0.001; PR=1.9; 95%CI 1.409-2.267). Patients with DM who does not adhere to medication are 1.9 times more likely to have individual with low-income coping compared to patients who adhere to medication. Individual coping that is not good can be seen from the results of respondents' answers to the questionnaires they have answered at the time of the study, these results indicate that type 2 patients with DM mostly state that they never stay away from complaining and frustration, rarely try suppressing and avoid personal emotions, never deal with problems by seeking appropriate action and never changing habits in solving problems. Lifestyle changes in patients with DM can increase stress on themselves, due to the necessity of dependence on drugs that are consumed to quickly recover from the disease, where the way to overcome this is by increasing individual coping by doing impulse control exercises such as adapting to positive thinking (Albai et al., 2017; G W Stuart, 2016) and improve spiritually by supporting patients for better health status and conditions (Li et al., 2014). The quality of life of people with type 2 diabetes is related to their coping techniques. The application of coping mechanisms in patients with diabetes affects the patient's adherence to DM therapy, which can result in low or high blood glucose levels in patients with diabetes (Dewi et al., 2021).

In addition to individual coping variables, family income significantly influences medication adherence in patients with DM (p = <0.001; PR = 1.7; 95% CI 1.346-2.258). patients with DM who do not adhere to medication are 1.7 times more likely to have an income of Rp. <2,000,000 compared to patients who adhere to medication. Patients with DM who have low incomes are unable to buy DM drugs and do not have transportation to visit the Puskesmas, so this is an obstacle for them to consume DM drugs regularly. Additionally, those who are already above 50 years of age, because some of them cannot work and do not have a steady income, this affect their compliance in taking DM drugs, which are classified as non-compliant. This study conforms to the research of Putri et al. (2021) where most respondents who seek treatment are more than 60 years old, so they do not have a job and a steady income. In the Julaiha study (2019), it was stated that the patient's ability to pay for medicines, transportation, and other needs greatly influence income. Outpatient patients with DM who do not adhere to medication are 2.9 times more likely to have an income of Rp. <2,100,000 compared to patients who adhere to medication. Further research by Chew et al. (2015) showed that income had a significant effect on adherence to diabetes medication in adults (p=0.003; X2=11.42). In young adults with type 2 diabetes mellitus, higher income (adjusted odds ratio 0.90) was a significant variable in medication nonadherence. In this study, in addition to univariate and bivariate analysis, binary logistic regression analysis was also conducted to identify the dominant factors that influence medication adherence in type 2 patients with DM. Variables of motivation, family support, individual coping and income are candidate variables in logistic regression modeling with value (p < 0.25).

Table 3
Logistics Regression Model

Variable	B	Nilai p	Exp(B)	95% C.I	
				Lower	Upper
Motivation	0.872	0.031	2.4	1.083	5.287
Family support	2.760	<0.001	7.8	7.349	33.958
Individual coping	1.430	<0.001	4.2	1.960	8.914
Income	0.865	0.028	2.3	1.097	5.140
Constant	-8.986	<0.001	<0.001		

Table 3 shows that the dominant variable influencing medication adherence in type 2 patients with DM is family support (p = <0.001; PR = 7.8; 95%CI 7.349-33.959). patients with DM who do not adhere to medication are 7.8 times tend to have poor support compared to patients who adhere to medication. Family support refers to a person's attitudes, actions, and acceptance of a sick person. During the treatment process, patients with DM need a lot of social support from others (Lenny & Fridalina, 2018). The low family support is because the family is not aware of the dangers of complications associated with type 2 diabetes mellitus, and one of the best ways to prevent complications is to take medication as directed (Gustianto et al., 2020).

CONCLUSION AND RECOMMENDATIONS

This study concluded that the motivational variables (p= <0.001; PR= 2; 95%CI 1.560-2.668), family support (p= <0.001; PR = 4.2; 95%CI 2.827-6.496), individual coping (p = <0.001; PR=1.9; 95%CI 1.409-2.267), and income (p= <0.001; PR=1.7; 95%CI 1.346-2.258) were associated with medication adherence in type 2 patients with DM. family is the dominant variable that influences medication adherence in type 2 patients with DM. Patients with DM who do not adhere to medication are 7.8 times more likely to have poor support than patients who adhere to medication.

Conflict of Interest Statement

The authors declared that no potential conflicts of interests with respect to the authorship and publication of this article.

REFERENCES

Adikusuma, W., & Qiyaam, N. (2018). Adherence level and blood sugar control of type 2 diabetes mellitus patients who gets counseling and short messages service as reminder and motivation. *Asian Journal of Pharmaceutical and Clinical Research*, *11*(2). https://doi.org/10.22159/ajpcr.2018.v11i2.22988

Albai, A., Sima, A., Papava, I., Roman, D., Andor, B., & Gafencu, M. (2017). Association between coping mechanisms and adherence to diabetes-related self-care activities: A cross-sectional study. *Patient Preference and Adherence*, *11*, 1235–1241. https://doi.org/10.2147/PPA.S140146

Almira, N., Arifin, S., & Rosida, L. (2019). Faktor-Faktor Yang Berhubungan Dengan Perilaku Kepatuhan Minum Obat Anti Diabetes Pada Penderita Diabetes Melitus Tipe 2 di Puskesmas Teluk Dalam Banjarmasin. *Hemeostasis*, *2*(1), 9–12.

Arif, M. (2019). Hubungan Dukungan Keluarga Dengan Kepatuhan Minum Obat Pada Pasien Diabetes Melitus Tipe 2 Diruang Poli Penyakit Dalam Rsud Dr. Achmad Mochtar Bukittinggi Tahun 2017. *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699.

Arifin, H., Nani, S., Makassar, H., Makassar, N. H., & Makassar, N. H. (2020). Hubungan Self Care Dengan Kualitas Hidup Pada Pasien Diabetes Melitus Tipe 2 di RSUD Sinjai. *Jurnal Ilmiah Kesehatan Diagnosis*, *15*(4), 406–411.

Awodele, O., & Osuolale, J. A. (2015). Medication adherence in type 2 diabetes patients: Study of patients in alimosho general hospital, Igando, Lagos, Nigeria. *African Health Sciences*, *15*(2), 513–522. https://doi.org/10.4314/ahs.v15i2.26

Bestari, I. L. (2020). Characteristics Of Patients With Type 2 Diabetes Mellitus At Surabaya Haji General Hospital. *The Indonesian Journal of Public Health*, *15*(3), 286. https://doi.org/10.20473/ijph.v15i3.2020.286-294

Chew, B. H., Hassan, N. H., & Sherina, M. S. (2015). Determinants of medication adherence among adults with type 2 diabetes mellitus in three Malaysian public health clinics: A cross-sectional study. *Patient Preference and Adherence*, *9*, 639–648. https://doi.org/10.2147/PPA.S81612

Dewi, R., Anugrah, I. H., Permana, I., Budhiana, J., & Melinda, F. (2021). Hubungan Mekanisme Koping Dengan Kualitas Hidup Pada Penderita Diabetes Melitus Tipe 2. *Jurnal Kesehatan Indra Husada*, *9*(1), 1–9.

Ferreira, S., & Castleberry, G. (2019). A Systems Thinking Perspective of Medication Adherence for Patients with Diabetes Mellitus. *Procedia Computer Science*, *153*, 218–224. https://doi.org/10.1016/j.procs.2019.05.073

G.W. Stuart. (2016). *Prinsip dan Praktik Keperawatan Kesehatan Jiwa* (1st ed.). Elsevier Ltd.

Gu, L., Wu, S., Zhao, S., Zhou, H., Zhang, S., Gao, M., Qu, Z., Zhang, W., & Tian, D. (2017). Association of social support and medication adherence in Chinese patients with type 2 diabetes mellitus. *International Journal of Environmental Research and Public Health*, *14*(12). https://doi.org/10.3390/ijerph14121522

Gustianto, V., Sadik, D., Gusti, Y. T., Studi, P., Kebidanan, D., Adila, S., Lampung, B., Masyarakat, K., & Kesehatan, F. (2020). Hubungan Dukungan Keluarga Dalam Program Prolanis Dengan Kepatuhan Minum Obat Pasien Diabetes Melitus Tipe 2 di Puskesmas Rawat Inap Banjarsari Kota Metro Tahun 2019. *Jurnal Ilmu Kesehatan Indonesia*, *1*(1), 1–11. http://repository.poltekkes-denpasar.ac.id/1224/%0Ahttp://digilib2.unisayogya.ac.id/handle/123456789/1340%0Ahttp://jurnal.umitra.ac.id/index.php/jikmi/article/view/301

Harries, A. D., Satyanarayana, S., Kumar, A. M. V., Nagaraja, S. B., Isaakidis, P., Malhotra, S., Achanta, S., Naik, B., Wilson, N., Zachariah, R., Lönnroth, K., & Kapur, A. (2013). Epidemiology and interaction of diabetes mellitus and tuberculosis and challenges for care: a review [Review article]. *Public Health Action*, *3*(1), 3–9. https://doi.org/10.5588/pha.13.0024

IDF. (2016). Diabetes and impaired glucose tolerance. 6th ed. Brussels: Diabetes Atlas. In *Offshore* (Vol. 76, Issue 7).

Janitra, F. E., & Sandika, D. (2018). Correlation Between Blood Glucose Control And Decrease Of Peripheral Vascularization In Diabetes Mellitus Patient. *Nurscope : Jurnal Penelitian Dan Pemikiran Ilmiah Keperawatan*, *4*(1), 18. https://doi.org/10.30659/NURSCOPE.4.1.18-22

Jannoo, Z., & Khan, N. M. (2019). Medication Adherence and Diabetes Self-Care Activities among Patients with Type 2 Diabetes Mellitus. *Value in Health Regional Issues*, *18*, 30–35. https://doi.org/10.1016/j.vhri.2018.06.003

Jimmy, B., Jose, J., Al-Hinai, Z. A., Wadair, I. K., & Al-Amri, G. H. (2014). Adherence to medications among type 2 diabetes mellitus patients in three districts of al Dakhliyah governorate, Oman: A cross-sectional pilot study. *Sultan Qaboos University Medical Journal*, *14*(2).

Julaiha, S. (2019). Analisis Faktor Kepatuhan Berobat Berdasarkan Skor MMAS-8 pada Pasien Diabetes Mellitus Tipe 2. *Jurnal Kesehatan*, *10*(2), 203. https://doi.org/10.26630/jk.v10i2.1267

Kassahun, T., Gesesew, H., Mwanri, L., & Eshetie, T. (2016). Diabetes related knowledge, self-care behaviours and adherence to medications among diabetic patients in Southwest Ethiopia: A cross-sectional survey. *BMC Endocrine Disorders*, *16*(1), 1–11. https://doi.org/10.1186/s12902-016-0114-x

Kementerian Kesehatan RI. (2018). Riset Kesehatan Dasar Tahun 2018. In *Kementerian Kesehatan RI* (Vol. 53, Issue 9).

Lenny, L., & Fridalina, F. (2018). Faktor-Faktor yang Berhubungan dengan Kepatuhan Berobat Jalan Pasien Diabetes Mellitus Tipe II. *Jurnal Ilmu Kesehatan Masyarakat*, *7*(02), 85–93. https://doi.org/10.33221/jikm.v7i02.110

Li, M., Li, T., Shi, B. Y., & Gao, C. X. (2014). Impact of motivational interviewing on the quality of life and its related factors in type 2 diabetes mellitus patients with poor long-term glycemic control. *International Journal of Nursing Sciences*, *1*(3), 250–254. https://doi.org/10.1016/j.ijnss.2014.05.022

Liberty, I. A., Roflin, E., Aziz, M., Pariyana, P., & Tjekyan, S. (2018). Oral Antidiabetic Utilization and Various Factors as an Indicator for HbA1c Control Among Patients with Type 2 Diabetes. *Makara Journal of Health Research*, *22*(3), 128–132. https://doi.org/10.7454/msk.v22i3.9018

Lin, L. K., Sun, Y., Heng, B. H., Kwang Chew, D. E., & Chong, P. N. (2017). Medication adherence and glycemic control among newly diagnosed diabetes patients. *BMJ Open Diabetes Research and Care*, *5*(1), 1–10. https://doi.org/10.1136/bmjdrc-2017-000429

Maeda, U., Shen, B. J., Schwarz, E. R., Farrell, K. A., & Mallon, S. (2013). Self-efficacy mediates the associations of social support and depression with treatment adherence in heart failure patients. *International Journal of Behavioral Medicine*, *20*(1), 88–96. https://doi.org/10.1007/s12529-011-9215-0

Meidikayanti, W., & Wahyuni, C. U. (2017). Hubungan Dukungan Keluarga dengan Kualitas Hidup Diabetes Melitus Tipe 2 Di Puskesmas Pademawu. *Jurnal Berkala Epidemiologi*, *5*(2), 240–252. https://doi.org/10.20473/jbe.v5i2.2017.240-252

Mohd, M. M. M. A.-H., Phung, H., Sun, J., & Morisky, D. E. (2016). Improving adherence to medication in adults with diabetes in the United Arab Emirates. *BMC Public Health*, *16*(1), 1–11. https://doi.org/10.1186/s12889-016-3492-0

Murakami, H., Yasui-Furukori, N., Otaka, H., Nakayama, H., Murabayashi, M., Mizushiri, S., Matsumura, K., Tanabe, J., Matsuhashi, Y., Yanagimachi, M., Sugawara, N., Shimoda, K., & Daimon, M. (2020). Coping styles associated with glucose control in individuals with type 2 diabetes mellitus. *Journal of Diabetes Investigation*, *11*(5), 1215–1221. https://doi.org/10.1111/jdi.13225

Ningrum, D. K. (2018). Kepatuhan Minum Obat pada Penderita Diabetes Melitus Tipe II. *Higeia Journal of Public Health*, *1*(3), 84–94.

Ogurtsova, K., da Rocha Fernandes, J. D., Huang, Y., Linnenkamp, U., Guariguata, L., Cho, N. H., Cavan, D., Shaw, J. E., & Makaroff, L. E. (2017). IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. *Diabetes Research and Clinical Practice*, *128*, 40–50. https://doi.org/10.1016/j.diabres.2017.03.024

Olorunfemi, O., & Ojewole, F. (2019). Medication belief as correlate of medication adherence among patients with diabetes in Edo State, Nigeria. *Nursing Open*, *6*(1), 197–202. https://doi.org/10.1002/nop2.199

Park, hwa Y., Seo, sin A., Yoo, H., & Lee, K. (2018). Medication adherence and beliefs about medication in elderly patients living alone with chronic diseases. *Patient Preference and Adherence*, *12*, 175–181. https://doi.org/10.2147/PPA.S151263

Pednekar, P., Heller, D. A., & Peterson, A. M. (2020). Association of medication adherence with hospital utilization and costs among elderly with diabetes enrolled in a state pharmaceutical assistance program. *Journal of Managed Care and Specialty Pharmacy*, *26*(9), 1099-1108B. https://doi.org/10.18553/jmcp.2020.26.9.1099

Permatasari, S. N., Mita, & Herman. (2020). Hubungan Peran Fungsi Petugas Kesehatan Dengan Kepatuhan Minum Obat Pada Pasien Diabetes Melitus Tipe 2 Di Wilayah Kerja Puskesmas Gang Sehat Pontianak. *Tanjungpura Journal of Nursing Practice and Education*, *2*(1). https://doi.org/10.26418/tjnpe.v2i1.42014

Putri, A. H., Setiani, L. A., & Nurdin, N. M. (2021). Analisis Faktor-Faktor yang Mempengaruhi Kepatuhan Penggunaan Obat Pasien Diabetes Mellitus Tipe 2 di Rumah Sakit PMI Kota Bogor. *Proceeding of Mulawarman Pharmaceuticals Conferences*, *13*(1), 41–48. https://doi.org/10.25026/mpc.v13i1.441

Sharma, A., Mentz, R. J., Granger, B. B., Heitner, J. F., Cooper, L. B., Banerjee, D., Green, C. L., Majumdar, M. D., Eapen, Z., Hudson, L., & Felker, G. M. (2019). Utilizing mobile technologies to improve physical activity and medication adherence in patients with heart failure and diabetes mellitus: Rationale and design of the TARGET-HF-DM Trial. *American Heart Journal*, *211*, 22–33. https://doi.org/10.1016/j.ahj.2019.01.007

Vervloet, M., van Dijk, L., Santen-Reestman, J., van Vlijmen, B., van Wingerden, P., Bouvy, M. L., & de Bakker, D. H. (2012). SMS reminders improve adherence to oral medication in type 2 diabetes patients who are real time electronically monitored. *International Journal of Medical Informatics*, *81*(9), 594–604. https://doi.org/10.1016/j.ijmedinf.2012.05.005

Widodo, C., Tamtomo, D., & Prabandari, A. N. (2016). Hubungan Aktifitas Fisik, Kepatuhan Mengkonsumsi Obat Anti Diabetik Dengan Kadar Gula Darah Pasien Diabetes Mellitus di Fasyankes Primer Klaten. *Jurnal Sistem Kesehatan*, *2*(2). https://doi.org/10.24198/jsk.v2i2.11237

World Health Organization. (2016). Proportional mortality (% of total deaths, all ages). *World Health Organization*, 1.