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Research Article

The Relationship of Medication Adherence to Controlled HbA1c and ASCVD Risk in Type II Diabetes Mellitus Patients in Minggir Primary Health Care

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ABSTRACT

Type II diabetes mellitus (DM) therapy can be evaluated from the controlled HbA1c. Another aspect that needs to be controlled in patients with DM is lipid levels. Lipid levels should be controlled in a patient with type II DM to prevent atherosclerotic cardiovascular disease (ASCVD). The study was conducted to determine the relationship between medication adherence with controlled HbA1c and ASCVD risk in patients with type II DM. The study was an analytical observational study with a cross-sectional research design used to examine the relationship between medication adherence with controlled HbA1c and ASCVD risk. Our respondents were patients following a chronic disease management program at Minggir Primary Health Care. The level of medication adherence was measured using the Medication Adherence Report questionnaires. The ASCVD risk was measured using the American College of Cardiology/American Heart Association tools. The chi-squared test was applied to determine the relationship between medication adherence with HbA1c values and ASCVD risk in patients with type II DM. Most patients with type II DM had high medication adherence (60%), controlled HbA1c values (56.4%), and high ASCVD risk (70.9%). There was no significant relationship between medication adherence in type II DM patients with controlled HbA1c values and ASCVD risk.

INTRODUCTION

According to the World Health Organization (WHO), the prevalence of type 2 diabetes in Indonesia will increase from 8.4 million in 2000 to 21.3 million in 2030 (IDF, 2021). Almost all provinces experienced an increase in diabetes prevalence in 2013-2018. There were four provinces with the highest prevalence of diabetes in 2013 and 2018: The Special Region of Yogyakarta (DIY), Jakarta, North Sulawesi, and East Kalimantan (Indonesian Ministry of Health and Health Research and Development Center, 2019). One of the regencies in DIY is Sleman. According to the Sleman Regency Health Office, in 2020, diabetes mellitus (DM) was included in the top ten diseases, ranking 4th in Sleman Regency. The prevalence of DM has increased from the previous year, from 36,864 to 59,378 in 2019 (Public Health Office for Sleman Regency, 2020).

According to the American Diabetes Association (ADA) in 2019, DM is a metabolic disorder characterized by blood glucose levels exceeding normal limits or hyperglycemia due to abnormalities in insulin secretion, insulin action, or both. DM is classified into four major types: type 1 DM, type 2 DM, gestational DM, and other types of DM. Type 2 DM is caused by increased blood sugar due to decreased insulin secretion by the pancreas gland (Indonesia Ministry of Health, 2020; PERKENI, 2021). Non-pharmacological management of patients with DM can be done by implementing a healthy lifestyle with eating arrangements and increasing physical activity. In contrast, pharmacological treatments can be done by administering oral anti-hyperglycemia drugs and insulin (Indonesian Ministry of Health, 2020). DM is a health disorder that must be addressed immediately, so the goal of treatment in patients with DM is to prevent complications

and improve the success of treatment therapy (Pramestutie *et al*., 2016).

One of the challenges to successful treatment of patients with DM is their medication nonadherence (Naufanesa *et al*., 2020; Siwi *et al*., 2022). Questionnaires can measure the level of medication adherence. One type of questionnaire used to measure patient medication adherence is the Medication Adherence Report Scale (MARS) (Alfian *et al*., 2017). The treatment result of DM should be monitored by regular HbA1c checks (PERKENI, 2021). HbA1c is an average picture of blood sugar levels, a moderate view of blood sugar levels over the past three months; HbA1c measurement must be carried out routinely (IDF, 2019, 2021). The HbA1c test is performed at least twice yearly to see treatment therapy results. HbA1c cannot be used for evaluation in certain conditions such as anemia, hemoglobinopathy, history of blood transfusion in the last 2-3 months, hemoglobin metabolism disorder, conditions that affect erythrocyte age, and impaired renal function. Diabetes is under control if the result of HbA1c is <7%, and for elderly patients, the target HbA1c is 7.5% - 8.5% (PERKENI, 2021).

Uncontrolled DM can cause severe acute and chronic complications, especially in the macrovascular, microvascular, nervous system, or neuropathy, affecting health and quality of life and cause increased morbidity and mortality (Indonesian Ministry of Health, 2020). Macrovascular complications affect the heart, brain, and blood vessels, while microvascular complications occur in the eyes and kidneys. Patients with DM also experience other complaints, such as motor, sensory, and autonomic neuropathy (Indonesian Ministry of Health, 2020). Diabetes is among the leading causes of death in Indonesia (Indonesia Ministry of Health, 2020). Patients with DM have an eight times greater risk of developing dyslipidemia than non-diabetic patients (Eka *et al*., 2016). Dyslipidemia in patients with uncontrolled DM can cause Atherosclerotic Cardiovascular Disease (ASCVD) (Husni *et al*., 2018; Puspaseruni, 2021; Riset *et al*., 2022). Some studies address ASCVD risk factors but do not predict future cardiovascular disease events (Anharudin *et al*., 2022). Prevention of ASCVD can now be done by calculating the predicted risk of cardiovascular disease in the next ten years. Cardiovascular risk prediction is essential to prevent the occurrence of ASCVD by helping plan the treatment of cardiovascular disease. A treatment plan to reduce cardiovascular disease incidence is aimed at reducing the progressivity of atherosclerotic plaque formation (Dwivani *et al*., 2018).

Puskesmas is a primary healthcare facility that reduces the number of non-communicable diseases, especially type 2 DM (Radito, 2014). Based on this condition, this study aimed to analyze the level of oral antidiabetic medication adherence in patients with type 2 DM. It can help to control HbA1c to improve patients' quality of life and prevent DM disease complications in Minggir Primary Health Care, Sleman Regency, Yogyakarta.

METHODS

Study Site and Population

This was an analytical observational study with a research design used to see the relationship between medication adherence with controlled HbA1c values and ASCVD risk. The respondents in this study were selected using purposive and non-probability sampling techniques. The respondents were patients with type II DM at Minggir Primary Health Care. The research obtained permission from the Sleman Regency Government Health Office with letter 020/459.

Inclusion Criteria

The research respondents were chronic disease management program patients at the Minggir Primary Health Care, Sleman, Yogyakarta, who were 40 – 79 years old, who received oral anti-hyperglycemic treatment for at least one year, could communicate verbally well, had no disease complications, and were willing to sign informed consent (IC) forms to participate. Patients were aged 40 – 79 years who used oral antihyperglycemic medication for at least three months and had scheduled HbA1c checks for patients with DM. They were willing to fill in the IC form and were actively involved as study respondents. Before asking for signatures, the researcher explained information about the study participants that was expected from them before the study was conducted. The conjunction process was done with the DM patients' HbA1c checking activities from Minggir Primary Health Care.

Exclusion criteria

Exclusion criteria in this study were type 2 DM patients with complications, conditions that could affect HbA1c values such as anemia, hemoglobinopathy, a history of blood transfusions in the last 2-3 months, hemoglobin metabolism disorder, a condition that affects erythrocyte age and impaired renal function,

being pregnant, questionnaire results and HbA1c examination, or incomplete lipid profile.

Medication Adherence Report Scale (MARS)

The MARS questionnaire is a free tool to measure the level of medication adherence. The MARS questionnaire consists of 5 items that assess non-compliant behaviors (forgetting to take medication, changing medication dosage, stopping the medication, not adhering to dosage, and taking less medication than prescribed). This study used the MARS questionnaire which was already used in several previous studies to measure medication adherence in patients with DM (Adikusuma *et al*., 2014; Chan *et al*., 2020; Firdiawan *et al*., 2021; Latifatunnisa *et al*., 2023; Perwitasari *et al*., 2022). The questionnaire was translated into the Indonesian language and had good validity and reliability with r values > r table (0.396) and the Cronbach alpha coefficient of 0.80313 (Alfian *et al*., 2017). The category of medication adherence based on the MARS questionnaire contains five question items, which are grouped into high adherence levels (score 25) and low commitment (score < 25) (Alfian *et al*., 2017).

Controlled HbA1c

Assessment of the HbA1c category in patients with DM was done based on the routine laboratory results of patients participating in the DM chronic disease management program. HbA1c values were divided into two categories: controlled and uncontrolled. The HbA1c category is under control if it meets the HbA1c therapy target for pre-elderly (40–59 years) < 7% and elderly (60–79 years) patients between 7.5-8.5% (PERKENI, 2021). HbA1c measurements were taken routinely at Minggir Primary Health Care.

ASCVD risk

In this study, the prediction of cardiovascular disease risk in the next ten years was done using ACC/AHA. The ASCVD risk was grouped into low <5%, moderate 5-7.5%, and high >7.5%. Early detection of cardiovascular risk events can be done to identify if patients are at low or high risk, and calculations can be done using the calculator provided on the American College of Cardiology website (Dwivani *et al*., 2018).

Statistical analysis

The data in this study comprised patient characteristics, including gender, age, education level, job, duration of DM, and type of therapy. Data in this study were collected to measure medication adherence, HbA1c values, and ASCVD risk. Data analysis used a chi-square test to determine the relationship between medication adherence with HbA1c values and ASCVD risk in patients with type II DM. This study also used the Odds Ratio (OR) calculation to determine how much influence was detected between variables. Statistical data analysis was conducted at the Clinical Epidemiology and Biostatistics Unit (CEandBU), Faculty of Medicine, Universitas Gadjah Mada, Yogyakarta, using the IBM SPSS 22 program (Chicago, USA) with a 95% confidence interval (CI) and significance set as $p<0.05$.

Ethical approval

All the procedures performed met the ethical standards of the institution. Formal consents were obtained from the patients. Ethical clearance from the Health Research Ethics Commission of the Faculty of Health Sciences, Respati University Yogyakarta, with letter number 027.3/FIKES/PL/III/2023.

RESULTS AND DISCUSSION

Demographic Characteristics of Participants

We analyzed the association between medication adherence with HbA1c and ASCVD risk in patients with type II DM (with 55 respondents) at Minggir Primary Health Care. An overview of the respondent's characteristics can be seen in Table 1, indicating most respondents were female. Based on Table 1, most of the respondents in this study were pre-elderly (40 – 59 years) with a percentage of 49.1%, and older people (60 – 79 years) with 50.9%. Based on the educational status of the patients with type II DM at Minggir Primary Health Care, they grouped into low and high. The low education category included respondents who graduated from elementary/junior/senior high school, while the high education category included those who graduated from D3, bachelor's, master's, and doctorate. Based on the level of education, the respondents were dominated by those in the low-education category (94.5%) compared to the higher-education respondents.

Regarding occupation, the patients with type II DM at Minggir Primary Health Care were grouped into working and not working. Regarding the type of occupations, some working respondents worked as farmers, farm laborers, and other jobs, while the non-working respondents were homemakers and retirees. The category of working with not working can be seen from two perspectives: the availability of personal financial support that supports access

Table 1. Distribution of Characteristics of DM Patients Respondents at Minggir Primary Health Care

Respondent Characteristics	(n)	Percentage (%)
Gender		
Female	35	63.6
Male	20	36.4
Age		
40 – 59 years	27	49.1
60 – 79 years	28	50.9
Level of Education		
Low	52	94.5
High	3	5.5
Job		
Not Work	20	36.4
Work	35	63.6
Smoking Status		
Not Smoking	49	89.1
Smoke	6	10.9
Type of Medication		
Single	21	38.2
Combination	34	61.8
Duration of DM		
Less five years	37	67.3
More five years	18	32.7
Medication Adherence		
High	33	60
Low	22	40
HbA1c Values		
Control	31	56.4
Uncontrol	24	43.6
ASCVD Risk		
Low	16	29.1
High	39	70.9

to medical services or treatment and daily work routines to increase information (Akrom *et al*., 2019). Most respondents (63.6%) were in the working category. In this study, most respondents (89.1%) were not smokers. Based on Table 1, the anti-diabetic medication used was oral anti-hyperglycemic medication, either a single or combination type. Most of the respondents in this study (61.8%) received more combination medication therapy than single use. Based on Table 1, most of the study respondents were diagnosed with DM for less than five years (67.3%). DM duration and good quality of life will prevent or delay long-term complications (Adikusuma, 2017). However, the duration of DM is usually less indicative of the actual disease process because many patients with DM are only diagnosed when complications have already occurred (Siwi *et al*., 2022).

Table 1 shows that females dominated the respondents. This study aligns with the data from the Basic Females that females have more significant risk factors for DM than males, especially with a history of gestational DM or a history of giving birth to a baby weighing more than 4 kg (Almasdy *et al*., 2015; PERKENI, 2021). DM in females can also occur due to a decrease in the hormone estrogen due to premenstrual syndrome and post-menopause, which makes body fat quickly accumulate (Yulianti and Anggraini, 2020).

Based on the results of Basic Health Research (Riskesdas) 2018, the prevalence of DM sufferers in Indonesia are females (Indonesian Ministry of Health and Health Research and Development Center, 2019). Besides, older people dominated the respondents. According to Basic Health Research (Riskesdas) 2018, the prevalence of DM tends to occur in older people due to ageing, affecting the performance of metabolism, reproduction, and other body functions. Ageing also causes a decrease in human physiological conditions accompanied by changes in body composition or ageing, resulting in reduced endocrine function of the pancreas and decreased sensitivity of pancreatic cells to glucose (Adikusuma, 2017; Almasdy *et al*., 2015; Indonesian Ministry of Health and Health Research and Development Center, 2019; Mulyani *et al*., 2016).

Medication Adherence

Data on the measurement of medication adherence in patients with type II DM at Minggir Primary Health Care can be seen in Table 2. Based on Table 1, medication adherence was measured using the MARS questionnaire. In terms of the level of medication adherence based on the MARS questionnaire, the result showed that most patients (33 patients or 60%) had a high level of medication adherence, and the remaining 22 patients had low medication adherence. The result of the statistical analysis showed that there was a significant relationship between gender and the level of medication adherence. There was no significant relationship in terms of age, job, level of education, smoking status, type of medication, and duration of DM with the level of medication adherence.

Table 2 shows that out of the respondents (63.6%), 47.3% had a high level of medication adherence, and 16.4% had a low level of medication adherence. Based on gender there was a significant relationship between gender and the level of medication adherence. Females have a 5.365 times greater chance of high medication adherence compared to men. The results of this study align with Ningrum's research (2020), which found a significant relationship between gender and medication adherence in patients with type II DM (Ningrum, 2020). According to Novian (2013), gender relates to life roles and behaviors that differ between females and males. Females usually pay more attention to their health than males (Novian, 2013). Based on the table above, elderly patients (60-79 years) had a high level of medication adherence (34.5%) compared to pre-elderly respondents (40 -59 years) who had a low level of medication adherence (23.6%). According to research by Pradana (2015) and Siwi *et al*. (2022), the older the age, the lower the level of medication adherence; also, the younger the age, the higher the level of medication adherence (Pradana, 2015; Siwi *et al*., 2022).

Based on the level of education, 94.5% of patients were in the low education category, with 58.2% having a high level of medication adherence and 36.3% having low medication adherence. The result showed that more respondents had a low level of education compared to those with higher education levels. According to several researchers, the higher the level of education, the easier it is to receive information, knowledge, and awareness about medication adherence (Pramana *et al*., 2019; Ningrum, 2020; Siwi *et al*., 2022). The result of this study showed no significant relation between the respondents' level of education and their medication adherence.

Table 2. Frequency Distribution of Respondents According to Medication Adherence

Respondent Characteristics	Medication Adherence		Total	p-value	OR (95%CI)
	High	Low			
Gender					
Female	26 (47.3%)	9 (16.4%)	35 (63.6%)	0.010*	5.365
Male	7 (12.7%)	13 (23,6%)	20 (36.4%)		(1.630 -17.656)
Age					
40 – 59 years	14 (25.5%)	13 (23.6%)	27 (49.1%)	0.349	0.510
60 – 79 years	19 (34.5%)	9 (16.4%)	28 (50.9%)		(0.171-1.525)
Level of Education					
Low	32 (58.2%)	20 (36.3%)	52 (94.5%)	0.557	3.200
High	1 (1.8%)	2 (3.6%)	3 (5.5%)		(0.272-37.628)
Job					
Not Work	14 (25.4%)	6 (10.9%)	20 (36.4%)	0.391	1.965
Work	19 (34.5%)	16 (29.1%)	35 (63.6%)		(0.613-6.298)
Smoking Status					
Not Smoking	31 (56.4%)	18 (32.7%)	49 (89.1%)	0.204	3.444
Smoke	2 (3.6%)	4 (7.3%)	6 (10.9%)		(0.573-20.713)
Type of Medication					
Single	12 (21.8%)	9 (16.4%)	21 (38.2%)	0.955	0.825
Combination	21 (38.2%)	13 (23.6%)	34 (61.8%)		(0.273-2.497)
Duration of DM					
Less five years	24 (43.6%)	13 (23.6%)	37 (67.3%)	0.446	1.846
More five years	9 (16.4%)	9 (16.4%)	18 (32.7%)		(0.588-5.797)

*There is a significant relationship (p-value < 0.05)

Table 3. Frequency Distribution of Respondents According to HbA1c values

Respondents Characteristics	HbA1c values		Total	p-value	OR (95%CI)
	Controlled	Uncontrolled			
Gender					
Female	19 (34.5%)	16 (29.1%)	35 (63.6%)	0.898	0.792
Male	12 (21.8%)	8 (14.5%)	20 (36.4%)		(0.260-2.414)
Age					
40 – 59 years	8 (14.5%)	19 (34.5%)	27 (49.1%)	<0.001*	0.092
60 – 79 years	23 (41.8%)	5 (9.1%)	28 (50.9%)		(0.026-0.327)
Level of Education					
Low	28 (50.9%)	24 (43.6%)	52 (94.5%)	0.248	-
High	3 (5.5%)	-	3 (5.5%)		
Job					
Not Work	12 (21.8%)	8 (14.5%)	20 (36.4%)	0.898	1.263
Work	19 (34.5%)	16 (29.1%)	35 (63.6%)		(0.414-3.851)
Smoking Status					
Not Smoke	27 (49.1%)	22 (40%)	49 (89.1%)	0.686	0.614
Smoke	4 (7.3%)	2 (3.6%)	6 (10.9%)		(0.103-3.669)
Type of Medication					
Single	15 (27.3%)	6 (10.9%)	21 (38.2%)	0.136	2.813
Combination	16 (29.1%)	18 (32.7%)	34 (61.8%)		(0.880-8.988)
Duration of DM					
Less five years	24 (43.6%)	13 (23.6%)	37 (67.3%)	0.125	2.901
More five years	7 (12.7%)	11 (20%)	18 (32.7%)		(0.906-9.286)

*There is a significant relationship (p-value < 0.05)

Regarding the respondents' age, there were more pre-elderly and older people. In older people, ageing affects the performance of metabolism, reproduction, and other body functions. Ageing also causes a decrease in human physiological conditions accompanied by changes in body composition or ageing, resulting in memory problems so that they often forget to take medicine. Based on the job, 63.6% of respondents were working, with 34.5% having a high level of medication adherence and 29.1% having a low level of medication adherence.

The working group tends to have increased physical activity and are busier, so they do not have much time to see a doctor or take medicine, not according to the doctor's instructions due to active activities (Siwi *et al*., 2022). Based on smoking status, 89.1% of the respondents were non-smokers, with 56.4% having a high level of medication adherence and 32.7% having a low level of medication adherence. Based on the type of DM medication, 61.8% of the respondents received combination therapy, with 38.2% having high medication adherence and 23.6% having low medication adherence. Combination therapy will decrease medication adherence, so the treatment therapy is not maximized (Mulyani *et al*., 2016). There were some factors affecting low medication adherence in combination therapy; for example, some respondents felt that taking more than two medications a day had no effect, did not cause any improvement, and even sometimes caused side effects (Ningrum, 2020).

Based on the duration of DM, 67.3% of the respondents were diagnosed with DM for less than five years, with 43.6% having a high level of medication adherence and 23.6% having a low level of medication adherence. Based on the duration of DM, medication adherence is higher in newly diagnosed patients and will decrease after the first six months of treatment therapy (Adikusuma, 2017). A high level of medication adherence is found in newly diagnosed patients because these patients are still very obedient to the recommendations given. Still, the duration of DM did not have a significant relationship with medication adherence. The duration of suffering from a disease does not affect medication adherence, and everyone has other factors that affect medication adherence (Siwi *et al*., 2022). Patients diagnosed for more than five years do not always have a low level of medication adherence. This pattern is because there is awareness and behaviors to maintain health, so they comply with medication (Ningrum, 2020).

Medication adherence can be improved because most patients with type II DM have family support. Family support can help patients achieve a high level of medication adherence, including the willingness of family members to accompany patients during consultations and blood sugar level checks, as well as their willingness to help remind patients to take medicine. The greater the support from family, the higher the medication adherence (Ningrum, 2020). Based on the level of medication adherence, it was known that most patients had

high medication adherence. The results of this study align with research conducted by Wibowo *et al*. (2021) that measured medication adherence using the MARS questionnaire, which showed that most respondents had good medication adherence (Wibowo *et al*., 2021). This finding indicates that patients with type II DM know the importance of maintaining health and complying with healthcare personnel providing medication therapy instructions.

HbA1c Values

Data on the examination of HbA1c values in patients with type II diabetes mellitus at Minggir Primary Health Care can be seen in Table 3. Based on Table 1, most research respondents had controlled HbA1c values (56.4%), while the remaining 43.6% had uncontrolled HbA1c values. The result of the statistical analysis showed that there was a significant relationship between age and controlled HbA1c. There was no significant relationship in data on gender, jobs, level of education, smoking status, type of medication, and duration of DM with controlled HbA1c. HbA1c measurements are the best single test to measure the risk of tissue damage due to high blood sugar levels. DM patients' blood sugar levels are more likely to increase than usual, especially after a meal with high sugar content and low exercise, making it difficult to control (Karimah *et al*., 2018). HbA1c values reflect the average blood glucose level during the previous 8-12 weeks. HbA1c testing is recommended every 3 or 4 times a year to determine the quality of blood glucose control. HbA1c results for pre-elderly > 7% and elderly patients between 7.5-8.5% indicate poor adherence to controlling blood sugar levels (PERKENI, 2021).

Table 3, based on gender, shows that 63.6% of the respondents were female, with 34.5% having controlled HbA1c and 29.1% having uncontrolled HbA1c. Based on age, elderly patients (60-79 years) had controlled HbA1c values (41.8%) compared to pre-elderly patients (40-59 years) who had uncontrolled HbA1c values (34.5%). Based on age, there was a significant relationship between age and controlled HbA1c. The pre-elderly had a 0.092 times greater chance of controlled HbA1c than the elderly. This pattern is because the dominant respondents were elderly patients with a high level of medication adherence, so most of the HbA1c values in the elderly patients were under control.

Based on education, 94.5% of the respondents had low education, with 50.9% having controlled HbA1c and 43.6% having uncontrolled HbA1c. Based on the job, out of 63.6% of the working respondents, 34.5% had controlled HbA1c, and 29.1% had uncontrolled HbA1c. Based on smoking status, 89.1% of the respondents were non-smokers, with 49.1% having controlled HbA1c and 40% having uncontrolled HbA1c. Table 3 shows that 61.8% of the respondents received combination therapy, with 29.1% having controlled HbA1c and 32.7% having uncontrolled HbA1c.

According to research conducted by Gumantara and Oktarina (2017) and Latifatunnisa *et al*. (2023), combination therapy of oral antihyperglycemic medication is more efficient in controlling blood sugar levels than single therapy. It can reduce HbA1c values (Gumantara and Oktarlina, 2017; Latifatunnisa *et al*., 2023). Based on the duration of DM, 67.3% of the respondents were diagnosed with DM for less than five years, with 43.6% having controlled HbA1c and 23.6% having uncontrolled HbA1c. In terms of HbA1c, it is known that most patients have controlled HbA1c. Uncontrolled HbA1c may be caused by diseases affecting hemoglobin, kidney disease, unknown liver disease, side effects of vitamin C/E supplement consumption, and high cholesterol levels. However, some conditions that could affect HbA1c are not excluded; for example, errors in HbA1c measurements because patients did not fast 12 hours before blood collection (PERKENI, 2021).

ASCVD Risk

Data on ASCVD risk examination in patients with type II DM at Minggir Primary Health Care can be seen in Table 4. Based on Table 1, most respondents had a high ASCVD risk (70.9%), while the remaining 29.1% had a low ASCVD risk. Based on the result of the statistical analysis, there was a significant relationship between gender and age in ASCVD risk. There was no significant relationship between job, level of education, smoking status, type of medication, and duration of DM with ASCVD risk.

Table 4 shows that most respondents were female, with a low ASCVD risk of 25.5% and a high ASCVD risk of 38.2%. According to data from the 2018 Basic Health Research (Riskesdas), female heart disease is more prevalent (Indonesian Ministry of Health and Health Research and Development Center, 2019). Females have the hormone estrogen, which has cardioprotective effects. In female patients with DM, estrogen's protective properties for cardiovascular health, including its ability to suppress obesity and dyslipidemia, are reduced (Wakabayashi, 2017).

Table 4. Frequency Distribution of Respondents According to ASCVD Risk

Respondents Characteristics	ASCVD Risk		Total	p-value	OR (95%CI)
	Low	High			
Gender					
Female	14 (25.5 %)	21 (38.2 %)	35 (63.6%)	0.041*	6.000
Male	2 (3.6 %)	18 (32.7%)	20 (36.4%)		(1.200-30.011)
Age					
40 – 59 years	16 (29.1%)	11 (20 %)	27 (49.1%)	<0.001*	-
60 – 79 years	-	28 (50.9 %)	28 (50.9%)		
Level of Education					
Low	16 (29.1%)	36 (65.5%)	52 (94.5%)	0.548	-
High	-	3 (5.5%)	3 (5.5%)		
Job					
Not Work	8 (14.5%)	12 (21.8%)	20 (36.4%)	0.299	2.250
Work	8 (14.5%)	27 (49.1%)	35 (63.6%)		(0.683-7.417)
Smoking Status					
Not Smoke	15 (27.3%)	34 (61.8%)	49 (89.1%)	0.660	2.206
Smoke	1 (1.8%)	5 (9.1%)	6 (10.9%)		(0.237-20.542)
Type of Medication					
Single	7 (12.7%)	14 (25.5%)	21 (38.2%)	0.811	1.389
Combination	9 (16.4%)	25 (45.5%)	34 (61.8%)		(0.425-4.542)
Duration Of DM					
Less five years	12 (21.8%)	25 (45.5%)	37 (67.3%)	0.641	1.680
More five years	4 (7.3%)	14 (25.5%)	18 (32.7%)		(0.455-6.208)

*There is a significant relationship (p-value < 0.05)

Based on gender, there was a significant relationship between gender and ASCVD risk. Females have a 6.000 times lower risk of ASCVD compared to men.

Based on age, elderly patients (60-79 years old) had a high risk of ASCVD with a percentage of 50.9%, compared to pre-elderly patients (40-59 years old) with a low risk of ASCVD with a percentage of 29.1%. According to Basic Health Research (Riskesdas) 2018, heart disease is more prevalent in the elderly (Indonesia Ministry of Health and Health Research and Development Center, 2019). Based on the level of education, 94.5% of the respondents had low education, with 65.5% having a high risk of ASCVD. This is in line with research by Kozakiewicz *et al*. (2016), showing that patients with a high level of education had a lower risk of CVD than those with a lower level of education. Based on jobs, 63.6% of the respondents worked, with 49.1% having a high ASCVD risk and 14.5% having a low ASCVD risk.

Table 4 shows that 89.1% of the respondents were non-smokers, with 61.8% having a high risk of ASCVD. Based on the type of medication, 61.8% of patients received combination therapy, with 45.5% having an increased risk of ASCVD compared to those who received single treatment. Based on the duration of DM, 67.3% of patients were diagnosed with DM for less than five years, with 45.5% having a high risk of ASCVD compared to patients diagnosed with DM for more than five years. According to research by Bertoluci and Rocha (2017), the duration of DM is a crucial determinant of CVD risk; patients over ten years have a higher CVD risk (Bertoluci and Rocha, 2017). According to research conducted by Aljufri (2020), the calculation of ASCVD risk in patients with type II DM should be improved in managing primary and secondary prevention of ASCVD by optimizing the intensity of statin therapy.

Patients with type II DM who get statins can reduce the incidence of ASCVD and mortality (Aljufri, 2020). This is according to the guidelines for managing dyslipidemia in Indonesia; all diabetic patients should receive moderate or high-intensity statin therapy. In the primary prevention of ASCVD in patients aged 40-75, the risk of ASCVD in the next ten years is calculated first, and then the appropriate statin intensity is determined. The higher the predicted value of ASCVD risk, the greater the benefit of statin

therapy. Statins can also be given at an advanced age for secondary prevention of ASCVD (PERKENI and Andi Makbul Aman, 2021).

Relationship between medication adherence and HbA1c control

The relationship between medication adherence and HbA1c control in patients with type II DM was analyzed using Chi-squared tests. The result of medication adherence measurement based on the MARS questionnaire showed that 60% of respondents had a high level of medication adherence, and 56.4% had controlled HbA1c. According to the theory, a patient with medication adherence has controlled HbA1c (Alfian, 2015; Wibowo *et al*., 2021; Soraya *et al*., 2022). The present study also showed that blood sugar levels were influenced by the patient's level of medication adherence, most of which were high.

The level of medication adherence was divided into two groups: patients with high and low adherence. At the same time, based on HbA1c, the patients were divided into two: controlled and uncontrolled. Table 5 shows that a high level of medication adherence was accompanied by controlled HbA1c (38.2%), a high level of medication adherence was accompanied by uncontrolled HbA1c (21.8%), a low level of medication adherence was accompanied by controlled HbA1c (18.2%), and a low level of medication adherence was accompanied by uncontrolled HbA1c (21.8%).

The results of the chi-square test analysis obtained a p-value = 0.268 (p>0.05), so there was no significant relationship between medication adherence in patients with type II DM and whether or not HbA1c was under control. Patients with a high level of medication adherence had a 2.1 times greater chance of controlled HbA1c compared to patients with a low level of medication adherence. However, this study's results differed from those of several researchers, which showed a significant relationship between medication adherence and HbA1c (Adikusuma, 2017; Latifatunnisa *et al*., 2023; Perwitasari *et al*., 2022). Reduction in the level of HbA1c was found in the high-adherence group compared to the low-adherence group (Sankar *et al*., 2018).

Relationship between medication adherence and ASCVD risk

The relationship between medication adherence and the risk of ASCVD in patients with type II DM was analyzed using chi-squared tests. Some factors influenced medication adherence: patients, therapeutics, and related healthcare systems. Patient demographic characteristics comprised gender, age, education, job, and psychological factors related to knowledge, motivation in therapy, and relationship with the doctor. Therapeutic factors comprised duration and complexity of treatment, type of therapy, side effects, and route of administration. In addition, there were also factors related to the healthcare system and patients' interaction with the healthcare personnel (Firdiawan *et al*., 2021). Some patients routinely participated in the monthly activities conducted by Minggir Primary Health Care, such as monthly blood sugar checks in the second week and administering antidiabetic medication; they met the healthcare personnel who reminded them to take the medication. These healthcare personnel-assisted activities could reduce the possibility of medication non-adherence at Minggir Primary Health Care.

Table 5. Relationship between Medication Adherence and Controlled HbA1c

		HbA1c values		p-value	OR (95% Cl)
		Controlled 31 (56.4%)	Uncontrolled 24 (43.6%)		
Medication Adherence	High	21 (38.2%)	12 (21.8%)	0.292	2.100 (0.700 – 6.301)
	Low	10 (18.2%)	12 (21.8%)		

Note: CI, confidence interval; OR, odds ratio.

Table 6. Relationship between Medication Adherence and ASCVD Risk

		ASCVD Risk		p-value	OR (95% Cl)
		Low 16 (29.1%)	High 39 (70.9%)		
Medication Adherence	High	9 (16.4%)	24 (43.6%)	0.952	0.804 (0.247 – 2.614)
	Low	7 (12.7%)	15 (27.3%)		

Note: CI, confidence interval; OR, odds ratio.

The therapy given to patients with DM does not contradict the recommendations from the American Diabetes Association and the Indonesian Society of Endocrinology. In addition, this therapy is also included in the Indonesia National Formulary list, making it free of charge for BPJS members. The medication therapy is related to the DM therapy algorithm. According to the Indonesian Endocrinology Society (2021), patients with type II DM can receive monotherapy (single therapy) or a combination if they have undergone monotherapy for at least three months. However, the HbA1c target still has not been met. Combination therapy involves two types of oral antihyperglycemic medication: metformin or first-line antidiabetic medication used with other antidiabetic medication with different mechanisms such as sulfonylurea, a thiazolidinedione, DPP-4 inhibitor, and insulin (PERKENI, 2021).

In this study, the influential factor was the patient-related factors. This is related to the patient's awareness of complying with medicine as doctors and other healthcare personnel recommend, without which the result of therapy will not be optimal, making it challenging to achieve therapy goals (Adikusuma, 2017). In general, patients with DM do not have medication adherence because they feel bored of routinely taking antidiabetic medicines all their lives (Siwi *et al*., 2022). Most of the patients with low medication adherence mentioned the factor of forgetfulness (36.4%) in the questionnaire. Regarding jobs, most respondents worked, so they had high physical activity, so there was no time to forget to take medicine. Most elderly respondents (60-79 years) experienced memory, hearing, vision loss, and disease complications, so they did not take medicine deliberately (Ningrum, 2020). In general, patients with DM do not have medication adherence by accident, for example, when they forget to take medicine, or intentionally, for example, they do not take medicine when they feel that the disease has improved or worsened because they lack knowledge about the purpose of diabetes treatment therapy (Alfian, 2015).

The results of the medication adherence measurement based on the MARS questionnaire showed that 60% of the patients had high medication adherence. Still, the result of ASCVD risk was not directly proportional to it because most respondents had a high ASCVD risk (70.9%). In theory, if patients have medication adherence, DM will be controlled, and the risk of ASCVD will be reduced (Husni *et al*., 2018; Puspaseruni, 2021; Riset *et al*., 2022). However, this study showed a high risk of ASCVD in patients with high medication adherence. The level of adherence was divided into two groups: patients with high and low adherence. Similarly, the risks of ASCVD were divided into two groups: low and high. As presented in Table 6, a high level of medication adherence with a low risk of ASCVD had a percentage of 16.4%. A low level of medication adherence with a low risk of ASCVD had a percentage of 12.7%; a high level of medication adherence with a high risk of ASCVD had a percentage of 43.6%; and a low level of medication adherence with a high risk of ASCVD had a percentage of 27.3%. The result of the chi-squared test obtained a p-value = 0.768, so there was no significant relationship between medication adherence in type II diabetes mellitus patients with ASCVD risk. Patients with a high level of medication adherence had a 0.8 times lower risk of ASCVD compared to patients with a low level of medication adherence. The results of this study are consistent with research by Rwegerera (2014), showing that, in DM therapy, high medication adherence is not significantly associated with better glycemic control or the magnitude of CVD risk (Rwegerera, 2014). The results of this study indicated no significant relationship between medication adherence with HbA1c and ASCVD risk in patients with type II DM at Minggir Primary Health Care, Sleman Yogyakarta. The factors that might influence the results of this study were from the questionnaire instrument. Medication adherence is measured using a scale not specific to patients with type II DM, so there may be inaccuracies in patient responses. The weakness of measuring medication adherence using a questionnaire is that there is a high possibility of errors in filling out the questionnaire, causing bias in the questionnaire results. Biases include the patient's desire to be seen as compliant and the patient's inaccurate memory.

CONCLUSIONS

Most patients with type II diabetes mellitus had high medication adherence (60%), controlled HbA1c (56.4%), and high ASCVD risk (70.9%). Gender had a significant relationship with the level of medication adherence. There was a significant relationship between age and controlled HbA1c. Gender and age had a significant association with ASCVD risk. However, there was no significant relationship between medication adherence in type II DM patients with HbA1c and ASCVD risk.

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