

# ANALYSIS OF DETERMINANTS OF COMPLICATIONS IN TYPE 2 DIABETES MELLITUS AT ALOEI SABOE HOSPITAL, GORONTALO CITY

Gladis A. Ismail <sup>1\*</sup>, Nur Nasry Noor <sup>2</sup>, Andi Zulkifli <sup>3</sup>, Ridwan Amiruddin <sup>4</sup>,  
Nurhaedar Jafar <sup>5</sup> and M. Tahir Abdullah <sup>6</sup>

<sup>1,2,3,4,5,6</sup> Public Health, Hasanuddin University, Makassar, Indonesia.

Email: <sup>1</sup>[gladisismail.gi@gmail.com](mailto:gladisismail.gi@gmail.com) (\*Corresponding Author), <sup>2</sup>[nasrysaja@gmail.com](mailto:nasrysaja@gmail.com),  
<sup>3</sup>[zulkifliabdullah@yahoo.com](mailto:zulkifliabdullah@yahoo.com), <sup>4</sup>[ridwan.amiruddin@gmail.com](mailto:ridwan.amiruddin@gmail.com), <sup>5</sup>[eda.gizi@gmail.com](mailto:eda.gizi@gmail.com),  
<sup>6</sup>[mtahirabd@gmail.com](mailto:mtahirabd@gmail.com)

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## Abstract

**Context/Background:** Based on the 2018 Basic Health Research (Riskesdas) of the Indonesian Ministry of Health regarding Diabetes Mellitus, the national prevalence of DM is 2% and the prevalence rate of DM in Gorontalo Province is above the national average of 2.60%. **Aims/Objectives:** This study aims to analyse the determinants that are risk factors for complications of Type 2 Diabetes Mellitus. **Methodology:** This research uses a case control study design with a total sample size of 154 consisting of 77 cases and 77 controls selected by systematic random sampling method. Data analysis was carried out using Stat version 14 program. **Results:** The results showed that the determinants that became risk factors for complications in patients with type 2 diabetes mellitus were length of suffering (OR=2.206; 95%CI = 1.102- 4.430), drug compliance (OR=2.604; 95%CI = 1.292-5.268) and self-care behaviour (OR=2.324; 95%CI = 1.160- 4.671). The results of logistic regression analysis showed that length of suffering was the main determinant of the incidence of complications in patients with type 2 diabetes mellitus. **Conclusions:** Increased health promotion, especially related to the determinants of DM complications, is needed to reduce the incidence of DM complications.

**Keywords:** Determinants, Complications, Diabetes Mellitus Type 2.

## INTRODUCTION

Non-communicable diseases are an important cause of premature death and disability. One of the non-communicable diseases is Diabetes Mellitus[1]. Diabetes mellitus (DM) is a chronic metabolic disorder characterised by high blood sugar levels (hyperglycaemia) which will result in impaired insulin secretion and insulin resistance[2].

Diabetes mellitus is a national and global health concern today. According to the World Health Organisation (2023) there are approximately 422 million people worldwide with diabetes, the majority living in low- and middle-income countries[3]. In 2021 the International Diabetes Federation (IDF) recorded 537 million adults (aged 20 - 79 years) or 1 in 10 people living with diabetes worldwide and Indonesia is in fifth position with 19.47 million people with diabetes[4]. Based on RISKESDAS data, the prevalence of DM was 1.5% in 2013 and increased to 2% in 2018[5].

Based on the Basic Health Research (Riskesdas) of the Indonesian Ministry of Health in 2018 regarding Diabetes Mellitus, it shows that the prevalence of DM sufferers in Gorontalo Province is 2.4%, where the prevalence rate is higher when compared to the national prevalence rate according to Riskesdas in 2018 which is only 2.0% [5]. Data obtained from the Gorontalo Provincial Health Office in the last 3 years, namely in 2020 the prevalence of Diabetes Mellitus was 0.49%, in 2021 the prevalence of

Diabetes Mellitus was 2.03% and in 2022 the prevalence of Diabetes Mellitus was 2.60%[6].

A multicentre study conducted in China and Micronesia, which collected data from outpatients found that the prevalence of chronic complications of Type 2 Diabetes Mellitus is very high consisting of 33.4% with macrovascular complications and 34.7% having microvascular complications. This occurs due to poor glycaemic control and failure to achieve treatment goals especially in the outpatient setting which is prone to having low therapy adherence and inadequate monitoring[7]. The incidence of chronic complications can increase if not able to control risk factors such as age, gender, duration of illness, drug consumption, and BMI[8].

Considering the adverse effects that occur if DM patients cannot control blood sugar properly will risk complications, the determinants of the incidence of complications in type 2 DM patients need to be known. The results of this study are expected to be taken into consideration in determining activity programmes and policies in the context of preventing and managing diabetes mellitus.

### **Objectives:**

This study aims to analyse the determinants that are risk factors for complications of Type 2 Diabetes Mellitus at Aloe Saboe Hospital, Gorontalo City,

## **METHODOLOGY**

### **Study Design**

This study was conducted in Gorontalo City. This study used a case management study design to determine the determinants that are risk factors for complications in patients with type 2 diabetes mellitus.

### **Population and Sample**

The population in this study were Type 2 Diabetes Mellitus patients registered as inpatients at Aloe Saboe Hospital, Gorontalo City in 2022 as many as 484 people. As for patients affected by type 2 DM complications, there were 245 people. A total of 154 respondents met the criteria to participate in this study. The sample was divided into 2 groups, namely case and control groups with a ratio of 1: 1.

### **Research Variable**

The dependent variable is the incidence of complications. The independent variables consisted of length of stay, body mass index, physical activity, medication compliance, age and self-care behaviour.

### **Data Collection**

Data collection was conducted through the interview method by visiting each respondent's home. Researchers took about 15-20 minutes to interview each respondent. The measuring instrument used at the time of data collection was a questionnaire.

### **Data Analysis**

Data were processed using Stata version 14 program. The association and magnitude of risk factors between dependent and independent variables were analysed with the

chi-square test. The multivariate analysis used was the logistic regression test with a confidence level of 95% ( $\alpha = 0.05$ ).

### Ethical Approval

This study was approved by the Health Research Ethics Committee of Hasanuddin University with ethical approval recommendation number 6393/UN4.14.1/TP.01.02/2023. Informed consent was obtained from all research respondents, data confidentiality was maintained and privacy was guaranteed.

## RESULTS

**Table 1: Distribution of Respondents Based on Characteristics**

Respondent Characteristics	Frequency (n)	Percentages (%)
<b>Address (District)</b>		
Sipatana	27	17,53
Northern city	28	18,18
Centre city	16	10,39
Dungingi	8	5,19
Southern city	23	14,94
East city	29	18,83
Hulonthalangi	8	5,19
Dumbo Raya	9	5,84
Western city	6	3,90
<b>Age (Years old)</b>		
25-34	8	5,19
35-44	16	10,39
45-54	41	26,62
55-64	56	36,36
≥65	33	21,43
<b>Gender</b>		
Female	80	51,95
Male	74	48,05
<b>Education</b>		
Not in school/Not completed primary school	2	1,30
Completed primary school	43	27,92
Completed secondary	34	22,08
Completed tertiary	41	26,62
Completed diploma/bachelor's degree/master's degree	34	22,08
<b>Occupation</b>		
Driver	6	3,90
Farmer	31	20,13
Self-employed	32	20,78
Civil servants/Military/Honorary	13	8,44
Retired	15	9,74
Private employee	4	2,60
Housewife	53	34,42
<b>Total</b>	154	100

Table 1 shows that 29 respondents (18.83%) resided in the eastern city sub-district and 56 people (36.36%) of them were in the age group of 55-64 years. Most of the respondents were female 80 (51.95%), and 43 people (27.92%) had the last level of education, namely elementary school graduates. Then as many as 53 people (34.42%) who work as housewives.

**Table 2: Distribution of Respondents by Complication Type**

Types of Complications	Number of Respondents (n=77)	
	Frequency (n)	Percentages (%)
Retinopathy	20	25,97
Neuropathy	26	33,77
Nefropathy	14	18,18
CHD	1	1,30
Stroke	4	5,19
Hypertension	12	15,58
<b>Total</b>	<b>77</b>	<b>100</b>

Table 2 shows that the most common type of complication suffered by respondents was neuropathy, with 26 cases (33.77%), while the least common type of complication suffered was coronary heart disease, with 1 case (1.30%).

**Table 3: Bivariate Analysis of the Incidence of Complications**

Determinants of Complications	Case		Control		OR	CI 95% LL-UL
	n	%	n	%		
<b>Lama Menderita</b>						
5-10 years	48	62,34	33	42,86	2,206	1,102-4,430
<5 years	29	37,66	44	57,14		
<b>Body Mass Index (BMI)</b>						
≥25 kg/m <sup>2</sup>	37	48,05	34	44,16	1,169	0,591-2,316
<25 kg/m <sup>2</sup>	40	51,95	43	55,84		
<b>Physical Activity</b>						
≤1499 METS	30	38,96	26	33,77	1,252	0,615-2,550
≥1500 METS	47	61,04	51	66,23		
<b>Medication Adherence</b>						
Score <8	50	64,94	32	41,56	2,604	1,292-5,268
Score 8	27	35,06	45	58,44		
<b>Age</b>						
≥60 years old	23	29,87	22	28,57	1,064	0,501-2,263
15-59 years old	54	70,13	55	71,43		
<b>Self Care Behavior</b>						
≤59	47	61,04	31	40,26	2,324	1,160-4,671
≥60	30	38,96	46	59,74		
<b>Total</b>	<b>77</b>	<b>100</b>	<b>77</b>	<b>100</b>		

Table 3 shows that based on the determinants of complications, length of illness, medication compliance and self-care behaviour are significant risk factors for the incidence of complications with an OR of 2.206 and 95% CI 1.102-4.430 for the determinant of length of illness, OR of 2.604 and 95% CI 1.292-5.268 for the determinant of medication compliance and OR of 2.324 and 95% CI 1.160-4.671 for the determinant of self-care behaviour. The analysis also found that body mass index, physical activity and age were not significant risk factors for the incidence of complications with an OR of 1.169 and 95% CI 0.591-2.316 for BMI determinants, OR of 1.252 and 95% CI 0.615-2.550 for physical activity determinants and OR of 1.064 and 95% CI 0.501-2.263 for age determinants.

**Table 4: Logistic Regression Analysis of Determinants of Complications Incidence**

Variable	p-value	OR	CI 95%	
			LL	UL
Long suffering	0,000	8,440	3,220	22,121
Medication adherence	0,000	4,702	2,184	10,125
Self-care behavior	0,000	8,114	3,131	21,023

Table 4 shows the results of multivariate logistic regression analysis. Each independent variable that shows a p-value <0.25 in the bivariate analysis can be included in the multivariate analysis. In this multivariate analysis, it was found that length of stay, medication adherence and self-care behaviour were associated with the incidence of complications in patients with type 2 diabetes mellitus. Based on the OR value, it shows that the duration of suffering is the main determinant of the incidence of complications in patients with type 2 diabetes mellitus with OR 8.440 and 95% CI value 3.220-22.121. This shows that patients with type 2 diabetes mellitus who have a long history of suffering from DM 5-10 years have a risk of 8.440 times to experience complications compared to patients with DM who have a long history of suffering <5 years.

## DISCUSSION

### Long Suffering

The results showed that length of suffering was a significant risk factor for the incidence of complications. Based on the results of multivariate analysis, it was found that the length of suffering was a risk factor that became the main determinant of the incidence of complications in patients with type 2 diabetes mellitus.

This study is in line with research conducted by Purwandari et al which shows that every increase in the length of suffering by 1 year will increase the risk of chronic complications of Diabetes Mellitus Type 2 by 2.274 times [9]. However, based on the research of Kusdiyah et al showed different results that there was no significant relationship between the length of suffering with the incidence of DM complications [10].

Diabetes mellitus causes complications that end in death. Disease duration is associated with subjective complaints. The severity is seen from the length of the disease, the risk of subjective complaints can increase with the duration of DM disease. If subjective complaints are not controlled or the cause is unknown, they can lead to complications [11].

### Body mass index

Based on the results of the analysis, it was found that BMI is a risk factor that is not significant for the incidence of complications in patients with type 2 DM. This is because the average IMT results of respondents are normal so that most respondents are at IMT <25 kg/m<sup>2</sup>.

The same research results were found by Han et al that there was no significant relationship between body mass index and diabetic retinopathy [12]. However, different results were shown in a study conducted by Fortuna et al who found that the p-value of Body Mass Index (BMI) <0.05 so it can be concluded that BMI can be a factor affecting the incidence of complications in patients with diabetes mellitus [13].

Obesity is not just about being overweight. High levels of fat overload the body's bones and internal organs and risk causing blockages in blood vessels that can lead to disease. In the long run, this condition increases the risk of various chronic complications [14]. In obese people, there are excessive calories because the consumption of large amounts of food causes the accumulation of fat tissue under the skin. Insulin resistance or insulin resistance will arise, where the accumulated fat tissue will inhibit the work of insulin in the body's tissues and muscles so that sugar cannot be transported into cells and accumulate in blood vessels [14].

### **Physical activity**

The results showed that most of the respondents whose physical activity  $\geq 1500$  MET experienced complications. Therefore, physical activity is a risk factor that is not significant for the incidence of complications in patients with type 2 diabetes.

This finding is in line with research conducted by Purwandari et al and shows that the value ( $p > 0.05$ ) means that there is no relationship between physical activity and the incidence of complications of type 2 DM [9]. In contrast to the research of Badrujamaludin et al who found that there was a relationship between physical activity and the incidence of neuropathy in patients with type 2 DM [15].

Exercise is a physical activity that is very beneficial for improving blood circulation, losing weight and improving sensitivity to insulin, so that it will improve blood glucose levels. Controlled blood glucose levels can prevent the risk of DM complications [16].

### **Medication adherence**

Based on the results of the study, it was found that respondents with poor drug compliance had more complications. These results indicate that the level of drug compliance is a significant risk factor for the incidence of complications.

The same results were found in a study by Laksono et al which showed that people with DM who took irregular medication had a 3 times greater risk of developing complications than people with DM who took regular medication [17]. Another case with research conducted by Rasdianah et al shows the results that there is no relationship between compliance with taking medication with the incidence of complications in Type 2 DM patients [18].

Diabetes mellitus is a degenerative disease that requires long-term and continuous treatment, although this treatment cannot cure the patient's disease but with regular therapy it will reduce and slow down complications that may occur. Therefore, patient compliance in taking medication plays an important role in the success of treatment [19].

### **Age**

The results showed that age is a risk factor that is not significant for the incidence of complications in patients with type 2 DM. In this study, most respondents were in the age group of 15-59 years.

The results of this study are in line with the research of Budiman et al which showed that there was no effect of age on the incidence of diabetic ulcers [20]. However, different results were found by Hutapea et al that neuropathy complications occurred more in DM patients aged  $\geq 60$  years [21].

Age over 60 years is an advanced age where a person experiences a decrease in various organ functions that have the potential for various degenerative diseases including DM and its complications. This is in accordance with what Smeltzer & Bare stated that age > 60 years tends to result in increased insulin resistance. Uncontrolled increase in insulin resistance in DM patients will result in chronic hyperglycaemia which has an impact on damage to various organ systems called DM complications [22].

### **Self care behavior**

Based on the results of the analysis, it is known that self-care behaviour is a significant risk factor for the incidence of complications in patients with type 2 diabetes. In this study, the majority of respondents had an irregular diet, foot care, blood sugar control and lack of medication compliance.

This research is in line with a study conducted by Indriani et al found that self care behaviour that is lacking has a 4 times greater chance of experiencing neuropathy complications than people who have good self care [23]. In contrast to research conducted by Sasombo et al who found that there was no relationship between self care and complications of diabetes mellitus in patients [24].

This is because diabetes self-care is an action taken by individuals to control diabetes which includes treatment and prevention of complications, so that self-care that is done well can minimise acute or chronic complications, especially by following self-care practices which include a recommended diet, self-intake which includes exercise, medicines and blood glucose monitoring [25].

### **CONCLUSION**

There are several risk factors that determine the incidence of complications in patients with type 2 DM, including length of stay, medication compliance, and self-care behaviour. Among these risk factors, length of illness is the main determinant of complications in type 2 DM patients. Increased health promotion, especially related to the determinants of diabetes mellitus complications, is needed to reduce the incidence of complications of type 2 diabetes mellitus.

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