



Original Article

The Relationship of Diabetes Mellitus, Cognitive Impairment, Sleep Disturbance, and Sleep Impairment on Depression Among Elderly 75 Years Old and Over in Indonesia

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ABSTRACT

Background/Purpose: The elderly are more susceptible to decline in health, both physically and mentally. The most common mental disorder experienced by the elderly is depression. Depression in the elderly can be associated with aging itself, with the highest prevalence of depression in Indonesia being 75 years and over. The life expectancy of the Indonesian population also continues to increase every year, so that the very-old elderly group will continue to grow.

Methods: This is a descriptive-analytic study with a cross-sectional design using IFLS-5 data. A total of 543 respondents were selected according to the criteria in this study. Depression was assessed using the CESD-10 questionnaire. Univariate analysis was carried out to see the characteristics of the respondents, bivariate analysis using the Chi-Square test and Fisher's Exact test was carried out to see the relationship between variables, and multivariate analysis was carried out using the Binary Logistic Regression test.

Results: The prevalence of depression among elderly 75 years and over is 14.5%. The analysis showed that diabetes mellitus, cognitive impairment, sleep disturbance, and sleep impairment significantly correlate with depression. The most influential risk factor for depression is diabetes mellitus ($p=0,026$; $OR=3,85$; $CI=1,170-12,640$).

Conclusion: The prevalence of depression among the elderly 75 years and over in Indonesia is relatively high. Diabetes mellitus is the most influential factor of depression. There is a significant relationship between diabetes mellitus, cognitive impairment, sleep disturbance, and sleep impairment with depression among the elderly 75 years and over in Indonesia.

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1. INTRODUCTION

The elderly are more susceptible to decline in health, both physically and mentally. According to Erik

Erikson's theory, after reaching the age of 65, a person will experience the final stages of life, namely ego integrity versus despair. Those who cannot accept and adapt will pass this stage in despair, leading to mental

and behavioral disorders.¹ The most common mental disorder experienced by the elderly is depression.²

Many studies show increased morbidity, mortality, hospitalization, and loss of functional status in elderly patients associated with general mental disorders, especially depression.³ Elderly with depression is also more prone to decline in cognitive function, which is the leading cause of the high dependency rate of the elderly.⁴ This suggests that depression does not only affect the elderly themselves but also has an impact on those around them.

According to Gulfizar, depression in the elderly can be associated with aging itself.⁵ As people age, increasing exposure to various risk factors and decreasing functional status can affect a person's psychological state, so that the elderly have a high risk for depression.⁶ According to Indonesia Basic Health Research 2018, the prevalence pattern of depression in Indonesia continues to increase with age, the highest at the age of 75 years and over with a prevalence of 8.9%.⁷ The life expectancy of the Indonesian population also continues to increase every year, so it is predicted that the elderly with the age group of 75 years and over will increase.

There are various other factors associated with depression such as functional impairment, female gender, living alone, marital status, low education, comorbid diseases, smoking and alcohol use, cognitive impairment, and decreased physical activity.⁵

Even so, there have not been many studies on depression in Indonesia that focused on the oldest-old. Therefore, this study was conducted to determine the factors that influence depression among the elderly 75 years and over, hoping that it can be modified into prevention efforts.

2. METHODS

2.1. Research Design

This is a descriptive-analytic study with a cross-sectional study design using IFLS-5 (Indonesian Family Life Survey-5) data with a representative sample of 83% of the total population in Indonesia. The survey was conducted in 13 provinces in Indonesia from October 2014–end of April 2015.⁸ After weighing the cases, 543 respondents were selected according to the inclusion criteria in this study.

2.2. Data Collection and Measurement

Depression was assessed using the CESD-10 questionnaire (Center for Epidemiological Studies Depression Scale), with a score greater than or equal to 10 indicating the presence of

depression.⁹ Sociodemographic characteristics such as gender, education level, marital status, area of residence, and employment status were obtained using a questionnaire. Data on diabetes mellitus, hypertension, and stroke were obtained through a history of diagnosis by medical personnel. Cognitive function was assessed using the TICS (Telephone Interview for Cognitive Status) questionnaire, with a score greater than or equal to 8 indicating cognitive impairment.¹⁰ Smoking data and social participation were obtained through interviews. Sleep disturbance and sleep impairment were assessed using the PROMIS (Patient-Reported Outcomes Measurement Information System) questionnaire, with a T score >50 indicating the presence of sleep disturbance and sleep impairment.¹¹

2.3. Statistical Analysis

Data processing and analysis was performed using Microsoft Excel and SPSS v23.0. Univariate analysis was carried out to see the description of each variable in the form of a frequency distribution table and percentage. Bivariate analysis was carried out to see the relationship between variables using the Chi-Square test. If the analysis results do not meet the Chi-Square rule, the analysis is carried out using the Fisher's Exact test. Multivariate analysis using the Binary Logistic Regression test was carried out to determine which independent variables had the most influence on depression.

2.4. Ethical Clearance

The ethical approval was issued by the Research Ethics Commission of the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia (Number 04/05/KEP-FKIKUJ/2021).

3. RESULTS

The analysis results showed that there were 543 respondents aged 75 years and over with an average age of 79.40 years old. The majority of respondents are male (50.1%), with less than nine years of education (87.6%), unmarried or divorced (51.6%), living in rural areas (60, 6%), did not work (60.6%), did not have diabetes mellitus (97.2%), did not have hypertension (74.5%), did not have a stroke (97.6%), had cognitive impairment (61.1%), smoked (55.3%), did not experience sleep disturbance (58.8%), did not experience sleep impairment (66.8%), and did not participate in community activities (73.6%). 14.5% of respondents (79 of 543 respondents) who experience depression. [Table 1]

The results of bivariate analysis stated that there was a statistically significant relationship between diabetes mellitus ($p=0.019$; OR=3.73; CI=1.316-10.577), cognitive impairment ($p=0.015$; OR=1.92; CI=1.125-

3.261), sleep disturbance ($p=0.000$; OR=3.53; CI=2.126-5.846), and sleep impairment ($p=0.000$; OR=4.15; CI=2.525-6.827) on depression. [Table 2]

The results of the multivariate analysis also stated that diabetes mellitus ($p=0.026$; OR=3.85; CI=1.170-12.640), impaired cognitive function ($p=0.017$; OR=1.98; CI=1.130-3.453), sleep disturbance ($p=0.004$; OR=2.29; CI=1.297-4.054), and sleep impairment ($p=0.000$; OR=2.83; CI=1.622-4.930) had a statistically significant relationship with depression. Diabetes mellitus is the most influential risk factor for depression. [Table 3]

4. DISCUSSION

The prevalence of depression in the elderly aged 75 years and over is 14.5%. This is in line with the systematic study and meta-analysis conducted by Luppá M et al., which stated that 17.1% of

Table 1. Distribution of Respondents According to Sociodemographic Characteristics, Comorbid Diseases, Habits and Lifestyles, Psychosocial Characteristics, and Prevalence of Depression

Variable		Number of Respondents	
		Frequency (n)	Percentage (%)
Gender	Male	272	50.1
	Female	271	49.9
Education level	≥9 years	67	12.4
	<9 years	476	87.6
Marital Status	Married	263	48.4
	Unmarried/Divorce	280	51.6
Area of Residence	Urban	214	39.4
	Rural	329	60.6
Employment Status	Still Working	214	39.4
	Retired	329	60.6
Diabetes Mellitus	Not diagnosed	528	97.2
	Diagnosed	15	2.8
Hypertension	Not diagnosed	404	74.5
	Diagnosed	139	25.5
Stroke	Not diagnosed	530	97.6
	Diagnosed	13	2.4
Cognitive Impairment	No	211	38.9
	Yes	331	61.1
Smoking habits	No	243	44.7
	Yes	300	55.3
Sleep Disturbance	No	319	58.8
	Yes	224	41.2
Sleep Impairment	No	362	66.8
	Yes	180	33.2
Social Participation	Yes	143	26.4
	No	399	73.6
Depression	No	464	85.5
	Yes	79	14.5

Table 2. Relationship between Sociodemographic Characteristics, Comorbid Diseases, Habits and Lifestyles, and Psychosocial Characteristics with Depression

Respondent Characteristics	Depressed		Not Depressed		p value	OR (95% CI)
	n	%	n	%		
Gender						
Female	41	15.1	230	84.9	0.702	1.10 (0.681-1.769)
Male	38	14	234	86		
Education Level						
<9 years	67	14.1	409	85.9	0.405	0.75 (0.382-1.476)
≥9 years	12	17.9	55	82.1		
Marital Status						
Unmarried/Divorce	42	15	238	85	0.758	1.08 (0.668-1.738)
Married	37	14.1	226	85.9		
Area of Residence						
Rural	52	15.8	277	84.2	0.303	1.30 (0.788-2.145)
Urban	27	12.6	187	87.4		
Employment Status						
Retired	52	15.8	277	84.2	0.303	1.30 (0.788-2.145)
Still working	27	12.6	187	87.4		
Diabetes Mellitus						
Diagnosed	6	37.5	10	62.5	0.019	3.73 (1.316-10.58)
Not diagnosed	73	13.9	454	86.1		
Hypertension						
Diagnosed	22	15.8	117	84.2	0.620	1.15 (0.671-1.954)
Not diagnosed	57	14.1	347	85.9		
Stroke						
Diagnosed	2	15.4	11	84.6	1.000	1.07 (0.233-4.920)
Not diagnosed	77	14.5	453	85.5		
Cognitive Impairment						
Yes	58	17.5	274	82.5	0.015	1.92 (1.125-3.261)
No	21	10.0	190	90.0		
Smoking habits						
Yes	45	15.0	255	85.0	0.740	1.09 (0.670-1.756)
No	34	14.0	209	86.0		
Sleep Disturbance						
Yes	53	23.8	170	76.2	0.000	3.53 (2.126-5.846)
No	26	8.1	294	91.9		
Sleep Impairment						
Yes	49	27.2	131	72.8	0.000	4.15 (2.525-6.827)
No	30	8.30	333	91.7		
Social Participation						
No	23	16.1	120	83.9	0.544	1.18 (0.694-1.996)
Yes	56	14.0	344	85.5		

Table 3. Multivariate Analysis of Independent Variables on Depression

Variable	p	OR	95% CI	
			Lower	Upper
Diabetes Mellitus	0.026	3.85	1.170	12.640
Cognitive Impairment	0.017	1.98	1.130	3.453
Sleep Disturbance	0.004	2.29	1.297	4.054
Sleep Impairment	0.000	2.83	1.622	4.930

respondents experienced depression.¹²

In this study, there was no significant relationship between gender and depression. The results of this study differ from the research conducted by Brailean et al., who found that older women had higher levels of depressive effect ($p < 0.001$) and somatic symptoms ($p < 0.001$) than men. On the other hand, several other studies have found the opposite results. Safitri Burhan et al. conducted a study on the elderly population in general, and the results stated that there was no significant relationship between gender and depression.¹³ Research explicitly conducted on the oldest-old by Bergdahl et al. also stated that there was no difference in the level of depression in older women and men.¹⁴ This is in line with the statement of Sialino et al. that with age, the ratio of the risk of depression between women and men will decrease. Older women aged 75 years and over have no risk factors for specific depression, such as postmenopausal depression. In addition, with increasing age, men will experience a decrease in coping with the loss of a partner and a decrease in seeking social support. This accelerated decline in mental health in men led to a decrease in the risk ratio between sex and depression in the very old elderly.¹⁵ Therefore, it is suspected that gender is a factor that influences depression in the elderly, but the level of significance decreases with age.

The results of this study stated that there was no statistically significant relationship between education level and depression. This result differs from the research conducted by Safitri Burhan et al., which found a significant relationship between education level and depression, with p value=0.014 ($p < 0.05$).¹⁴ This difference in results may be due to the differences in the categories of high and low levels of education. In the research of Safitri Burhan et al., the level of education is divided into three categories: not going to school, education up to high school, and above high school.

Meanwhile, in this study, the level of education is divided into 2 categories: ≥ 9 years and < 9 years, by considering the time of compulsory education in Indonesia. In addition, the disproportionate number of respondents between those with 9 years or more of education and those with less than 9 years of education in this study can also affect the analysis results. On the other hand, Lee Sang-Woo et al. conducted a study comparing the factors of depression in the young-old and oldest-old. In that study, it was found that life satisfaction and depression in the oldest-old group were more related to subjective perceptions in life, such as satisfaction with family relationships or self-esteem, compared to objective conditions of life, including education level.¹⁶ Research conducted by Wei Zhang et al. states that other factors influence the relationship

between education level and mental health. Women, rural residents, and the elderly are at higher risk of distress, making education less useful for them in coping with adversity. The oldest-old also had more risk factors for depression, such as economic decline, more chronic illnesses, and lower levels of psychological well-being.¹⁷ Therefore, it is suspected that education is a factor that influences depression in the elderly, but the level of significance will decrease with age.

This study also stated no statistically significant relationship between marital status and depression. The result is different from a meta-analysis conducted by Yan XY et al., which stated that there was a relationship between marital status and depression, with being unmarried/divorced being associated with depression.¹⁸ On the other hand, the study conducted by Bulloch et al. stated that the relationship between marital status and depression was influenced by gender and age. In terms of age, the study found that there was a decrease in the incidence of depression in those who were unmarried/divorced with age. This is because the older a person is, the better the psychological adaptation and coping mechanisms in experiencing loss.¹⁹ In addition, according to Fleming et al., the oldest-old are also usually more prepared for the death of their partner.²⁰ Therefore, it is suspected that marital status is a factor that influences depression in the elderly, but the level of significance decreases with age.

The area of residence did not have a significant relationship with depression in this study. This result is different from the research conducted by Li Lydia et al., which states that elderly living in rural areas are associated with higher rates of depression.²¹ Bergdahl et al. conducted a study specifically on the oldest-old group and compared the rates of depression in rural and urban areas. It was found that 34% of the elderly in rural areas and 27% of the elderly in urban areas experienced depression. The higher rates of depression in the elderly living in rural areas are due to lack of access to treatment and inappropriate treatment choices.²² On the other hand, research conducted by Yulianti et al. stated that the elderly who live in urban areas have a higher risk for depression.²³ In another study conducted by Fitriana et al., there was no difference in the level of depression in the elderly living in urban and rural areas.²⁴ It appears that other factors influence the relationship between the area of residence and depression. Those who live in rural or urban areas have protective factors and risk factors.²⁵ Therefore, the relationship between residence and depression is still controversial.

The study results found that there was no statistically significant relationship between employment status and depression. The result of this study is different from the research conducted by Aryawangsa et al.,

who found that depression rates were higher in older people who did not work. Work is a form of active living behavior and is related to one's income.²⁶ On the other hand, research conducted by Guanghan Gao states that those who work have a higher pressure, so they are more prone to depression.²⁷ Anne et al. stated that as they age, the elderly increasingly adjust their needs and desires to income so that their level of well-being is not affected. Therefore, with increasing age, the relationship between employment status and income with depression decreases.²⁸

A statistically significant relationship was found between diabetes mellitus and depression in this study. The results of the bivariate analysis of this study are in accordance with the research conducted by Chou et al., which stated that there was a relationship between diabetes mellitus and depression.²⁹ The result of the multivariate analysis in this study is in line with the research conducted by Suriastini et al. That study used a multivariate logistic regression test and stated that comorbid diseases, including diabetes mellitus, had a significant relationship with the incidence of depression. In that study, it was explained that the relationship between the two was mediated by a decrease in quality of life caused by chronic pain and functional impairment. The prevalence of depression was also found to be higher in the elderly who experienced chronic pain due to complications.³⁰ On the other hand, Chen Fenqin et al. found that by using multivariate analysis, there was a significant relationship between overweight and poor physical activity ability in patients with diabetes mellitus and the incidence of depression.³¹ The relationship between diabetes mellitus and depression can be explained by the high psychological burden caused by the diagnosis of diabetes mellitus. The psychological burden due to diagnosis increases rumination thinking patterns and impaired concentration in the elderly, leading to depression.³² In addition, many complications experienced by people with diabetes mellitus can also interfere with the psychological state of the elderly.³³ Other studies suggest that the incidence of depression in people with diabetes mellitus is associated with decreased medication adherence, poor metabolic control, high incidence of complications, decreased quality of life, increased use and costs of health care, increased disability and lost productivity and increased risk of death.³⁴

Hypertension did not have a significant relationship with depression in this study. This result is different from the study conducted by Boima et al., which stated that the elderly with hypertension had a doubled risk of experiencing depression compared to young people with hypertension.³⁵ Research in Spain found an association between moderate or severe hypertension and depression, but not mild hypertension. On the other hand, research conducted by Kabutoya states that depressive symptoms are

associated with low blood pressure.³⁶ Long J et al. stated that although there is a theory of vascular depression that proposes that cerebrovascular disease can influence and trigger depressive syndrome in the elderly, the meta-analysis results do not support that hypertension is a risk factor for depression.³⁷ Apparently, the relationship between hypertension and depression is still controversial, so further studies are needed to analyze the relationship between hypertension and depression.

The results of this study differ from the research conducted by Hornsten et al. which compared the prevalence of depression in the elderly with and without stroke. That study stated that stroke patients experienced a decrease in the ability of ADL (activities of daily living) so that they were more prone to depression. This study stated no statistically significant relationship between stroke and depression.³⁸ This difference in results may be due to the disproportionate number of respondents between those who had a stroke and those who did not have a stroke in this study.

The results of this study stated that there is a statistically significant relationship between cognitive impairment and depression. The result of the bivariate analysis of this study is in accordance with the research conducted by Juniarta et al., which states that there is a relationship between cognitive impairment and depression with a p -value=0.001 ($p < 0.05$).³⁹ The results of the multivariate analysis in this study are in line with the research conducted by Weyerer S et al. among the elderly 75 years and over. That study found that mild cognitive impairment and subjective memory impairment increased the risk of depression in the elderly through multivariate analysis.⁴⁰ Cognitive impairment and depression are said to have a two-way relationship. Decreased quality of life due to cognitive impairment impacts the psychological condition of the elderly and causes problems such as depression. On the other hand, other studies have shown that individuals with depression tend to have decreased performance related to neuropsychological aspects.⁴¹

Smoking habits does not have a significant relationship with depression in this study. This study differs from a cross-sectional study conducted on 167 elderly people in Hong Kong, which stated that there was an association between smoking and depressive symptoms, with current smokers having a higher risk than ex-smokers.⁴² It is also supported by research conducted by Almedia et al., which states that people who still smoke and former heavy smokers are associated with an increase in the frequency and severity of depression.⁴³ In this study, no further analysis was carried out regarding the length of time smoking and the number of cigarettes consumed per day, so the degree of smoking of the respondents could not

be known. This may be the reason for the differences in the results of this study with previous studies.

A statistically significant relationship was found between sleep disturbance and depression in this study. The result of the bivariate analysis of this study is in accordance with the research conducted by Madyaningrum et al., which states that there is a relationship between sleep disturbance and depression with a value of $p=0.001$ ($p < 0.05$).⁴⁴ This is also supported by research conducted by Lee Eun et al. who stated that persistent sleep disturbance was associated with recurrence of depression in the elderly.⁴⁵ The result of the multivariate analysis of this study is in accordance with the research conducted by Basta Maria who found that sleep disturbance is related to the incidence of depression.⁴¹ On the other hand, Jaussent Isabelle et al. stated that only two components of sleep disturbance, namely difficulty in initiating sleep (DIS) and difficulty in maintaining sleep (DMS), have a relationship with depression in the elderly. This relationship between sleep disturbance and depression can be explained by the inflammatory theory, where sleep disturbances increase inflammatory markers such as C-reactive protein and interleukin-6 that increase the risk of depression.⁴⁵ Other studies suggest the relationship between the two is related to the regulation of REM sleep and HPA-axis activity.⁴⁶

The analysis results also showed a statistically significant relationship between sleep impairment and depression. The result of the bivariate analysis of this study is in accordance with a study conducted by Liu et al. states that sleep quality indirectly affects depression.⁴⁷ The result of the multivariate analysis of this study is in accordance with the research conducted by Jaussent Isabelle et al. who stated that excessive daytime sleepiness (EDS) was associated with the incidence of depression in later life.⁴⁶ This is also supported by research conducted by Berger Mathieu, which states a two-way relationship between EDS and depression.⁴⁸ This association between sleep impairment and depression can also be explained by the inflammatory theory. This study found a stronger relationship between depression and sleep impairment than sleep disturbance. Sleep impairment measures poor sleep quality outcomes, such as fatigue and daytime sleepiness, while sleep disturbance measures the context or process of poor sleep quality, such as sleeping time or duration. One of the allegations that resulted in this is that the elderly in Indonesia may be accustomed to sleeping disturbances due to the close relationship between families, sleeping in the same room with other family members, and small living spaces. The mechanisms that explain the relationship between depression and sleep disorders are complex and need to be studied further.⁴⁴

There was no significant relationship between social

participation and depression in this study. The result of this study is different from research conducted by Luo Mengyun et al., which stated that high levels of social involvement were associated with decreased depression and higher quality of life.⁴⁹ On the other hand, JooHong Min et al. stated that social gatherings positively affect the elderly who do have good mental health. The study also stated that the relationship between social engagement and mental health was influenced by the type of activity and the initial level of depression.⁵⁰

5. CONCLUSION

The prevalence of depression in the elderly aged 75 years and over in Indonesia is relatively high, at 14.5%. Diabetes mellitus is the most influential factor of depression. There is a significant relationship between diabetes mellitus, impaired cognitive function, sleep disturbance, and sleep impairment with depression.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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