Journal of Epidemiology and Public Health (2024), 09(04): 515-527
Masters Program in Public Health, Universitas Sebelas Maret

Research
Open Access

Multilevel Analysis of Factors Affecting Depression Risk among the Elderly: Loneliness, Living Status, Physical Activity, Age, Gender, and Education

Emirza Nur Wicaksono[1)], Didik Gunawan Tamtomo[2)], Hanung Prasetya [3)], Bhisma Murti[1)]

[1)]Master's Program in Public Health, Universitas Sebelas Maret
[2)]Faculty of Medicine, Universitas Sebelas Maret
[3)]Study Program of Acupuncture, Health Polytechnic, Ministry of Health Surakarta

Received: 25 August 2024; Accepted: 28 September 2024; Available online: 16 October 2024

ABSTRACT

Background: There is still a high prevalence of depression in the elderly which is affected by loneliness, low physical activity, gender, last education, and residence status. Elderly people who live alone or have lost a life partner are more prone to depression. Although family support and public health services such as Posyandu are expected to protect against the risk of depression, there have not been many studies that have examined in depth the influence of Posyandu as a contextual factor in reducing the risk of depression in the elderly. This study aims to analyze the influence of these factors and the role of Posyandu in reducing the risk of depression.
Subjects and Method: This study used a cross-sectional design conducted in 25 Posyandu Elderly in Grogol District, Sukoharjo Regency from August to September 2024. A total of 204 elderly respondents aged 60 years and above were selected using Stratified Random Sampling. The dependent variable in this study was depression collected using the PHQ-9 questionnaire, and loneliness was assessed by the UCLA Loneliness Scale. Other independent variables such as physical activity, gender, education, and life status were collected through structured interviews. Multilevel linear regression analysis is used to analyze the relationship between these factors and the risk of depression, taking into account the individual and contextual levels (Posyandu).
Results: The average age of the respondents was 66.27 years old (Mean = 66.26, SD = 5.16), with 79.41% of them being female. Loneliness was significantly associated with an increased risk of depression (b= 0.05; CI 95%= 0.07 to 0.10; p=0.024), while living with family reduces the risk of depression (b= -6.33; CI 95%= -8.26 to -4.40; p<0.001). Physical activity did not show a significant association with depression. Gender, education level, and age are also not significant predictors of depression. Contextual speaking, posyandu has no effect as a contextual variable on the variable of depression in the Grogol sub-district (ICC=2.64%).
Conclusion: Loneliness is a significant risk factor for depression in the elderly while living with family also reduces the risk of depression in the elderly.

Keywords: Elderly, depression, loneliness, housing status, multilevel analysis, physical activity

Correspondence:
Emirza Nur Wicaksono. Master's Program in Public Health, Universitas Sebelas Maret. Jl. Ir Sutami 36A, Surakarta 57126, Central Java, Indonesia. Email: emirza.wicaksono@gmail.com. Mobile: +6281770247207.

Cite this as:
Wicaksono EN, Tamtomo DG, Prasetya H, Murti B (2024). Multilevel Analysis of Factors Affecting Depression Risk among the Elderly: Loneliness, Living Status, Physical Activity, Age, Gender, and Education. J Epidemiol Public Health. 09(04): 515-527. https://doi.org/10.26911/jepublichealth.2024.09.04.11.

BACKGROUND

Depression is a global public health problem that disproportionately affects the elderly population. In Indonesia, the elderly population is increasing rapidly, with 8.97% of the total population over 60 years old (23.4 million people) in 2017, and this number continues to grow (Afrizal, 2018). Older people face significant mental health challenges, one of which is depression. In contrast to depression in younger age groups, depression in the elderly is often hidden and difficult to diagnose due to symptoms that overlap with the physical decline associated with aging. Older adults who experience depression can experience serious declines in quality of life, including deterioration in physical, cognitive, and social health. This can increase the risk of isolation, decreased immunity, and even death due to suicide (Ministry of Health, 2014).

Depression in the elderly can interfere with their ability to enjoy daily activities and function socially, which in turn increases the risk of physical decline and disability. Those who suffer from depression are at higher risk of developing chronic diseases such as heart disease, diabetes, and hypertension, as depression worsens the management of these diseases. In addition, depression in the elderly is also closely related to a higher risk of suicide compared to other age groups. Elderly people who feel deprived of social support or who feel that there is no longer a purpose in life are often at greater risk of committing suicide (Sadock, 2015).

The main risk factors for depression in the elderly include loneliness caused by the death of a life partner, loss of friends, and decreased social activity. Loneliness, or "loneliness," is an emotional condition that is often experienced by the elderly who lose meaningful social bonds (Manuntung, 2018). This can lead to maladaptive behaviors such as withdrawing from social interactions, decreased physical activity, and the appearance of feelings of uselessness, which exacerbate depression (Lutviana, 2017; Putri, 2016). Elderly people who live alone, without social support from their families, are more prone to depression than those who live with their families (Lutviana, 2017).

Until now, there have not been many studies that have explored how Posyandu can play a role in reducing the risk of depression in the elderly (Tristian, 2024). Posyandu as a form of community-based health service, is designed to provide health support to the elderly, both physically and mentally and emotionally (Ministry of Health, 2021). The use of a multilevel approach in this study is important to understand contextual factors such as the role of Posyandu. Interventions at the community level through Posyandu are expected to have a significant impact on supporting the mental health of the elderly by increasing social interaction and community support, which can ultimately reduce the risk of depression (Kadariya, 2019, Tristian, 2024). Therefore, this study aims to analyze the influence of loneliness, residence status, physical activity, age, gender, and recent education on the risk of depression in the elderly, as well as explore the contextual influence of Posyandu on the risk of depression.

SUBJECTS AND METHOD

1. Study Design

This research used a cross-sectional design, by observing populations and samples at the same time conducted in 25 elderly posyandu

spread across 9 villages in Grogol District, Sukoharjo Regency, Central Java from August to September 2024.

2. Population and Sample

The study population consisted of the elderly living in Grogol District, Sukoharjo Regency, Central Java. A total of 204 respondents were selected using stratified random sampling spread across 25 posyandu, each posyandu took 8-9 study samples. All posyandu studied have an intermediate strata category Respondents who participated were individuals aged 60 years and above, lived in the area for at least one year, and were willing to participate in the study.

3. Study Variables

The dependent variable is Depression. The independent variables were Loneliness, Residence Status, Physical Activity, Age, Gender and Last Education. In addition, Posyandu is also included as a contextual variable.

4. Operational Definition of Variables

Loneliness: An emotional mental state characterized by feelings of emptiness, feeling lonely, having no friends, and not fitting into expected social relationships that lead to inhibition of a person's social relationships as assessed by the UCLA Loneliness Scale Version 3.

Residence Status: defined as a person who lives with the respondent, either with family or on their own.

Physical Activity: any body movement produced by skeletal muscles that require energy expenditure, limb movements of the elderly which include endurance, flexibility and muscle strength.

Age: defined as the period of time that a person or something has passed since it was born, created, or started until the time the data was taken.

Gender: defined as a concept that refers to roles, behaviors, activities, and attributes that are considered appropriate by the Society. The study subjects in this study are male and female.

Last Education: The last education taken by the respondent based on the highest education diploma possessed by the respondent

Risk of Depression: respondents who have psychological disorders and are characterized by cognitive, behavioral, and emotional problems such as decreased self-concept, deep sadness, errors in thinking, and physical changes.

5. Study Instruments

The study instrument used for data collection is using a questionnaire. Depression variables were measured using the PHQ-9 (Patient Health Questionnaire-9) questionnaire which identifies the level of depression based on the nine main symptoms of depression adapted from the Diagnostic and Statistical Manual of Mental Disorders (DSM). The loneliness variable was measured using the UCLA (University of California, Los Angeles) loneliness scale version 3 which consisted of 20 items that assessed the level of loneliness based on feelings of social and emotional isolation. Physical activity variables were measured by PASE (Physical Activity Scale for the Elderly) which evaluates the daily physical activity of the elderly, including daily activities, exercise, and household chores. Meanwhile, socio-demographic data (gender, age, education, residence status) uses a questionnaire that includes information about gender, age, last education level, and residence status (living alone or with family).

6. Data Analysis

Univariate analysis describes the characteristics of the study variables such as age, gender, education, loneliness, and physical activity of the elderly in frequency and percentage. Bivariate analysis was performed to see the relationship between independent variables (loneliness, physical activity, gender, education, and residence status) and

depression using the Chi-Square test at a confidence level of 95% (CI 95%). Multivariate analysis using multilevel logistic regression was carried out at two levels: individual (loneliness, physical activity, gender, education, and residence status) and contextual (role of Posyandu). Intraclass Correlation Coefficient (ICC) is used to measure the contribution of individual and contextual variables to depression. This analysis was processed using Stata 13

7. Research Ethics

Study ethics include informed consent, anonymity, and confidence. Handled with care during the study process. The studyer has received a letter of ethical feasibility from the Health Study Ethics Commission of dr. Moewardi Hospital, Surakarta City on August 22, 2024 with the number 2.086/-VIII/HREC/2024.

RESULTS

This study was carried out from August to September 2024 on 204 elderly people in 25 elderly posyandu spread across 9 villages in Grogol District, Sukoharjo Regency.

1. Univariate Analysis

Table 1 shows that the continuous data study subjects have an average age of 66.26 (mean 66.26, SD 5.16), a loneliness score with UCLA with an average of 41.25 (mean 41.25, SD 13.08), the distribution of loneliness scores on the UCLA scale shows a wide range between 24 to 74. Physical activity with a PASE scale with an average score of 16.71 (mean 16.71, SD 4.87), the distribution of physical activity scores with the PASE scale shows a range between 6 and 24. And the depression risk score with the PHQ-9 scale with an average of 6.09 (mean 6.09, SD 4.19) the distribution of depression score with the PHQ-9 scale shows a range between 0 to 16.

Table 1. Characteristics of study subjects in Posyandu Elderly in Grogol District, Sukoharjo Regency continuous data (N=204)

Variable	Mean	SD	Min.	Max.
Age	66.26	5.16	60	90
Lonely	41.25	13.08	24	74
Physical Activity	16.71	4.87	6	24
Depression	6.09	4.19	0	16

Table 2 shows the characteristics of 204 study subjects, from the last education, 18 respondents were highly educated (8.82%), 39 respondents were educated at high school equivalent (19.12%), 45 respondents were educated at junior high school equivalent (22.06%), 82 respondents were educated in elementary school (40.20%), and 20 respondents did not go to school or did not finish elementary school (9.80%). In terms of employment, 15 respondents were retirees (7.35%), 15 respondents were not working (7.35%), 129 respondents were housewives (63.24%), and 45 respondents were self-employed (22.06%). A total of 42 respondents were male (20.59%), 162 respondents were female (79.41%), 182 respondents lived with family (89.22%), 22 respondents lived alone (10.78%).

Table 2. Characteristics of study subjects in Posyandu Elderly in Grogol District, Sukoharjo Regency categorical data (N=204)

Characteristic	Category	Frequency (N)	Percentage (%)
Last Education	Higher Education	18	8.82
	High school equivalent	39	19.12
	Junior high school equivalent	45	22.06

Characteristic	Category	Frequency (N)	Percentage (%)
	Elementary School	82	40.20
	Not in school/not graduating from elementary school	20	9.80
Job	Pensioner	15	7.35
	Not working	15	7.35
	Housewives	129	63.24
	Wirasawasta	45	22.06
Gender	Man	42	20.59
	Woman	162	79.41
Residence Status	Alone	22	10.78
	With Family	182	89.22

2. Bivariate Analysis

Table 3 shows that there is a positive effect between loneliness on the risk of depression in the elderly and loneliness statistically affects the increase in the risk of depression. The higher the UCLA score, the older the elderly will be at risk of depression by 0.015 times (b= 0.05; CI 95%= 0.00 to 0.10; p=0.036). There is a negative relationship between residence status and depression risk in the elderly and residence status statistically affects the increase in depression risk. Elderly people who live alone are 6.33 times more likely to be depressed than older people who live with family (b= -6.33; CI 95%= -8.30 to -4.36; p=0.000). Data analysis showed that there was no statistically significant effect between physical activity and the risk of depression in the elderly (b= -0.04; CI 95%= -0.15 to 0.62; p=0.398). Data analysis also showed that there was no statistical effect between age on the risk of depression in the elderly (b= -0.42; CI 95%= -0.14 to 0.06; p=0.420). Data analysis also showed that there was no statistical relationship between sex and the risk of depression in the elderly (b= -0.71; CI 95%= -2.21 to 0.67; p=0.312). Data analysis also showed that there was no statistical effect between last education on the risk of depression in the elderly (b= 0.24; CI 95%= -0.89 to 1.37; p=0.676).

Table 3. Bivariate analysis of loneliness, living status, physical activity, age, gender, education on the risk of depression in the elderly

Independent variables	b	CI 95%		p
		Lower limit	Upper limit	
Aloneness	0.05	0.00	0.10	0.036
Residence Status	-6.33	-8.30	-4.36	0.000
Physical Activity	-0.04	-0.15	0.62	0.398
Age	-0.42	-0.14	0.06	0.420
Gender	-0.71	-2.21	0.67	0.312
Last Education	0.24	-0.89	1.37	0.676

3. Multivariate Analysis

Table 4 shows the results of multilevel multiple linear regression analysis of the effects of loneliness, residence status, physical activity, age, gender, and last education on depression in the elderly. In loneliness, it has a statistical effect on the increased risk of depression. The higher the UCLA score, the older the elderly will be at risk of depression by 0.05 times (b= 0.05; CI 95%= 0.07 to 0.10; p=0.024). There is a negative relationship between living status and the risk of depression in the elderly. And living status statistically affects the increased risk

of depression. Elderly people who live alone are 6.33 times more likely to be depressed than older people who live with family (b= -6.33; CI 95%= -8.26 to -4.40; p<0.001).

Then in table 4, it was explained that the data analysis did not have a statistically significant effect between physical activity on the risk of depression in the elderly (b= -0.05; CI 95%= -0.15 to 0.05; p=0.398). Data analysis also showed that there was no statistically related relationship between age and the risk of depression in the elderly (b= -0.04; CI 95%= -0.14 to 0.05; p=0.420). Data analysis also showed that there was no statistical effect between sexes on the risk of depression in the elderly (b= -0.63; CI 95%= -1.99 to 0.72; p=0.312). Data analysis also showed that there was no statistically significant effect between education on the risk of depression in the elderly (b= 0.10; CI 95%= -1.00 to 1.21; p=0.676).

Posyandu as a random effect variable showed that its contribution to depression in the elderly in Grogol sub-district was very small (ICC=2.64%), this showed that there was no contextual influence of loneliness, residence status, physical activity, age, gender, and last education on depression in the elderly in posyandu in Grogol sub-district (ICC=2.64%).

Table 4 Multivariate analysis with multilevel linear regression of loneliness, living status, physical activity, age, gender, education on the risk of depression in the elderly

Independent variables	b	CI 95%		p
		Lower limit	Upper limit	
Fixed Effect				
Lonely	0.05	0.07	0.10	0.024
Residency Status	-6.33	-8.26	-4.40	0.000
Physical Activity	-0.05	-0.16	0.05	0.398
Age	-0.04	-0.14	0.05	0.420
Gender	-0.63	-1.99	0.72	0.312
Last Education	-0.10	-1.00	1.21	0.676
Random effect				
Posyandu				
Var (constanta)	0.31			
Var (residual)	11.42			
N observation 204				
Log likelihood = -540.38				
LR test vs. linear regression, p=0.35				
Inter Class Corelation (ICC)=2.64%				

DISCUSSION

a. The effect of loneliness on the risk of depression in the elderly

Based on the analysis in Table 4, there is a positive relationship between loneliness and the risk of depression in the elderly. Loneliness was statistically shown to increase the risk of depression, with results showing that the higher the UCLA score, the more likely the elderly were to experience depression by 0.05 times (b= 0.05; CI 95%= 0.07 to 0.10; p=0.024). These results are consistent with the study of Hindriyastuti and Safitri (2022), which stated that loneliness can have a significant impact on the level of depression in the elderly. High levels of loneliness increase the risk of depression, while older people who get enough social support tend to have a lower risk of depression.

Loneliness in the elderly is often related to a lack of social support, both from

family and the surrounding environment. Seniors who do not have support from family or do not have adequate social interaction tend to feel isolated, which worsens their mental state. This is also emphasized by a previous study which stated that the elderly who feel they do not have social support are more likely to be at risk of depression. A lack of emotional and social support can make them feel helpless, worsening their mental state and increasing their risk of depression. Support from family, friends, and community can help reduce loneliness and, in turn, prevent depression (Rahmawati et al., 2023).

In addition, loneliness is often exacerbated by declining physical conditions in the elderly. Decreased bodily functions, such as fatigue and reduced concentration, can make the elderly feel helpless and increasingly isolated from their environment. They may be reluctant to participate in social activities or activities held in orphanages or communities due to physical limitations. This state causes them to choose to isolate themselves, which ultimately worsens feelings of loneliness and triggers depression. Therefore, it is very important to pay special attention to social and mental health interventions to reduce loneliness and prevent depression in the elderly (Sadock, 2015).

b. The effect of residence status on the risk of depression in the elderly

The results showed that there was a negative relationship between residence status and the risk of depression in the elderly, where the elderly who lived alone had a 6.33 times greater risk of depression compared to the elderly who lived with their families (b= -6.33; CI 95%= -8.26 to -4.40; p=0.000). This result is in line with the theory presented by Fitriana (2021), which states that the elderly who live alone tend to feel isolated and lonely, and often feel alienated from the people around them. Feeling neglected by family or the surrounding environment can increase feelings of loneliness which contributes to the risk of depression.

Elderly people who live alone often lack attention and support from their families, which can lead to them feeling meaningless or neglected. Rahmawati et al. (2023) stated that indifferent family factors can be the main cause of feelings of emotional loneliness in the elderly. Lack of attention from family can trigger stress and feelings of unwanted, which ultimately worsens the mental state of the elderly. Elderly people who live alone tend to spend time without meaningful activities, so the social isolation they experience increases the likelihood of depression.

In addition, the elderly who live alone often experience a decrease in independence and difficulties in carrying out daily activities. When they do not have people to help with daily activities, such as eating, dressing, or maintaining hygiene, feelings of inadequacy and dependence can arise, which can increase the risk of depression (Darmawan, 2019). This decline in physical and mental abilities, without adequate social support, can make the elderly feel even more helpless, thus increasing the likelihood of depression. Family support in daily life, both emotionally and physically, is essential to prevent feelings of isolation and lower the risk of depression in the elderly.

c. The effect of physical activity on the risk of depression in the elderly

The data analysis showed that there was no statistical relationship between physical activity and the risk of depression in the elderly (b= -0.05; CI 95%= -0.15 to 0.05; p=0.398). This is different from the meta-analysis conducted by Prabandari (2021) which stated that physical activity can reduce the risk of depression and can improve the quality of life of the elderly (aOR=0.78; CI 95%= 0.62 to 0.98; p=0.03). Moderate-

intensity physical activity is recommended to reduce the risk of depression in the elderly (aOR= 1.25; CI 95% = 1.05 to 1.48; p=0.001). Fitriana et al. (2021) said that physical activity has benefits for a person's mental health, such as relieving stress, and loneliness, improving sleep quality, and preventing depression. A person who has good physical activity tends to have better physical and mental health and vice versa. In addition, they rarely do activities outside the home so they rarely interact with their friends. Someone who only does minimal activities will make them feel bored quickly. A person's lack of activity and lack of interaction with others can also trigger feelings of loneliness.

Physical activity did not have a significant effect on the risk of depression in the elderly, it is possible that the variation in physical activity measured in this study was not high enough to show a clear association. According to Mahindru (2023) in the elderly, physical activity tends to decline overall, and the elderly mostly have relatively uniform activity levels. In addition, other factors such as awareness level or exercise habits can also affect the results, so no significant association was found.

Another factor that may affect these results is the difference in methodology with previous studies. For example, studies using longitudinal designs may be more effective at detecting long-term changes caused by physical activity to mental health. Meanwhile, the cross-sectional design used in this study only measures relationships at one time, which may limit our understanding of the impact of physical activity on depression in the elderly (Mahindru, 2023).

Local context and population characteristics may also be the reason why these results differ from other studies. In the elderly population in the study area, physical activity may not have a large impact because the elderly in this area may focus more on lighter household activities or their involvement in community health programs such as Posyandu is not structured enough to encourage an increase in intense physical activity. This can reduce the variability of physical activity levels and make it difficult to see a real effect on the risk of depression (Kadariya, 2019).

d. The effect of age on the risk of depression in the elderly

The results of this study showed that age had no significant effect on the risk of depression in the elderly (b= -0.04; CI 95%= -0.14 to 0.05; p=0.420). This finding is in line with a study by Kurniawan (2022) which also found that age is not directly correlated with the level of depression in the elderly. These results suggest that although older people generally experience physical and mental decline as they age, age factors themselves may not be a major determinant of depression risk. Conversely, other factors such as physical health conditions and social support seem to play a greater role in influencing the mental health of the elderly.

Fazila and Khairani (2018) also support this finding by stating that age is not a significant predictive factor for depression in the elderly. Although increasing age is often accompanied by a decline in physical abilities and the emergence of chronic diseases, not all older people experience depression. Depression in the elderly is more often associated with factors such as social isolation, loneliness, and physical weakness that reduce the ability of the elderly to be independent in carrying out daily activities. Therefore, rather than just looking at age as a risk factor, it is important to consider the physical and social condition of the elderly more thoroughly.

In another study by Chu et al. (2019), it was found that the risk of depression in the elderly is more influenced by the

presence of physical weakness or chronic diseases than the age itself. Seniors who have reduced physical abilities or suffer from chronic diseases such as diabetes or heart disease tend to have a higher risk of depression, regardless of their age. These findings suggest that elderly health care needs to be focused on improving quality of life and chronic disease management, as well as providing adequate social and emotional support to reduce the risk of depression.

e. The effect of gender on the risk of depression in the elderly

The results of this study showed that there was no significant effect between gender and risk of depression in the elderly (b= -0.63; CI 95%= -1.99 to 0.72; p=0.312). These results are in line with a study conducted by Mumulati (2020), which also found no relationship between sex and the incidence of depression in the elderly in nursing homes. This means that both male and female elderly people have the same risk of experiencing depression, so the gender factor is not the main determinant in the onset of depression among the elderly.

Another study by Fazila and Khairani (2018) also supports these findings by showing that there is no significant difference in depression rates between male and female elderly people. This suggests that the causes of depression in the elderly are more related to other factors, such as physical health conditions, social support, and emotional experiences experienced during their lives, rather than just gender factors. Although some studies suggest that women may be more susceptible to depression at a younger age, this factor does not appear to have a significant effect on the elderly.

In addition, a study conducted by Liu et al. (2017) stated that the incidence of depression in the elderly is often associated with worsening clinical dementia conditions, which are characterized by vascular disorders and changes in white matter in the brain. This shows that neurological and physiological factors are more dominant in influencing the risk of depression in the elderly than gender factors. Therefore, health care for the elderly should focus on the prevention and management of physical and mental health conditions, regardless of gender differences.

f. The effect of last education on the risk of depression in the elderly

Data analysis also showed that there was no statistically significant effect between last education and depression risk in the elderly (b= 0.10; CI 95%= -1.00 to 1.21; p=0.676). This is in line with a study conducted by Ngadiran (2020) which stated that the level of education did not have a significant influence on the level of depression, with a p value = 0.303 (>0.05). However, this study is not in line with the study conducted by Fazila and Khairani (2018) which shows that there is a relationship. It is also not in line with study conducted by Sutinah (2017) that there is a relationship between education and depression in the elderly. The level of education affects the level of a person's severe depression. The higher the education, the more open thinking it will make the elderly have an open mind so that it is easy to accept new things. On the contrary, the lower the education, the older the elderly have closed thoughts so they do not develop in terms of thinking.

According to the researchers, education may not have significantly affected depression because most respondents had relatively similar educational backgrounds. Meanwhile, the low education of the elderly in this study is because most of the elderly lived at that time and access to education at that time was still difficult. According to Mumulati (2020), the low education of the elderly at this time, is because in the past

educational facilities were still very lacking compared to today. Thus, most of the elderly are only able to complete education at the people's school level (elementary level).

g. The contextual effect of posyandu on the risk of depression in the elderly

Posyandu as a random effect variable showed that there was no contribution to depression in the elderly in the Grogol sub-district (ICC=2.64%) The results of this study are different from the results of a study conducted by Zhang et al. (2023) which showed that as many as 48.94% of respondents had taken advantage of the preventive care community. This study explains that community social capital and participation in social activities in individuals are related to the prevention of depression in the elderly. The intra-class correlation coefficient (ICC=13%) showed that the social activities of respondents spread across the communities where they lived greatly minimized the elderly for depression.

In this study, the absence of the influence of posyandu on the risk of depression in the elderly can be caused by the homogeneity of the posyandu strata in the study area. Variations in the types of services and frequency of activities at posyandu may be needed to obtain more diverse results. Posyandu for the Elderly has an important role in improving preventive behavior because it has direct access to the elderly population. Through the Elderly Posyandu, an integrated approach can be carried out by connecting various health services such as counseling, providing referrals to clinics or health centers if needed, exposure to information about health, healthy dietary patterns and good physical activity for elderly patients, providing motivation (support) and the implementation of activities that can improve individual behavioral skills such as elderly gymnastics (Ministry of Health, 2021).

This study has several limitations, including that the responses to the questionnaire can be influenced by individual interpretations. This can make the data less objective if respondents give answers based on their perceptions or interpretations. The study is also limited to a single region and cross-sectional design, therefore, it is difficult to determine the cause-and-effect relationship between the variables. The respondents only came from one sub-district (Grogol District). So further study with a longitudinal design and wider coverage of the area is needed. This can create bias and limit the representativeness of the study sample. Then all Posyandu that are used as study sites are all Intermediate strata, because of the homogeneity of the posyandu strata in the study area. Variations in the types of services and frequency of activities at posyandu may be needed to obtain more diverse results.

This study has implications for public health, including: The results of this study show that loneliness has a significant influence on the level of depression in the elderly. It emphasizes the importance of interventions that focus on reducing loneliness, such as social programs, group therapy, or community activities that can improve social interaction among older adults. The finding that living with family can lower the risk of depression suggests that social support from the family is essential for the mental well-being of the elderly. Therefore, programs that increase family involvement in elderly care, as well as community-based interventions, such as increasing the role of elderly posyandu are very relevant. Although the ICC score shows a small influence of Posyandu on depression variation, Posyandu still has great potential as a center of social support and health for

the elderly. This study indicates the need to expand the function of the elderly Posyandu, not only as a place for health checkups, but also as a means of more structured social interaction.

The findings of this study can be the basis for the development of mental health policies that focus more on the elderly. Governments and health policymakers need to pay more attention to improving mental health services for older people, including addressing loneliness and depression through interventions at the community and family levels. Although physical activity did not show a significant association with depression in this study, other literature suggests the mental health benefits of physical activity. Therefore, it remains important to promote physical activity among the elderly as part of depression prevention interventions

AUTHOR CONTRIBUTION

All authors have made meaningful and significant contributions to data analysis and the preparation of the final manuscript.

ACKNOWLEDGMENT

The author expressed his deep gratitude to the research subject for the willingness of time that had been given, the researcher also thanked the Grogol Health Center for the research permission given for the completion of this article, and the author also expressed his gratitude to all parties who played a role in the preparation of this article.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There was no conflict of interest in this study

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