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Analysis of Respondent Characteristics and Risk Factors Related to the Incidence of Opportunistic Infections in People With HIV/AIDS (ODHIV) in Gorontalo City

Fatrina M. Gani[1*], Irwan[2], Ayu Rofia Nurfadillah[3]
[1,2,3]Program Studi Kesehatan Masyarakat, Fakultas Olahraga dan Kesehatan, Universitas Negeri Gorontalo

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ABSTRACT

The decline in immune system function due to HIV in individuals with AIDS is closely related to opportunistic infections (Ols) Ols in People Living with HIV/AIDS (PLWHA) are infections that occur due to impaired immune function This study aims to analyze respondent characterisues and risk factors associated with opportunistic infections in PLWHA in Gorontalo City This study employs a quantitative analytical method with a cross-sectional study design. The study was conducted at the KPA (AIDS Handling Commission) of Gorontalo Province over a one-day period. The sampling technique used was total sampling, with a total of 35 respondents The results indicated that of the 35 PLWIHA, 23 experienced Ols The characteristics of the respondents with the highest frequency were female (18) respondents. 51. 49%), aged 24 years (25 respondents, 71.4%), with higher education (22 respondents, 62.96 unmarried or divorced (27 respondents, 77 1%1, and living with HIV for 5 years (2) respondents, 60 01 Bivartate analysis revealed that education level, marital status, occupation CD4 count HIV stage, and adherence to ARV medication were sunificantly associated with the occurrence of Ols Multivariate analysis identified three dominant variables influencing Of occurrence occupation CD4 count and ARV adherence It is recommended that PL WHA adhere more strictly to ARV medication to strengthen the immune system.

Corresponding Author:
Fatrina M. Gani1, Irwan2, Ayu Rofia Nurfadillah3
Program Studi Kesehatan Masyarakat, Fakultas Olahraga dan Kesehatan, Universitas Negeri Gorontalo
Email korespodensi: fatrinfatrin20200@gmail.com

INTRODUCTION

Indonesia is currently facing a major challenge in health development, namely"Triple Burden"which includes the burden of infectious diseases that are still high, the increasing prevalence of non-communicable diseases, and the re-emergence of diseases that were previously resolved or the emergence of new diseases [1]. The main challenges faced are the high cases of Tuberculosis (TB), where Indonesia is among the five countries with the largest TB cases in the world, the increase in new HIV infections with an estimated 630,000 people with HIV/AIDS (ODHA), the coverage of Complete Basic Immunization (IDL) which only reached 57.9% in 2018, and the threat of disease Zoonoses like Dengue Hemorrhagic Fever (DHF) and Covid-19, which account for about 70% of new infectious diseases in humans (Director General of P2P Ministry of Health of the Republic of Indonesia, 2020).

Today, HIV is still a serious threat with a high mortality rate, where sufferers are not only at risk of dying from the virus itself, but also from opportunistic infections (IO) and other accompanying complications. The weakness of the immune system caused by HIV, especially in people with AIDS, is strongly related to the emergence of opportunistic infections. An opportunistic infection is an infection that strikes when the immune system is no longer effective in fighting pathogens. Opportunistic infections (IO) are comorbidities that are common in people with HIV/AIDS (ODHA) due to a decreased immune system. This decrease in immunity causes various pathogens to attack various organs of the body, including the

respiratory, digestive, nervous, and skin systems. Opportunistic infections are diseases caused by microorganisms such as bacteria, fungi, viruses, or parasites, which are usually harmless to individuals with strong immune systems. However, when the immune system is weakened, these microorganisms can take advantage of the opportunity to cause infection [2]. The most common opportunistic infections found in people with AIDS in Indonesia are pulmonary tuberculosis, which accounts for about 50% of cases, followed by Hepatitis (30%), Candidiasis (25%), and Pneumonia (33%) [3].

Opportunistic infections (IOs) are often a significant health problem for patients with HIV/AIDS, especially in the late stages of the disease. Research conducted by Samingan & Martioso in 2023 revealed an interesting demographic pattern regarding the incidence of opportunistic infections in People With HIV/AIDS (ODHA). The study found that the incidence of opportunistic infections was more common in men, with a percentage of 64%, compared to women who were only 36% [4]. In addition, education level also seems to play a role in the risk of opportunistic infections Megawati (2016) reported that 57.1% of ODHA who experienced opportunistic infections had a low level of education. The same study showed that 57.1% of ODHA who experienced opportunistic infections had low incomes. Marital status is also an influential factor, with 73.7% of ODHA experiencing opportunistic infections having married status. Research shows that 40% of ODHA who experience opportunistic infections have a CD4 count of less than 200 cells/mL.

Gorontalo Province in 2024 will continue to increase the number of HIV/AIDS cases until the latest data in June 2024 there are 1180 cases of HIV/AIDS. Gorontalo City is the area with the highest HIV/AIDS cases with 367 cases, the second Gorontalo Regency with 320 cases, the third Pohuwato Regency with 149 cases, the fourth Bone Bolango Regency with 145 cases, the fifth Boalemo Regency with 108 cases and the last one North Gorontalo Regency with 91 cases. Initial observations carried out at KPA Gorontalo Province by interviewing peer companions of HIV/AIDS patients obtained that the number of ODHIV patients undergoing ARV therapy at KPA Gorontalo Province was 35 people (KPA Gorontalo Province, 2024). The purpose of this study was to analyze the characteristics of respondents and risk factors related to the incidence of opportunistic infections in people with HIV/AIDS (ODHIV) in Gorontalo City.

RESEARCH METHODS

This research is a quantitative analytical research with a research design cross-sectional. In this study, the target population taken is There are 35 people with HIV who underwent ARV therapy at KPA Gorontalo Province in December 2024. The sampling technique used in this study is total sampling so that the number of samples is as large as the population of 35 people with HIV/AIDS who are undergoing ARV therapy at KPA Gorontalo Province. The research instruments used were in the form of a demographic questionnaire and a questionnaire on compliance with ARV medication. ARV adherence to treatment was measured using scores obtained from the MMAS-8 questionnaire.

RESULTS

Table 1 Distribution of characteristics of respondents who experience opportunistic infection

Respondent Characteristics	Sum	
	n	%
Gender		
Man	17	48,6
Woman	18	51,4
Age		
< 24 years old	25	71,4
≥ 24 Years	10	28,6
Education Level		
Low (Elementary/Equivalent-Junior High/Equivalent)	13	37,1
Higher (High School/Equivalent-College	22	62,9
Marital Status		
Unmarried/Divorced	27	77,1
Marry	8	22,9
Long suffering from HIV		
< 5 Years	21	60,0
≥ 5 Years	14	40,0
Last CD4 Levels		
<200 cell/ µl	16	45,7
≥200cell/µl	19	54,3
Clinical Stage of HIV		
Final Stage (III-IV)	21	60,0

Early Stage (I-II)	14	40,0
Compliance with ARV Medication		
Non-compliant	20	54,3
Obedient	15	45,7
Duration of ARV Treatment		
<2 Years	15	42,9
≥2 Years	20	57,1
Opportunistic Infections (IO)		
Yes	23	65,7
Not	12	34,3
Types of Opportunistic Infections (IO)		
Candidiasis	3	13,1
Pneumocystist *Infection*	4	17,4
Tuberculosis (TB)	4	17,4
Herpes Simplex	1	4,3
Toxoplasmosis	2	8,7
Digestive Infections	5	21,7
Combination	4	17,4

Source: Primary Data, 2024

Based on table 1 above, it can be seen that the characteristics of the most respondents are female with a total of 18 respondents (51.4%), with the highest age being at the age of < 24 years with a total of 25 respondents (71.4%), the highest level of education is at the higher education level with a total of 22 respondents (62.9%), the most marital status Unmarried/divorced with a total of 27 respondents (77.1%), the most long-term HIV suffering was < 5 years with a total of 21 respondents (60.0%), the highest number of CD4 patients ≥200 cells/µl as many as 19 respondents (54.3%), the most end-stage clinical stage as many as 21 respondents (60.0%), the most adherence to taking ARV drugs was not compliant with taking ARV drugs as many as 20 respondents (57.1%), and the duration of ARV treatment was the most ≥2 years as many as 20 respondents (57.1%). Of the 35 HIV/AIDS patients, as many as 23 respondents (65.7%) had experienced opportunistic infections with the proportion of gastrointestinal infections being the most opportunistic type of infection, namely 5 respondents (21.7%), followed by Lung Infection and Tuberculosis as many as 4 respondents (17.4%), Toxoplasmosis as many as 2 respondents (8.7%) and Herpes Simplex as many as 1 respondent (4.3%). It was also found that patients who had experienced more than one opportunistic infection (combination) were 4 respondents (17.4%).

Table 2 Relationship of respondents' age with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

Age	**Incidence of Opportunistic Infections**				**Total**		***P-value***	**r**
	Yes		**Not**					
	n	**%**	**n**	**%**	**n**	**%**		
≥ 24 Years	17	73,9	8	66,7	25	71,4	0,470	0,076
< 24 years old	6	26,1	4	33,3	10	28,6		
Sum	**23**	**100,0**	**12**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

The results of the analysis of the relationship between age and the incidence of opportunistic infection obtained a P-value of 0.470 < □= 0.05. It can therefore be statistically concluded that there is no association between age and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.076 means that age with the incidence of opportunistic infection in ODHIV has a very weak relationship level

Table 3 Relationship of respondents' education level with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

Education Level	Incidence of Opportunistic Infections				Total		*P-value*	r
	Yes		Not					
	n	%	n	%	n	%		
Low (SD-SMP)	12	52,2	1	8,3	13	37,1	0,012	0,396
High (High School-College)	11	47,8	11	91,7	22	62,9		
Sum	**23**	**100,0**	**12**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

Based on table 3, the results of the analysis of the relationship between education level and the incidence of infection were obtained P-value = 0.012< □= 0.05. Therefore, it can be statistically concluded that there is a relationship between education level and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.396 means that the level of education and the incidence of opportunistic infection in ODHIV has a weak relationship level.

Table 4 Relationship of respondents' education level with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

Marital Status	Incidence of Opportunistic Infections				Total		*P-value*	*r*
	Yes		Not					
	n	%	n	%	n	%		
Unmarried/Divorced	21	91,3	6	50,0	27	77,1	0,011	0,423
Marry	2	8,7	6	50,0	8	22,9		
Sum	**23**	**100,0**	**12**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

Based on table 4, the results of the analysis of the relationship between marital status and the incidence of opportunistic infection were obtained P-value = 0.011 < □= 0.05. Therefore, it can be statistically concluded that there is a relationship between marital status and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.423 means that marital status with the incidence of opportunistic infection in ODHIV has a sufficient level of relationship.

Table 5 Relationship of respondents' employment with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

Work	Incidence of Opportunistic Infections				Total		*P-value*	*r*
	Yes		Not					
	n	%	n	%	n	%		
Work	17	73,9	3	25,0	20	57,1	0,006	0,425
Not Working	6	26,1	9	75,0	15	42,9		
Sum	**23**	**100,0**	**12**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

Based on table 5, the results of the analysis of the relationship between work and the incidence of opportunistic infection were obtained P-value = 0.006< □= 0.05. It can therefore be statistically concluded that there is a relationship between occupational and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.425 means that work with the incidence of opportunistic infection in ODHIV has a sufficient level of relationship.

Table 6 Relationship of late CD4 levels with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

Last CD4 Levels	Incidence of Opportunistic Infections				Total		*P-value*	*r*
	Yes		Not					
	n	%	n	%	n	%		
<200 cell/ µl	16	69,6	0	0,0	16	45,7	0,000	0,552
≥200 cells/µl	7	30,4	12	100,0	'19	54,3		
Sum	**23**	**100,0**	**12**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

Based on table 6, the results of the analysis of the relationship between the last CD4 level and the incidence of opportunistic infection showed that the value □= 0.000< □= 0.05. Therefore, it can be statistically concluded that there is a relationship between the last CD4 level and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.552 means that the last CD4 level with the incidence of infection.

Table 7 Relationship of HIV clinical stage with the incidence of opportunistic infection in people with HIV/AIDS (ODHIV)

Clinical Stage of HIV	Incidence of Opportunistic Infections				Total		*P value*	*r*
	Yes		Not					
	n	%	n	%	n	%		
Final Stage (III-IV)	18	78,3	3	25,0	21	60,0	0,002	0,459
Early Stage (I-II)	5	21,7	9	75,0	14	40,0		
Sum	**23**	**100,0**	**12**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

Based on table 7, the results of the analysis of the relationship between the clinical stage of HIV and the incidence of opportunistic infection showed that the P-value = 0.002 < □= 0.05. Therefore, it can be statistically concluded that there is a relationship between the clinical stage of HIV and the incidence of opportunistic infection in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.459 means that the clinical stage of HIV with the incidence of opportunistic infection in ODHIV has a sufficient level of relationship.

Table 8 Relationship of ARV Medication Adherence to Opportunistic Infection in People with HIV/AIDS (ODHIV)

Compliance with ARV Medication	Incidence of Opportunistic Infections				Total		*P-value*	*r*
	Yes		Not					
	n	%	n	%	n	%		
Non-compliant	17	73,9	3	25,0	20	57,1	0,006	0,425
Obedient	6	26,1	9	75,0	15	42,9		
Sum	**22**	**100,0**	**13**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

Based on table 8, the results of the analysis of the relationship between ARV drug adherence and the incidence of opportunistic infection showed that the P-value = 0.006 < □= 0.05. Therefore, it can be statistically concluded that there is a relationship between the adherence to taking ARV drugs and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.425 means that compliance with taking ARV drugs with the incidence of opportunistic infections in ODHIV has a sufficient level of relationship.

Table 9 Long-term relationship of ARV treatment with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

Duration of ARV Treatment	Incidence of Opportunistic Infections				Total		*P-value*	r
	Yes		Not					
	n	%	n	%	n	%		
<2 Years	10	43,5	5	41,7	15	42,9	0,918	0,017
≥2 Years	13	56,5	7	58,3	20	57,1		
Sum	**23**	**100,0**	**12**	**100,0**	**35**	**100,0**		

Source: Primary Data, 2024

Based on table 9, the results of the analysis of the long-term relationship between ARV treatment and the incidence of opportunistic infection showed that the P-value = 0.918 < □= 0.05. It can therefore be statistically concluded that there is no long-term association between ARV treatment and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV). The correlation value (r) of 0.017 means that the length of ARV treatment with the incidence of opportunistic infection in ODHIV has a very weak relationship level.

Table 10 Age, education level, occupation, marital status, last CD4 levels, clinical stage of HIV, adherence to taking ARV medication, and duration of treatment for the incidence of oporinistic infections

Variable	*P Value*	*r*
Age	0,652	0,076
Education Level	0,011	0,396
Marital Status	0,006	0,423
Work	0,006	0,425
Last CD4 Levels	0,000	0,552
Clinical Stage of HIV	0,002	0,459
Compliance with ARV Medication	0,006	0,425
Duration of Treatment	0,918	0,017

Source: Primary Data, 2024

Based on table 10, there is a relationship between variables of education, occupation, marital status, last CD4 level, clinical stage of HIV, and adherence to taking ARV drugs to the incidence of opportunistic infections in people with HIV/AIDS (ODHIV).

Table 11 Results of multivariate analysis to see the most dominant variables for the incidence of opportunistic infections in ODHIV

Research Variables		Model Log Likelihood	Change in -2 Log Likelihood	Df	Sig
Step 4	Work	-11,528	14,739	1	0,000
	CD4 levels	-13,909	19,501	1	0,000
	Compliance with ARV Medication	-6,109	3,900	1	0,048

Source: Primary Data, 2024

Based on table 11, multivariate results using logistic regression test analysis can be found that from the six variables, there are three variables related to the incidence of opportunistic infection in ODHIV, as evidenced by the sig value of the three variables <0.05.

DISCUSSION

Relationship of respondents' age with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

The results of the analysis found that most HIV/AIDS patients who had experienced opportunistic infections were at the age of ≥ 24 years as many as 17 respondents (73.9%) and those who were < 24 years old as many as 6 respondents (21.6%). Respondents who had never experienced opportunistic infection were 12 respondents consisting of 8 respondents ≥ 24 years old (66.7%) and 4 respondents < 24 years old (33.3%).

The results of the analysis of the Chi-square test on the relationship between age and the incidence of opportunistic infection showed that the value □= 0.652 < □= 0.05. It can therefore be statistically concluded that there is no association between age and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV).

According to the researcher's assumption based on the results of the study, age is not related to the incidence of opportunistic infections in ODHIV because the older a person is, the more mature he is physically and psychologically so that if he feels something different with his body, he will immediately seek treatment. In addition, everyone has a different response to infection and treatment. The age of <24 years is still at risk of opportunistic infections because at this age they tend to engage in unsafe sexual behaviors that can lead to sexually transmitted infections. Some people may be susceptible to opportunistic infections due to their general health status such as a history of previous infections. In addition, opportunistic infections such as candidiasis can affect all ages.

Age has a significant role in shaping a person's experience and knowledge, which in turn can influence decision-making and behavior. Younger individuals, due to their developmental process, tend to be quicker in exploring and trying new things. This urge to seek new experiences and sensations can increase the likelihood of engaging in risky behaviors, such as unsafe sexual activity and drug abuse (Yowel, et al 2016). Candidiasis infection is dominated by Candidate albicans. Candidiasis is a lesion in the oral cavity due to HIV infection and is found in 90% of AIDS patients. Candidiasis of the oral cavity can affect both men and women and all ages [5] .

Research conducted by Knussen in 2010 showed that age did not have a significant correlation with the risk of HIV infection [6]. This indicates that increasing a person's age does not automatically lead to an increase in risky behaviors that lead to HIV infection. On the other hand, Timmreck highlighted a significant increase in adolescent sexual activity and premarital sex in recent years. This phenomenon suggests that the risky behaviors that contribute to HIV infection often begin at a young age.

Relationship of respondents' education level with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

The results of the analysis found that most HIV/AIDS patients who had experienced opportunistic infections were at the low education level (SD-SMP) as many as 12 respondents (52.2%) and those with higher education level as many as 11 respondents (47.8%). The results of the Chi-square test analysis of the relationship between education level and the incidence of opportunistic infection showed that the value □= 0.011< □= 0.05. Therefore, it can be statistically concluded that there is a relationship between education level and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV).

According to the researchers' assumption based on the results of the study, low education levels lead to limited accurate information about HIV/AIDS, including symptoms, modes of transmission and the importance of treatment. Respondents with low levels of education may lack understanding that they are more susceptible to opportunistic infections due to HIV/AIDS conditions, so they delay or avoid medical treatment. In addition, a low level of education will make it difficult for ODHIV to understand the medical instructions given by doctors or nurses regarding ARV treatment and infection prevention. Although low education affects access to health information and health care, it is not a direct determinant of the strength of the immune system. People with low levels of education can still have a strong immune system and not be exposed to pathogens that cause opportunistic infections. People with higher education levels can also get opportunistic infections because people with higher education levels will definitely work. Working will create high stress levels which will have an effect on the immune system thereby increasing susceptibility to infections.

The stress response has a direct impact on the human immune system, which is manifested in a decrease in the number of T cells. The immune system, the body's natural defense, protects against pathogens such as bacteria and viruses through complex mechanisms. Decreased immune function can be triggered by chronic stress that interferes with hormones, cigarette chemicals that damage immune cells, and sleep deprivation that inhibits the production of cytokines, all of which weaken the body's ability to fight infections [7].

Education provides access to broader and deeper information, develops critical and analytical thinking skills, and skills to access and use information effectively. (Anggraeni & Aisah, 2018). According to Green, education is a key factor in improving individual knowledge. The higher a person's level of education, the more extensive their knowledge will be, which will ultimately positively affect their health behavior [8]. The survival of people with HIV/AIDS tends to be lower in populations with low levels of education. This is due to their limited access to adequate health information and health services, which are often exacerbated by conditions of poverty [9].

This research supports the findings of Ningsih (2020) which shows a correlation between education and the incidence of opportunistic infections. The results of this study, with a value of p = 0.000, indicate a significant relationship between education and the incidence [10]. A person's level of education affects their

ability to absorb information and change behavior for the better, so individuals with higher education have broad insights and have the potential to become role models in daily life.

The relationship between respondents' marital status and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

The results of the analysis found that most of the HIV/AIDS patients who had experienced opportunistic infections were those with unmarried/divorced status as many as 21 respondents (91.3%), then only 2 respondents (8.7%) were married. The results of the Chi-square test analysis of the relationship between marital status and the incidence of opportunistic infection showed that the value □= 0.006 < □= 0.05. Therefore, it can be statistically concluded that there is a relationship between marital status and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV).

According to the researchers' assumption based on the results of the study, unmarried ODHIV status is more susceptible to opportunistic infections due to a lack of social support to overcome the disease such as reminding to take medication, accompanying to the doctor or providing emotional support during treatment. In addition, the unmarried status makes ODHIV less likely to have a sense of responsibility to maintain their health because there is no partner or family that needs to be protected from HIV/AIDS. Unmarried people who undergo ARV therapy properly and maintain a lifestyle will make their immune system strong so as to avoid opportunistic infections. Married ODHIV can also experience opportunistic infections due to non-compliance in undergoing ART therapy, and have had HIV for a long time and have a weak immune system.

Unmarried status is often associated with an increased risk of HIV transmission. This is largely due to the tendency of unmarried individuals to change sexual partners more frequently, which significantly reduces the level of caution in their sexual practices. In addition, both unmarried men and women tend to have stronger sexual urges than those who are married and their sexual needs are met. This increased need can trigger involvement in unsafe or risky sexual behaviors, such as unprotected sex or with multiple partners, which ultimately increases vulnerability to HIV transmission [11]. According to research conducted by Sarah in 2019, individuals who do not have family support face a five-fold greater risk of ignoring HIV/AIDS prevention efforts.

This study is in line with research conducted by Azaam and Mustikasari (2020) that there is a relationship between the incidence of opportunistic infection and marital status with a value of p = 0.04. Married men will have healthy and responsible behavior in having sexual relations with their partners do not want negative impacts in having sexual intercourse, but a person who is unmarried has a higher level of risky sexual behavior because to vent their sexual desires.

Respondents' occupation's relationship with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

The results of the analysis found that most of the HIV/AIDS patients who had experienced opportunistic infections were those who worked as many as 17 respondents (73.9%), and those who did not work as many as 6 respondents (26.1%). The results of the analysis of the Chi-square test of the relationship between work and the incidence of opportunistic infection showed that the value □= 0.006 < □= 0.05. It can therefore be statistically concluded that there is a relationship between occupational and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV).

According to the researchers' assumption based on the results of the study that working ODHIV will provide enough income to allow individuals to access sexual services. This can increase the risk of exposure to infection, especially for people with disabilities who may already have a weakened immune system. Working ODHIVs have good financial stability thus allowing them to meet basic needs such as good nutrition and medicines. In contrast to ODHIV who do not work, they will have limitations in accessing necessary health services, such as Antiretroviral (ARV) treatment and routine check-ups. Without adequate access, they are vulnerable to opportunistic infections because their immune systems are not well managed.

Andersen (1975) identified three main factors that influence a person in utilizing health services. First, predisposing factors refer to an individual's tendency to use health services, which is influenced by personal characteristics such as age, gender, education, and beliefs. Second, supporting factors are related to the individual's ability to access health services, such as financial availability, proximity to health facilities, and quality of service. Working people make it possible to have good financial availability. Finally, the need factor indicates the existence of a medical reason that urges a person to seek health care. In other words, a person's decision to utilize health services is the result of a complex interaction between personal, social, and health factors. Many ODHA experience economic hardship, which can limit their ability to pay for transportation or healthcare costs. This results in delays in getting treatment and increases the risk of opportunistic infections.

Research conducted by Ningsih (2020) indicates a significant correlation between employment status and the risk of opportunistic infections (IO) [10]. Individuals who have self-employment and income tend to have greater purchasing power, which in some cases can lead to high-risk behaviors. As stated by Saktina &

Satriyasa (2017), adequate income can facilitate access to commercial sex services, which is known as one of the major risk factors for transmission of sexually transmitted infections (STIs), including IO [12]. Therefore, employment status not only reflects economic conditions, but can also be an indicator of risky behaviors that have the potential to increase susceptibility to infection.

Relationship of late CD4 levels with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

The results of the analysis found that most of the HIV/AIDS patients who had experienced opportunistic infections, namely those whose last CD4 level was <200 cells/µl as many as 16 respondents (69.6%) and then the last CD4 level ≥200 cells/µl as many as 7 respondents (30.4%). The results of the Chi-square test analysis of the relationship between the clinical stage of HIV and the incidence of opportunistic infection showed that the value □= 0.000 < □= 0.05. Therefore, it can be statistically concluded that there is a relationship between the clinical stage of HIV and the incidence of opportunistic infection in people with HIV/AIDS (ODHIV).

According to the researchers' assumption based on the results of the study, low CD4 levels <200 cells/µl cause the immune system to not function optimally, as a result the body is more susceptible to infection by various pathogens. Pathogens that are not harmful to healthy people will be especially dangerous for people with low CD4 levels because the pathogen has the opportunity to multiply quickly and cause extensive damage to the body. Low CD4 levels also make opportunistic infections in ODHIV often difficult to treat because the body struggles to fight the infection. However, people with CD4 levels >500 cells/µl are still at risk of opportunistic infections due to gradual immune damage, so even though CD4 levels are high, immunity still decreases, in addition to infections, infections can also arise due to other pathogens or environmental factors that affect the body's immunity.

Opportunistic infections appear when the immune system is severely weakened. The number of CD4 cells in the blood is a key indicator for measuring immune damage from HIV, and helps doctors decide when to start antiretroviral (ARV) therapy. CD4, a marker of immune system health, interacts with MHC II, then with the HIV virus, allowing the virus's RNA to enter the T-helper lymphocyte cells. HIV converts viral RNA into DNA, damaging T-helper cells, lowering CD4, and weakening immunity. CD4 screening is important to determine patients who need IO prophylaxis and ARV therapy. CD4 decrease of 70-100 cells/mm on average3/year, and ARV can increase 50-100 cells/mm3/year [13].

This study is in line with Ladyani and Kiristianingsih (2019), who found a significant relationship between CD4 count and opportunistic infections (IO) in HIV/AIDS patients at Abdoel Hospital. HIV infection causes a progressive decline in the immune system, characterized by a decrease in the number and function of CD4 cells. CD4 cells are categorized into two groups, namely below 350 cells/mm3 and above 350 cells/mm3. Patients with CD4 counts below 350 cells/mm3 had a four-fold higher risk of developing opportunistic infections compared to those with CD4 counts above 350 cells/mm3. Therefore, a low CD4 count significantly increases a person's susceptibility to opportunistic infections [14].

Relationship of HIV clinical stage with the incidence of opportunistic infection in people with HIV/AIDS (ODHIV)

The results of the analysis found that most of the HIV/AIDS patients who had experienced opportunistic infections were those in the late clinical stage (III-IV) as many as 18 respondents (78.3%) and the early stage (I-II) as many as 5 respondents (21.7%). The results of the Chi-square test analysis of the relationship between the clinical stage of HIV and the incidence of opportunistic infection showed that the value □= 0.002 < □= 0.05. Therefore, it can be statistically concluded that there is a relationship between the clinical stage of HIV and the incidence of opportunistic infection in people with HIV/AIDS (ODHIV).

According to the researchers' assumption based on the results of the study, the higher clinical stage of HIV indicates the more severe damage to the immune system of ODHIV. Weak immunity makes pathogens easily live and multiply in organs, making the body more susceptible to opportunistic infections. ODHIV with a late clinical stage but not opportunistic infection because in some cases, especially when the CD4 count of ODHIV is very low, doctors will prescribe prophylactic drugs to prevent certain opportunistic infections. In addition, access to good health services allows ODHIV to always monitor health conditions, and quickly deal with health problems. However, ODHIV with a low clinical stage can still be affected by opportunistic infections because each ODHIV body's response to HIV is different. The body may also experience a temporary decline in the immune system due to factors such as stress, lack of sleep, or other diseases.

The clinical stage of HIV reflects the rate of progression of the infection, assessed based on symptoms such as weight loss, fever, diarrhea, and opportunistic types of infections. Research shows the majority of HIV patients are in stages III and IV, likely due to delays in seeking treatment until severe symptoms appear. Patients with advanced stages often show lower CD4 levels [15].

This study reinforces findings reported by Awadalla in 2015, which stated that people with HIV/AIDS who are in stage IV have a much higher risk of developing opportunistic infections (IO). As the stage of HIV

increases, there is a progressive decline in the patient's immune system. This decline causes the body to become increasingly susceptible to various opportunistic pathogens.

Relationship of ARV medication adherence to opportunistic infection incidence in people with HIV/AIDS (ODHIV)

The results of the analysis found that most of the HIV/AIDS patients who had experienced opportunistic infections were those who did not comply with taking ARV drugs as many as 17 people (73.9%), then those who complied with taking ARV drugs as many as 6 people (26.1%). The results of the Chi-square test analysis of the relationship between ARV drug adherence and the incidence of opportunistic infection showed that the value □= 0.006 < □= 0.05. Therefore, it can be statistically concluded that there is a relationship between the adherence to taking ARV drugs and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV).

According to the researcher's assumption based on the results of the study, respondents who do not comply with taking medication can make the HIV virus mutate and become resistant to drugs which will result in the virus will continue to multiply and continue to damage the immune system. This of course will make the body of HIV patients more susceptible to infection because it is easy for germs or viruses in the surrounding environment to enter the body. ODHIV who do not comply with taking ARV drugs but do not experience opportunistic infections due to low exposure to pathogens in addition to a healthy lifestyle, good nutrition, regular exercise, and avoiding smoking habits can help keep the immune system strong. However, there are also ODHIV who suffer from opportunistic infections even though they have complied with antriretroviral therapy because each ODHIV has a different speed of immune system recovery. Some people with HIV may take longer to reach optimal levels of immunity. Although ARV drugs can control the HIV virus, the damage that has already occurred may not fully recover.

The main key to the success of ARV therapy lies in the patient's adherence to taking the drug regularly, according to the schedule, dosage, time, and proper way. By following these rules, the development of the HIV virus can be suppressed, allowing ODHA to live a healthy life without the complications of opportunistic infections. Conversely, non-adherence in ARV therapy can be fatal, increasing the risk of opportunistic infections and drug resistance. This condition forces ODHA to take more drugs or more expensive drugs, so that compliance becomes a determining factor for ODHA's quality of life [16]. The body's response to ARV therapy during the first six months varies widely, reflected in changes in CD4 counts that can increase, decrease, or remain. This variation is caused by differences in the condition of the individual's body in receiving the effects of ARV drugs. However, effective ARV therapy, supported by good patient adherence, can significantly increase the expected amount of CD4, which is an important indicator of a healthy immune system in ODHA [17].

Research shows that non-adherence to ARV therapy, which causes patients to feel their health condition is deteriorating, significantly increases the risk of opportunistic infections (IOs) [18]. Various studies confirm that antiretroviral therapy (ART) drastically reduces the incidence of IO, aiding in the healing and repair of IO, including IO that does not yet have specific prophylaxis and therapies. Although ART is highly effective, antimicrobial prophylaxis is still necessary in patients with severe immunosuppression. However, ART has become the cornerstone of strategies to reduce various infections and HIV-related complications.

Long-standing relationship of ARV treatment with the incidence of opportunistic infections in people with HIV/AIDS (ODHIV)

The results of the analysis found that most of the HIV/AIDS patients who had experienced opportunistic infections were 13 respondents for the duration of ARV treatment ≥2 years (56.5%) and then the long duration of ARV treatment <2 years as many as 10 respondents (43.5%). The results of the Chi-square test analysis of the relationship between ARV treatment and the incidence of opportunistic infection showed that the value □= 0.918 < □= 0.05. It can therefore be statistically concluded that there is no long-term association between ARV treatment and the incidence of opportunistic infections in people with HIV/AIDS (ODHIV).

According to the researchers' assumption based on the results of the study, the length of treatment has no effect on the incidence of opportunistic infections because ARVs cannot always prevent the occurrence of infection, especially when treatment starts late. Pre-existing immune system damage and other factors such as non-compliance can affect treatment outcomes. For example, ODHIV who has undergone therapy for many years but does not consistently take ARVs will make the HIV virus continue to replicate and increase the risk of opportunistic infections. ARV drugs also cause uncomfortable side effects so that sometimes it will make HIV reduce the dose or stop treatment.

ARVs do not cure HIV, but they do drastically reduce the decline in immunity, which is responsible for the occurrence of opportunistic infections. According to the CDC, about 40% of Americans with HIV do not experience viral suppression, and not all infectious agents are diagnosed early, therefore by the time they

are diagnosed, their immune systems are already in decline, resulting in opportunistic infections. Infection occurs depending on exposure to infectious agents, and in countries that still have large numbers of bacterial and fungal infections, the pattern of exposure is different from countries with a small number of infectious diseases. Delay in starting antiretroviral therapy (ART) after positive test results, poor nutritional status, and poor medication adherence have been identified as major risk factors influencing the occurrence of opportunistic infections in ODHIV [19].

Some people who take antiretroviral drugs (ARVs) experience some side effects. The higher the dose of the drug used, the more severe the side effects, which can also be reviewed for a long time in the use of the drug. Decreased hemoglobin levels are the most severe side effects due to the use of antiretroviral (ARV) therapy [20].

The use of antiretroviral drugs (ARVs) often causes side effects in some individuals, with the intensity of which tends to increase with the dose and duration of use. One of the most significant side effects, especially of duviral type ARV therapy, is a decrease in hemoglobin levels. It is important to consult with a doctor to monitor and manage the side effects of ARVs, as side effects vary from drug to drug and individual, and can be short-term or long-term.

This study is in line with a study at Dr. H. Abdoel Moeloek Hospital which used a cross-sectional observational analytical method, found that 60% of 60 HIV/AIDS patients experienced opportunistic infections. However, an analysis of the relationship between the duration of ARV therapy and the incidence of opportunistic infections showed no significant association (p=0.210). These results indicate that although opportunistic infections are common in HIV/AIDS patients, the duration of ARV therapy does not directly affect the occurrence of the infection.

CONCLUSION

From the results of bivariate analysis, six variables were obtained related to the incidence of opportunistic infections in people with HIV/AIDS (ODHIV) in Gorontalo City. The six variables were education level, marital status, occupation, last CD4 level, clinical stage of HIV, and adherence to taking ARV drugs. The most dominant variables based on the results of multivariate analysis using logistic regression were occupation, last CD4 levels, and adherence to taking ARV medication.

SUGGESTION

For ODHIV who experience opportunistic infections, it is important to comply with ARV therapy in order to strengthen the immune system. In addition, it is necessary to implement a healthy lifestyle through balanced nutrition, adequate nutrition, personal hygiene, and seeking psychological and social support to overcome stress and anxiety.

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