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The Relationship Between Peer Support and the Incidence and Dimensions of Burnout Among Medical Students

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ARTICLE INFO	ABSTRACT
Keywords: Burnout, Medical Students, Peer Support	Introduction: Burnout is a psychological condition characterized by chronic stress that persists over a long period as a response to ongoing stressors. Burnout can lead to decreased academic performance, increased risk of dropout, and even suicide. Peer support may enhance self-confidence, reduce social pressure, and provide emotional stability, ultimately helping reduce the risk of burnout.
Submitted: May 22 th 2025 Reviewed: June 10 th 2025 Accepted: Aug 13 th 2025	Objective: This study examines the relationship between peer support and burnout among medical students at Sultan Ageng Tirtayasa University (Untirta). Methods: The research design employed was a cross-sectional design, utilizing the simple random sampling technique for data collection. The subjects were preclinical medical students from the 2021, 2022, 2023, and 2024 cohorts. Sampling was conducted using a simple random sampling technique. Data on peer support were collected using the Social Provision Scale (SPS), while burnout data were obtained through the Maslach Burnout Inventory–Student Survey (MBI-SS). The data were analyzed using univariate and bivariate analyses. Results: The results showed that the prevalence of burnout among students was 14.6%. Based on the dimensions of burnout, the majority of students reported high levels of exhaustion (58.4%), moderate levels of cynicism (47.2%), and low efficacy (100%). Regarding peer support, 96.6% of students reported high levels of peer support. Fisher's exact test yielded a p-value of 0.381. Conclusions: This study concludes that there is no significant relationship between peer support and burnout among medical students at the University.

Introduction

Burnout is a psychological condition characterized by chronic stress that persists over a prolonged period in response to various stressors (Maslach & Leiter, 2016). This condition can affect anyone, including university students. Academic demands, pressure, and heavy responsibilities often mark student life. These demands,

combined with expectations from oneself and others, become significant sources of stress that may lead to burnout (Hwang & Kim, 2022). Burnout resulting from prolonged academic pressure can lead to physical and mental exhaustion, decreased motivation for learning activities, and a detachment from the surrounding

environment and academic tasks (Fariborz et al., 2019).

Medical students, in particular, show a relatively high prevalence of burnout. A meta-analysis by Frajerman et al. (2019) covering 24 studies reported a global burnout prevalence of 44.2% among medical students. Another study by Chin et al. (2016) in Malaysia found that the prevalence of burnout increased with academic year progression, from 63.5% in the first year to 73.1% in the fourth year. In Indonesia, Simatupang & Widjaja (2021) reported that 62.1% of medical students at Tanumanegara University experienced burnout, while at Syarif Hidayatullah State Islamic University Jakarta, the prevalence was 11%. Despite the variations in prevalence rates, burnout remains a serious issue as it can reduce academic performance and negatively impact students' mental health in the long term (Linnenbrink & Pintrich, 2002). Burnout may even lead to a higher risk of college dropout (Arlinkasari & Akmal, 2017) and contribute to the development of depression, substance abuse, and suicidal ideation (Amir et al., 2018).

One of the factors that plays a role in preventing or reducing burnout is peer support. Students in the developmental phase of emerging adulthood spend a significant amount of time with their peers (Santrock, 2011). Support from fellow

students includes academic assistance, emotional support, companionship, and sharing experiences (Hidayah, 2018). Positive peer relationships can provide a sense of acceptance, emotional closeness, and a safe space for openness (Astuti et al., 2024). Peer support is believed to enhance self-confidence, reduce pressure, and provide emotional stability in facing academic burdens, thereby playing a role in lowering burnout levels. This is supported by studies from Rozsy (2018) at the University of Jember and Puspitasari & Sholihah (2022) at the Annuriyah Islamic Boarding School, who both found a significant negative relationship between peer support and burnout. Conversely, a study by Ali et al. (2018) in Pakistan found no significant relationship, while research by Bai et al. (2020) showed that negative peer interactions could lead to increased burnout. These findings indicate inconsistencies that warrant further investigation.

Based on this background, the present study examines the relationship between peer support and burnout among medical students. The findings are expected to contribute to burnout prevention efforts and inform educational institutions in designing effective social support strategies.

Methods

This quantitative study uses a cross-sectional approach involving 89 active preclinical medical students from the 2021, 2022, 2023, and 2024 cohorts at Sultan Ageng Tirtayasa University. The sampling technique used was simple random sampling from a population of 93 students. The inclusion criteria were active medical program students at Sultan Ageng Tirtayasa University. In contrast, the exclusion criteria included students who did not complete the questionnaire, those who had been medically diagnosed with psychological disorders, and students who were currently taking sedative medications.

The instrument used to measure burnout was the Maslach Burnout Inventory–Student Survey (MBI-SS), developed by Schaufeli et al. (2002), which consists of 15 items covering exhaustion, cynicism, and efficacy. The scale was a 7-point Likert scale, ranging from 0 (never) to 6 (every day). Respondents were categorized as experiencing burnout if they had a score of >14 on exhaustion, >6 on cynicism, and ≤ 22 on efficacy, based on criteria by Schaufeli et al. (2002). The researcher used the Indonesian-translated version of the MBI-SS by Maharani (2019), demonstrating validity values ranging from 0.478 to 0.870 and a reliability coefficient of 0.932.

Meanwhile, peer support was measured using the Social Provision Scale (SPS)

developed by Cutrona & Russell (1987). The researcher utilized the version translated into Indonesian by Inayah (2015), which has been proven to possess acceptable validity and reliability levels. This instrument comprises 29 items, including 18 positive and 11 negative statements, covering six support components. The scale uses a 4-point Likert format, namely: (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree. The results were categorized as high peer support if the total score was ≥ 72.5 and low peer support if the score was < 72.5 .

Data were analyzed using univariate analysis to examine the frequency distribution of respondent characteristics and key variables, and bivariate analysis using Fisher's exact test to determine the relationship between peer support and burnout levels.

Results and Discussion

Of the 174 medical students, 89 met the inclusion criteria and were included in this study. The questionnaires were distributed online via Google Forms, which were shared by student representatives of each cohort through their respective group chats.

Table 1. shows that most respondents were female, with the number of female students being approximately three times higher than that of male students. Regarding year of study, the most significant

proportion of respondents came from the 2021 cohort, with 28 students (31.5%). Furthermore, Table 2 indicates that most students (96.6%) reported high peer support.

Subsequently, Table 3 reveals that most respondents (85.4%) did not experience burnout. Lastly, Table 4 presents the distribution across the three dimensions of burnout, showing that most respondents experienced a high level of exhaustion (58.4%), a moderate level of cynicism

(47.2%), and a low level of efficacy (100%).

In Table 5, a statistical test was conducted using the Chi-square test to examine the relationship between two variables, namely peer support and burnout. However, the assumptions for the Chi-square test were not met; therefore, Fisher's Exact Test was used as an alternative. Based on Fisher's Exact Test, a p-value of 0.381 was obtained. This result indicates no significant relationship between peer support and the incidence of burnout.

Table 1. Demographic Characteristics of Respondents

Characteristics	n	%
Gender		
Female	66	74.2%
Male	23	25.8%
Year of Study		
2021	28	31.5%
2022	27	30.3%
2023	15	16.9%
2024	19	21.3%

Table 2. Overview of Peer Support

Peer Support	n	%
High	86	96.6%
Low	3	3.4%

Table 3. Overview of Burnout

Burnout	n	%
Yes	13	14.6%
No	76	85.4%

Table 4. The Distribution of Burnout Dimensions

Burnout Dimensions	n	%
<i>Exhaustion</i>		
High	52	58.4%
Moderate	16	18%
Low	21	23.6%
<i>Cynicism</i>		
High	16	18%
Moderate	42	47.2%
Low	31	34.8%
<i>Efficacy</i>		
High	0	0%
Moderate	0	0%
Low	89	100%

Table 5. The Relationship Between Peer Support and the Incidence of Burnout

		Burnout		Total	P value
		Yes	No		
Peer Support	Low	1 (33,3%)	2 (66,7%)	3 (100%)	0.381
	High	12 (14%)	74 (86%)	86 (100%)	
Total		13 (14,6%)	76 (85,4%)	89 (100%)	

Based on the research findings, the prevalence of burnout among medical students at Sultan Ageng Tirtayasa University was 14.6%, after combining the three dimensions of burnout. This result is comparable to the study conducted by Silva et al. (2022), which reported a burnout prevalence of 12.2% among medical students in Brazil. The similarity in findings may be attributed to the comparable characteristics of the respondents, pre-clinical medical students from semesters 1 to 8, and the use of the same measurement instrument, the Maslach Burnout Inventory–Student Survey (MBI-SS).

The relatively low prevalence of burnout among Sultan Ageng Tirtayasa University students may be attributed to the fact that the respondents were still in the pre-clinical phase and had not yet been exposed to the pressures of the clinical stage or internship (co-assistantship), which typically involves a heavier workload. This aligns with the opinion of Maslach & Leiter (2016), who stated that workload is one of the primary triggers of burnout. Additionally, it is possible that students experienced academic stress but were able to employ effective coping strategies, thereby preventing the

stress from escalating into complete burnout (De Hert, 2020).

In contrast, a meta-analysis conducted by Frajerman et al. (2019), which analyzed 24 studies among medical students worldwide, reported a significantly higher prevalence of burnout at 44.2% [CI: 33.4–55.0]. This discrepancy may be due to the larger sample size and the use of different measurement tools, such as the Maslach Burnout Inventory (MBI) and the Copenhagen Burnout Inventory (CBI).

Several key factors contribute to burnout among medical students, including a demanding curriculum, academic competition, exam-related stress, and high educational costs. The management style of the educational institution can also influence students' stress levels (Frajerman et al., 2019). Furthermore, active learning strategies such as Problem-Based Learning (PBL) may contribute to burnout, especially when implemented without clear curricular guidance or educator expectations (Boni et al., 2018). It is essential to recognize that burnout is a multifaceted condition, and each individual may experience and respond to it differently (Azeez et al., 2024).

Moreover, this study found that 58.4% of students experienced high levels of exhaustion. This may be due to intense academic demands and insufficient rest. This finding is consistent with a study by Almaki et al. (2017) in Saudi Arabia, which

reported a high exhaustion rate of 58.6%, attributed to intense competition during medical school admissions and residency placements. High levels of exhaustion can negatively impact the learning process, reduce the quality of healthcare services, increase the risk of medical errors, and decrease empathy towards patients.

A longitudinal study by Kachel et al. (2020) revealed an increase in cynicism among medical students. This condition is associated with high academic pressure, a lack of social support, hierarchical educational structures, and a hidden curriculum that emphasizes performative rather than collaborative values. In the present study, most students exhibited a moderate level of cynicism, accounting for 47.2%. Meanwhile, a survey by Putri et al. (2021) on medical students in Mataram found a high level of cynicism (56.3%), which may be attributed to the intense and demanding daily academic workload faced by medical students.

In such circumstances, cynicism may emerge as a self-protective mechanism to reduce stress by creating emotional distance or psychological withdrawal from the learning environment (Maslach & Leiter, 2016). One manifestation of cynical attitudes can be observed in academic disengagement, where students perceive assignments as formalities. As a result, they tend to procrastinate on completing tasks

until close to the deadline due to poor time management and a lack of emotional engagement and perceived meaning in the learning process itself.

In this study, the prevalence of low efficacy was 100%. This finding is consistent with studies by Santoso (2022) and Budiman et al. (2024) in Indonesia, which reported low efficacy rates of 97.8% and 97.4%, respectively. The high prevalence of low efficacy in this study may be attributed to the continuous academic pressure and high expectations that medical students face. These findings align with Khosravi's (2023) study, which stated that failure to meet idealistic expectations during medical education can trigger psychological distress and reduce self-efficacy. The study explains that many students who enter medical school are strongly motivated to become ideal doctors. However, the learning process proves to be highly demanding, competitive, and exhausting. When the efforts made do not align with the outcomes achieved, students may develop feelings of failure, incompetence, and low productivity.

Furthermore, this study found that most respondents perceived high levels of peer support, with 96.6% categorized as having high peer support. This high percentage indicates that medical students at Sultan Ageng Tirtayasa University perceive strong peer support in coping with complex

academic pressures. Peer support, including emotional, informational, and instrumental support, can arise from close social relationships within the campus environment. Research by Sulistiawijaya (2023) noted that similar learning environments encourage the development of close friendships among students. As students adjust, they tend to form friendships based on shared values, goals, and backgrounds, which strengthens their perception of peer support (Sawiji et al., 2022).

However, the very high proportion of students who reported high levels of peer support (96.6%) may indicate a potential ceiling effect. This occurs when the lack of variability in responses on the independent variable restricts the statistical ability to detect significant relationships. The consistency in perceived peer support could also be shaped by tendencies toward socially desirable responses or by cultural norms that prioritize collectivism and interpersonal harmony. These factors could have led students to report more positively on self-report measures, masking actual differences in peer support levels.

Several factors may explain the high level of peer support among medical students at Sultan Ageng Tirtayasa University. The relatively small number of students per cohort, approximately 50 individuals, allows for more intensive

interaction and closer peer relationships. In addition, learning methods such as Small Group Discussions also contribute to strengthening student relationships, as these methods encourage students to interact and discuss academic material and other topics (Sasmita & Rustika, 2015). Outside academic activities, student involvement in organizations provides further opportunities to build social networks and strengthen peer relationships. Furthermore, the perception of social support is known to be influenced by the size, closeness, and frequency of interaction within an individual's social network (Sarafino & Smith, 2011). Thus, the more frequent and meaningful student interactions, the greater the likelihood of forming strong peer support.

Fisher's exact test analysis found that peer support did not have a significant relationship with burnout among medical students ($p\text{-value} > 0.05$). This result suggests that the level of peer social support received does not directly influence students' tendency to experience burnout.

This finding may also be interpreted through the transactional model of stress and coping, as proposed by Lazarus and Folkman (1986), which conceptualizes stress as the result of an individual's cognitive appraisal of stressors and the coping strategies they employ. Even when peer support is present, it may not reduce burnout if students appraise academic

demands as overwhelming and rely more on internal coping mechanisms than on external support. This finding aligns with research by Apriliani (2023), which reported that peer support did not have a significant effect on burnout among university students. One possible explanation is that peer relationships may be more superficial and lack strong emotional bonds. Similarly, Najiha et al. (2023) found that peer support had no significant association with stress among medical students. These findings suggest that despite the availability of peer support, students may still experience high academic pressure, which is more strongly influenced by other factors such as academic competition or lack of support from other sources like family or faculty (Hidayat & Darmawanti, 2022).

In addition, research by Räisänen et al. (2020) indicated that peer support is not always the primary protective factor in reducing burnout. Burnout is more strongly influenced by individual factors such as self-regulation or psychological resilience. Medical students tend to rely more on independent study strategies and personal coping mechanisms to manage academic stress, rather than seeking peer support. This may be due to intense academic competition, the perception that others are also struggling with similar pressures, or concerns about appearing weak when

relying on others (Posselt & Lipson, 2016). Consequently, although peer support is available, not all students use it optimally as a coping resource for managing burnout.

Moreover, the quality of peer support may also influence these findings. Although students may report receiving peer support quantitatively, such support may not be functional or effective in alleviating academic stress (Hefner & Eisenberg, 2009). For example, if peers are also experiencing high levels of stress or burnout, they may be unable to provide adequate emotional or practical support.

On the other hand, social support may not always be perceived as helpful, particularly when the type of support does not match the individual's needs. For instance, a person may need emotional support but instead receives instrumental support, or vice versa, resulting in the assistance being perceived as ineffective or even psychologically burdensome (Sarafino & Smith, 2011). In the context of medical students, individuals may prefer to seek support from authority figures such as lecturers, mentors, or family members, who are perceived as more capable of providing relevant guidance or solutions (Kim et al., 2018). Therefore, peer support may not be the primary source students rely on when facing the heavy demands of medical education.

This study has several limitations. First, it employed a cross-sectional design, which does not allow for causal inference; only associative relationships can be analyzed. Second, the sample was limited to pre-clinical medical students at Sultan Ageng Tirtayasa University.

Conclusion

The analysis indicated no significant relationship between peer support and burnout. Nevertheless, implementing interventions to address burnout remains essential. It is recommended that institutions implement confidential academic and psychological support services, provide stress management training for both students and educators, and create a healthy, supportive learning environment to reduce the risk of burnout. Future research is advised with a broader sample, including students in the clinical phase, to gain a more comprehensive understanding of the issue.

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Association between HIV Clinical Stage and The Incidence of Opportunistic Infections among HIV/AIDS Patients at Banten Regional Hospital in 2020-2024

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ABSTRACT

Introduction: Untreated HIV conditions can progress to AIDS, which is the terminal phase of HIV infection, making the body more susceptible to other infections called opportunistic infections. Opportunistic infections are generally not dangerous for healthy people but can be fatal if they affect people with immunosuppression, such as HIV/AIDS patients.

Objective: This study aims to determine the relationship between HIV clinical stage and the incidence of opportunistic infections among HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Methods: This study is retrospective with a cross-sectional design. The sampling technique used was consecutive sampling, and the sample size calculation used the two-proportion comparison formula. The research data were analyzed univariate and bivariate using SPSS 26.0 Program. The research hypothesis was tested using the Chi-square statistical test and the Mantel-Haenszel Common Odds Ratio Estimate.

Results: The respondents in this study were 242 HIV/AIDS patients. The results of the analysis showed that the prevalence of HIV/AIDS at Banten Regional Hospital in 2020-2024 was 0.06%, with the highest proportion being stage I (50.83%), stage III (26.45%), stage IV (14.88%), and stage II (7.85%). The prevalence of opportunistic infections was 45.45%. Of the 110 patients identified as having opportunistic infections, 141 infections were obtained. Some patients had one type of opportunistic infection (81.82%), two types of opportunistic infections (11.82%), and $\geq$ three types of opportunistic infections (6.36%). The proportion of opportunistic infections based on etiology was dominated by bacterial infections (73.76%), parasitic infections (13.48%), fungal infections (6.38%), and viral infections (6.38%). The most common opportunistic infections suffered by HIV/AIDS patients at Banten Regional Hospital were tuberculosis (44.68%) and toxoplasmosis (9.93%).

Conclusions: Based on bivariate analysis, there was a significant relationship between the clinical stage of HIV and the incidence of opportunistic infections among HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Introduction

Human immunodeficiency virus or better known as HIV is a type of virus that

damages the human immune system, especially CD4⁺ T cells which are responsible for fighting various types of

infections. HIV conditions that are not managed properly can progress to Acquired Immunodeficiency Syndrome (AIDS) which is the terminal phase of HIV infection so that the body becomes more susceptible to various types of diseases and other infections. This definition is in line with the Indonesian Minister of Health Regulation Number 23 of 2022 concerning the Management of HIV, AIDS, and Sexually Transmitted Infections (STIs), namely HIV is a virus that damages a person's immune system and has the potential to cause AIDS.

Referring to data published by UNAIDS (2024) regarding the current global HIV/AIDS situation, it is known that in 2019, 1.7 million people were detected with new cases of HIV infection. Then, at the end of 2020, it was reported that 12 million people with HIV (PLHIV) were considered to be at high risk of dying from AIDS if they did not immediately receive antiretroviral therapy (ARV). Although effective treatment is currently available, in 2019, it was reported that more than 700,000 people with HIV/AIDS (PLWHA) died.

Indonesia has adopted the "Triple 95s" strategy, the 95-95-95 target in 2030 to prevent and control HIV. For the first 95, 95% of PLHIV are expected to know their status; then the second 95 is that 95% of PLHIV are undergoing antiretroviral (ARV) therapy, and the third 95 is that 95% of PLHIV undergoing ARV therapy are

expected to have experienced viral suppression. However, until December 2022, Indonesia was reported to have not been able to achieve this target because the first target, namely 95% of PLHIV can know their status, has only been achieved by 81%, which means that there are still some PLHIV who do not know their status as HIV/AIDS sufferers. Then, for the second 95%, only 41% have been achieved, which means that only half of PLHIV are receiving ARV therapy. As for the last 95%, only 19% have been achieved, meaning that only a tiny portion of PLHIV on ARV therapy has suppressed their viruses.

During the treatment process, it was found that only 51% of PLWHA survived ARV treatment, then 54% failed to follow up on ARV treatment, and 6% stopped ARV treatment. The other 40% died. Although the incidence of HIV has decreased in 2020, deaths due to HIV/AIDS have been reported to be increasing (Indonesian Ministry of Health, 2022). In the study by Laksemi et al. (2020), it was stated that the leading cause of disease severity and death due to HIV/AIDS in the world is due to opportunistic infections.

Opportunistic infections can be defined as diseases caused by viruses, parasites, bacteria, or fungi that affect a person with a weak immune system. These infections are generally not dangerous for healthy people with robust immune systems. However,

they can be very fatal and dangerous for people who are immunosuppressed or have weakened immune systems, such as those with HIV/AIDS. An increased risk of opportunistic infections in PLWHA can occur if patients do not undergo ARV treatment and antimicrobial prophylaxis. The emergence of opportunistic infections in PLWHA generally begins in the final or terminal stages. Most of these infections are severe and often cause death in infected individuals. However, research on opportunistic infections is still relatively rare, so researchers want to examine the incidence of opportunistic infections in PLWHA further (Putri et al., 2024).

Several factors, such as malnutrition, can influence the incidence of opportunistic infections in PLWHA, CD4+ T cell count, type of transmission risk factors for transmission, age, and gender. Opportunistic infections can differ from region to region depending on the country's geographic location. In the HIV case report by WHO (2023), it is known that the highest opportunistic infection in Brazil is tuberculosis (40%), in Mexico it is Cytomegalovirus (65-69%), and in America and Thailand it is *Pneumocystis carinii* pneumonia (64% and 26%) (Putri et al., 2024). In Indonesia, the incidence of opportunistic infections in PLWHA is reported to be quite diverse but is dominated

by candidiasis and tuberculosis (Arifputra et al., 2014).

Pradipta et al.'s (2020) research proves that the clinical stage of HIV has a significant relationship with the incidence of opportunistic bacterial infections, namely tuberculosis (TB). However, factors such as age, gender, CD4+ T cell levels, viral load, history of blood transfusion and injecting drug use, as well as the history of education, work, and sexual behavior, have no significant relationship with the incidence of opportunistic TB infections. Thus, it can be said that the clinical stage of HIV is one of the determinants of the incidence of opportunistic tuberculosis infections in PLWHA.

Based on data from the Banten Provincial Health Office (2023), the accumulation of HIV/AIDS case findings in Banten Province has exceeded the national estimate because it amounted to 17,243 people or 103% with a reported death rate of 1,513 people in the period 1998–2023. Referring to these figures, it is known that cumulatively, PLWHA, who are still alive in Banten Province, are 15,730 people or 93% of the total cases. Based on the systematic review that has been conducted, it is known that the high number of case findings and the number of deaths that occurred in PLWHA in Banten Province have never been studied until now. Therefore, this study aims to determine the

relationship between the clinical stage of HIV according to WHO and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Methods

This research is a retrospective study with a cross-sectional design that will simultaneously analyze the relationship between two variables. This study was conducted from October 2024 to February 2025 at Banten Regional Hospital.

The target population in this study was HIV/AIDS patients in Banten Province, but the accessible population was HIV/AIDS patients who checked themselves and received treatment at Banten Regional Hospital. The sample of this study was HIV/AIDS patients at Banten Regional Hospital who had medical records from January 2020 to December 2024 who met the selection criteria in the form of inclusion and exclusion criteria.

This study uses a consecutive sampling technique. According to Tjoanda and Halim (2021), the consecutive sampling technique tends to control selection bias compared to other non-probability sampling methods, considering that the samples selected in this sampling technique are determined based on the subjects' characteristics. This sampling method is quite popular in clinical

trials or other hospital research (hospital-based research).

The sample size was determined based on calculations using the Lemeshow (1997) formula to test the difference between two proportions. Based on the sample size calculation, the minimum sample size required was 78 medical records of HIV/AIDS patients.

Data management is carried out through the stages of collection, verification, editing, coding, data entry, and cleaning according to the variables. The data is then processed using the SPSS 26.0 Program. The data were analyzed using univariate and bivariate, and the results will be displayed in the form of frequency and percentage tables.

This research involves human subjects and requires ethical review from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Sultan Ageng Tirtayasa University. A letter of ethical clearance has been issued for this research, number 2/UN43.20/KEPK/2025, to ensure the safety, anonymity, and confidentiality of research subjects.

Results and Discussion

Banten Regional Hospital Profile

Banten Regional Hospital is located at Jalan Syekh Nawawi Al-Bantani, Banjarsari Village, Cipocok Jaya District, Serang City, Banten Province. This hospital

is a type B referral-level health facility that has various types of health services, such as general and emergency medical services, specialist and subspecialist medical services, specialist medical support services, dental and oral specialist services, nursing and obstetric services, and clinical also non-clinical support services. This hospital provides every health service organized by integrated work units/service units (Banten Regional Hospital, 2022).

In order to provide health services to HIV/AIDS patients, there is a VCT (Voluntary Counseling and Testing) Clinic called the Aglonema Clinic, which provides counseling and testing services (blood tests). At this clinic, patients will be given education related to HIV, how it is transmitted, how to prevent it, and how to treat sufferers. Experienced and skilled counselors will also give patients

counseling services. The general purpose of this counseling is to dig deeper into the history of transmission, risk factors for transmission, follow-up treatment, and provide motivation and full support to sufferers to live a healthier lifestyle so that they are more productive. One of the active roles of the Aglaonema Clinic in efforts to break the chain of HIV transmission is to provide antiretroviral therapy (ARV) services (Banten Regional Hospital, 2022).

Distribution of Subject Characteristics

After going through the data management process such as tabulation, verification, editing, coding, data entry, and cleaning, the number of research samples that met the inclusion and exclusion criteria was 242 patients. The following table is the distribution of the characteristics subjects of this study.

Table 1. Characteristics of HIV/AIDS patients at Banten Regional Hospital in 2020-2024

Characteristics	Frequency	
	N	%
1. Age Based on Risk Factors		
≤ 14 years	6	2.48
15-24 years	24	9.92
25-44 years	170	70.25
45-54 years	24	9.92
≥ 55 years	18	7.44
2. Age Based on diagnostic criteria		
≤ 14 years	6	2.48
> 14 years	236	97.52
3. Gender		

Men	180	74.38
Women	62	25.62
4. Non-infectious comorbidities		
Have comorbidities	36	14.88
Have no comorbidities	206	85.12
5. The region of origin		
Serang city	50	20.66
Serang Regency	85	35.12
Pandeglang Regency	43	17.77
Lebak Regency	14	5.79
Cilegon City	8	3.31
Tangerang Regency	15	6.20
Tangerang City	4	1.65
Outside Banten Province	23	9.50

Based on Table 1 above, it is known that HIV/AIDS patients at Banten Regional Hospital are mostly aged 25-44 years (70.25%). According to gender, men are more likely (74.38%) to suffer from HIV/AIDS than women (25.62%). Regarding comorbidity or accompanying disease conditions, only 14.88% of patients have non-infectious comorbidities such as malignancies (lymphoma, hemangioma, lymphangioma, and others), nephrotic syndrome, kidney stones, ureteral stones, chronic kidney failure, heart failure, diabetes melitus, iron deficiency anemia, hepatomegaly, splenomegaly, LBP, thyrotoxicosis, dyspepsia, ulcerative colitis, hemorrhoids, anal fistula, and epilepsy. Based on the region of origin, mostly come from Serang Regency (35.12%), Serang

City (20.66%), and Pandeglang Regency (17.77%).

Age is one of the factors related to the incidence of HIV/AIDS and opportunistic infections (Yuliyanasari, 2017; Amelia, 2016). In this study, age grouping is divided into age based on risk factors and age based on diagnostic criteria. The results of the data analysis showed that HIV/AIDS patients at Banten Regional Hospital were dominated by the productive age group 25-44 years, with 170 patients (70.25%). In comparison, the age group with the least (rare) HIV/AIDS was children aged ≤ 14 years with six patients (2.48%). The age group of adolescents and young adults (15-24 years) and retirement age (≥ 55 years) each showed a frequency of 24 patients (9.92%) and 18 patients (7.44%). The results of this study are in line with the Executive Report

on the Development of HIV/AIDS and Sexually Transmitted Infections (STIs) in Semester I of 2024 by the Ministry of Health, which revealed that the percentage of PLHIV in the January-June 2024 period mostly came from the productive age group of 25-49 years (63%), followed by the young adult age group of 20-24 years (19%), and the retirement age group ≥ 50 years (10%).

According to Arvinda (2024), HIV infections tend to increase and mainly occur in the productive age group because someone aged 30-39 years is assumed to have a financially stable job so that they can meet primary and tertiary needs such as a lifestyle that is at risk of HIV infection, while those in their 20s tend to be less aware of the risk of HIV/AIDS transmission from a free lifestyle so that they easily fall into unsafe risky sexual behavior and drug use with non-sterile needles.

As stated in the research of Ratha and Indrawan (2019), the large number of infections that occur at a young age is often associated with a lack of emotional maturity and attitudes that correlate with a lifestyle of free sex and drug abuse. The pathophysiology of HIV infection takes 5-10 years to develop into AIDS, so patients aged 30-39 years have likely been infected with HIV since they were in their late teens or early adulthood.

Gender is one of the patient identities that is often associated with the incidence of HIV/AIDS and opportunistic infections. Based on the results of the data analysis that has been carried out, it is known that male patients dominate people living with HIV/AIDS at Banten Regional Hospital at 74.38%, while the other 25.62% are female. This result is in line with the Executive Report on the Development of HIV/AIDS and STIs Semester I of 2024 by the Ministry of Health, that the percentage of PLHIV found in men is 71%, while in women it is 29%.

As stated in the study by Framasari et al. (2020), in 2012, an estimated 350,000 people in the Asia-Pacific region were infected with HIV, 64% of whom were men. Another study by Sutini et al. (2022) in East Java also revealed that the majority of AIDS patients were male (70.74%), included in the adult group (26–45 years) (62.65%), and worked as employees/laborers (46.08%).

Regarding the incidence of opportunistic infections, this study was dominated by men as many as 84 out of 110 patients (76.36%), while women were only 26 patients (23.64%). This result is similar to the study by Ratha and Indrawan (2019), which stated that the distribution of the proportion of AIDS patients by gender was higher in men (55.60%) than in women (44.40%). This finding is similar to the Ministry of Health Report (2017), which

stated that the proportion of men infected with HIV was twice of women. Research by Yusri et al. (2012) at RSUP H. Adam Malik Medan also supported this finding, observing that of the 163 patients infected through sexual transmission, 73% were male. The dominance of AIDS cases by male patients is often associated with a high-risk lifestyle, more likely to have many sexual partners, and a tendency to use drugs (Ratha and Indrawan, 2019). However, some studies do not find significant differences between male and female patients. The study by Damtie et al. (2013) showed a comparable prevalence of opportunistic infections among men (21.5%) and women (18.5%). The results of a cross-sectional study by Damtie et al. in Ethiopia, which had different results from the study in Indonesia, were influenced by the demographics of the research subjects, which women dominated compared to men, namely 216 of the 360 patients (60%) studied were women.

Comorbidity is one of the factors that has the potential to increase the risk of HIV infection and opportunistic infections in PLWHA because it is considered capable of significantly suppressing the immune system's function (Yuliyanasari, 2017). Comorbidities can be infectious or non-infectious diseases. Based on the results of the data analysis that has been carried out, it is known that most HIV/AIDS patients at

Banten Regional Hospital do not have non-infectious comorbidities (85.12%), and only a tiny number of patients have non-infectious comorbidities (14.88%). In this study, infectious comorbidities will be further explained as opportunistic infections. Infectious and non-infectious comorbidities generally influence each other because they are related to the mechanism of immunosuppression. This result is in line with the research of Sutini et al. (2022), which states that opportunistic infections occur due to immune suppression and are believed to be responsible for the development of patient morbidity and mortality. This statement is also supported by Woldegeorgis et al. (2023), that opportunistic infections remain the primary driver of morbidity and mortality in HIV/AIDS patients, causing much higher mortality observed in low and middle income countries.

When viewed from the region of origin, HIV/AIDS patients at Banten Regional Hospital mostly come from Serang Regency (35.12%), Serang City (20.66%), and Pandeglang Regency (17.77%). Based on the Cumulative Case Report of AIDS in Banten Province, which is included in the Banten Health Profile for 2023, it is stated that the number of new PLHIV receiving treatment in 2023 is 1,251 cases. The most cases are in South Tangerang City, Tangerang City, Serang Regency,

Tangerang Regency, Lebak Regency, Pandeglang Regency, Serang City, and the least is in Cilegon City. The variation of cases in Banten Regional Hospital, which tends to be dominated by patients from Serang Regency, Serang City, and Pandeglang Regency, occurs due to the geographical location and ease of access to Banten Regional Hospital as well as the status as an advanced referral hospital from these areas (Banten Provincial Health Service, 2023).

Univariate Analysis

HIV/AIDS Incidence in Outpatients and Inpatients

HIV/AIDS cases at Banten Regional Hospital are most often diagnosed in outpatient and inpatient services. Therefore, the prevalence of HIV/AIDS was analyzed univariately by comparing the accumulation of HIV-positive patients with the total number of patients undergoing outpatient and inpatient treatment at Banten Regional Hospital in 2020-2024.

Table 2. Prevalence of HIV/AIDS at Banten Regional Hospital for the Period January 2020 - December 2024

HIV cases	Frequency	
	N	%
Positive	242	0.06
Not confirmed	422.976	99.94
Total	423.218	100

Based on Table 2 above, it is known that the prevalence of HIV/AIDS at Banten Regional Hospital in the last 5 years was 0.06%. This value is comparable to the Executive Report on the Development of HIV/AIDS Cases and STIs by the Ministry of Health, where the prevalence of HIV/AIDS in Indonesia in 2020 was 0.059%, in 2021 was 0.05%, and in 2022 was 0.069%. In line with this report, Putri et al. (2024) also revealed that the prevalence of HIV/AIDS in Jambi Province in 2020 was 0.017%, in 2021 was 0.018%, and in 2022 was 0.021%. As stated in the research of Sutini et al. (2022), in the Asian continent, except for Thailand and North India, most of the HIV infection rates in the general population are <1%.

HIV/AIDS Proportion Based on Clinical Stage

The World Health Organization (WHO) has developed a system for grouping the severity of HIV/AIDS patients into four clinical stages. The system uses standard clinical parameters as the basis for medical decision-making for patients with HIV/AIDS that can be implemented simply by observing the patient's clinical condition, thus accommodating HIV testing in health facilities with limited or no access to laboratory testing.

HIV/AIDS cases can be classified according to the severity of clinical signs that appear in WHO clinical stages I to IV. More severe infections are considered to have a worse prognosis, and the severity depends on pathogen exposure, pathogen virulence, and immunological status (Sutini et al., 2022). In this study, clinical stages I and II are grouped as early stages, while clinical stages III and IV are grouped as advanced stages. This refers to the study of Weinberg and Kovarik (2010), that advanced HIV/AIDS disease is defined as HIV/AIDS clinical stage III or clinical stage IV or any clinical stage with a CD4+ T cell count <350 per mm^3 .

In areas with adequate resources, laboratory measurements such as CD4+ T cell counts and HIV viral load are commonly performed as diagnostic tools to determine the patient's level of immunosuppression and assess the rate of immune system damage. However, limited resources for testing the number of CD4+ T cell and HIV viral load in several places, including some areas in Banten Province, ultimately mean that doctors have to rely on clinical parameters when assessing patients.

In this study, the proportion of HIV/AIDS patients based on clinical stage was analyzed univariately by comparing the number of patients at each stage with the total number of HIV-positive patients in 2020-2024.

Table 3. Proportion of HIV/AIDS patients based on clinical stage

HIV Clinical Stage	Frequency	
	N	%
Stage I	123	50.83
Stage II	19	7.85
Stage III	64	26.45
Stage IV	36	14.88
Total	242	100

Based on Table 3 above, it is known that according to the clinical stage, HIV/AIDS patients at Banten Regional Hospital have the highest proportion of stage I (50.83%), followed by stage III (26.45%), then stage IV (14.88%), and the lowest proportion is stage II (7.85%). The results of this study are similar to the study by Damtie et al. (2013) because the majority of research subjects came from clinical stage I, while the fewest number of research subjects came from clinical stage IV.

Research conducted by Ratha and Indrawan (2019) showed different patient characteristics, where the most common clinical stage of HIV found in VCT BRSU Tabanan was actually at clinical stage III (57.1%), then clinical stage I (23.1%), and clinical stage II (11.1%). Clinical stage IV, as the highest HIV stage, was the least found (8.7%). The difference in the dominance of clinical stages that occurred between BRSU Tabanan Bali and Banten Regional Hospital is likely due to

differences in the level of awareness to avoid free sex and patient awareness to check themselves at the hospital. However, the main reason for the difference in characteristics is the conditions in the field, which shows that many HIV/AIDS patients at Banten Regional Hospital have just been diagnosed in pre-operative screening. Hence, the data listed in the patient's medical records still show clinical stage I.

According to Ratha and Indrawan (2019), clinical stages III and IV are more often found in hospitals because clinical symptoms have appeared, causing patients to visit a doctor, compared to clinical stage I, which is asymptomatic, or clinical stage II, which still has mild symptoms. The number of patients with clinical stage IV in this study was also not as many as patients with clinical stage III; this may be due to the progression of the disease in patients with clinical stage IV who had died before they had the chance to check themselves at the hospital. It is known that HIV/AIDS patients in the advanced stages are more likely to come to the doctor because various symptoms have appeared, so they decide to check themselves after an opportunistic infection occurs.

Occurrence of Opportunistic Infections in HIV/AIDS Patients

Opportunistic infections are the most common complications in HIV/AIDS

patients (Indonesian Ministry of Health, 2024). Therefore, the prevalence of opportunistic infections in HIV/AIDS patients was analyzed univariately by comparing the accumulation of patients suffering from opportunistic infections with the total number of patients confirmed positive for HIV/AIDS at Banten Regional Hospital in 2020-2024. The proportion of opportunistic infections based on the number of infections in each patient was also analyzed univariately, considering that each patient can have more than 1 type of opportunistic infection.

Table 4. Prevalence of opportunistic infections occurring in HIV/AIDS patients

Opportunistic Infections	Frequency	
	N	%
Yes	110	45.45
No	132	54.55
Total	242	100

Based on Table 4 above, from 242 patients confirmed positive for HIV, the prevalence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital was 45.45%.

Table 5. Proportion of opportunistic infections based on the number of infections in each HIV/AIDS patient

Number of Opportunistic Infections	Patient Frequency		Infections Frequency	
	N	%	N	%
1	90	81.82	90	63.83
2	13	11.82	26	18.44
≥ 3	7	6.36	25	17.73

Total	110	100	141	100
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Based on Table 5 above, 110 patients were identified as having opportunistic infections, with a total incidence of 141 infections. Patients who only had 1 type of opportunistic infection numbered 90 patients (81.82%), those with two types of opportunistic infections numbered 13 patients (11.82%), and with ≥ 3 types of opportunistic infections numbered seven patients (6.36%).

HIV/AIDS patients suffering from >1 type of opportunistic infection in this study were patients in advanced stages (clinical stages III and IV). This was proven by Mitiku et al. (2015), a study conducted in Debre Markos reported that patients with advanced stages (clinical stages III and IV) were more likely to develop opportunistic infections than patients with early stages (clinical stages I and II). In their study, Mitiku et al. reported that 185 opportunistic infections were successfully diagnosed in 172 patients, with 44.7% of patients suffering from single opportunistic infections, 3.1% having dual opportunistic infections, and 0.3% having triple opportunistic infections.

Some HIV/AIDS patients continue to suffer from opportunistic infections even though they have undergone antiretroviral therapy (ART) because the immunological and virological responses of each patient are different. This was stated by Thate et al.

(2023), that ART has increased the life expectancy of patients with HIV/AIDS because it can suppress the virus while increasing the number of CD4⁺ T cells. Some HIV/AIDS patients show inconsistent immuno-virological responses, such as viral load suppression. However, immunological failure still occurs, or vice versa: a good immunological response occurs, but virological failure occurs. Several studies have reported that HIV/AIDS patients who have an inconsistent immuno-virological response are considered to have a higher risk of developing AIDS and death (Thate et al., 2023). According to Woldegeorgis et al. (2023), although ART has been shown to stop damage to the immune system and prevent the development of HIV disease, studies show that opportunistic infections have not disappeared, either due to the disclosure of subclinical infections, drug toxicity and interactions, drug resistance, or high exposure to infectious agents.

Types of Opportunistic Infections in HIV/AIDS Patients

Various infectious agents, such as viruses, parasites, bacteria, and fungi, can cause opportunistic infections. In this study, the proportion of types of opportunistic infections in HIV/AIDS patients was analyzed univariately by comparing the number of patients based on the etiology of infection with the total number of

opportunistic infections experienced by HIV/AIDS patients at Banten Regional Hospital in 2020-2024.

Table 6. Proportion of opportunistic infections based on etiology

Types of Opportunistic Infections	Frequency	
	N	%
Virus	9	6.38
Parasite	19	13.48
Bacteria	104	73.76
Fungi	9	6.38
Total	141	100

Based on Table 6 above, it is known that according to its etiology, the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital showed the highest proportion of bacterial infections (73.76%), followed by parasitic infections (13.48%), and the lowest proportion with the same value was fungal and viral infections (6.38%).

Accumulated, the most common opportunistic infections suffered by HIV/AIDS patients at Banten Regional Hospital are tuberculosis (44.68%) and toxoplasmosis (9.93%). Based on the etiology, opportunistic viral infections that found are bronchitis, hepatitis B, herpes zoster, and other infections. Then, opportunistic parasitic infections other than toxoplasmosis are cryptosporidiosis and other parasitic infections. Then, opportunistic bacterial infections other than

tuberculosis are impetiginization of dermatosis, impetigo, syphilis, otitis media, gonorrhea, other dominant sexually transmitted infections, and other bacterial infections. The opportunistic fungal infections are oral candidiasis, cutaneous mucormycosis, seborrheic dermatitis, histoplasmosis, tinea corporis, cryptococcal meningitis, and other fungal infections.

These results are in line with the research of Lubis (2011) in Ratha and Indrawan (2019) that the most common opportunistic infections in AIDS patients at RSPI Sulianti Saroso were tuberculosis (67.4%). The second most common was toxoplasmosis (22.8%), then candidiasis (5.4%), chronic diarrhea (3.3%), and hepatitis C (1.1%). In contrast to the research results at Banten Regional Hospital and RSPI Sulianti Saroso, the pattern of opportunistic infections that occurred at Airlangga University Hospital was dominated by oral candidiasis (58.6%), followed by pulmonary tuberculosis (41.4%) and pneumonia (41.4%) (Asmarawati, 2018).

In the research of Mitiku et al. (2015), the most common opportunistic infections in HIV patients in Ethiopia are oropharyngeal candidiasis and tuberculosis, followed by central nervous system (CNS) disease, sepsis, *Pneumocystis carinii* pneumonia, bacterial pneumonia, Kaposi's sarcoma, and lymphoma. In general, milder infections such as herpes zoster and other skin

infections occur in the early stages (clinical stages I and II), while serious life-threatening infections such as CNS toxoplasmosis and cryptococcal meningitis occur in the advanced stages (clinical stages III and IV). Some life-threatening infections, such as pneumonia and tuberculosis, can occur in both the early and late stages.

Mycobacterium tuberculosis is a significant cause of morbidity and mortality among people living with HIV worldwide. In countries with a double burden of TB and HIV, the risk of developing tuberculosis in HIV/AIDS patients can be as high as 29-fold. According to WHO, in 2013, tuberculosis was the leading cause of death among people living with HIV (PLHIV).

The main factor behind the death of HIV patients with tuberculosis and vice versa is late diagnosis. The risk of tuberculosis is estimated to be 16–27 times greater in PLHIV compared to those without HIV infection. Meanwhile, autopsy studies among people who died of AIDS showed that almost half (46%) of them had

undetected TB before death (Indonesian Ministry of Health, 2020).

Looking at previous studies, opportunistic infections found at Banten Regional Hospital showed a different pattern of infection types compared to other hospitals. This proves there are differences in opportunistic infections between health centers because the pathogen patterns differ (Ratha and Indrawan, 2019). In addition, the role of Banten Regional Hospital as a referral center also contributes to the diversity of opportunistic infections because the demographics of its patients come from various cities/regencies.

Bivariate Analysis

This study was also analyzed bivariate to determine the relationship between the clinical stage of HIV and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital from January 2020 to December 2024 through the Chi-square statistical test. This study also assessed the odds ratio (OR) using the Mantel-Haenszel Common Odds Ratio Estimate in the SPSS 26.0 Program.

Table 7. Chi Square Test and Mantel-Haenszel Common Odds Ratio Estimate Test

Clinical Stage HIV	Opportunistic Infections				Total (n)	p-value	OR (95% CI)
	Yes		No				
	N	%	N	%			
Advanced Stage (Stage 3-4)	91	37.60	9	3.72	100	0.000 ^a	65.46 (28.31-151.34) ^b
Early Stage (Stage 1-2)	19	7.85	123	50.83	142		
Total	110	45.45	132	54.55	242		

Note: a) Chi Square Test and b) Mantel-Haenszel Common Odds Ratio Estimate

Based on Table 7 above, it is known that the results of the Chi-Square test analysis show a p-value of 0.000, considered significant because $p < 0.05$, which means that the hypothesis is accepted, that there is a significant relationship between the clinical stage of HIV and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital. These results are in line with the research of Dereje et al. (2019), which stated that there was a statistically significant difference in the incidence of opportunistic infections between WHO clinical stages, where the incidence of opportunistic infections was higher in stages III and IV compared to stages I and II with a p-value < 0.01 .

WHO clinical stage is the most significant predictor of opportunistic infections, according to Dereje et al. (2019). Patients infected with HIV in stages III and IV are more likely to develop opportunistic infections than patients in stages I and II. The most likely explanation for this is the

tendency of high viral load with low CD4+ T cells counts in HIV/AIDS patients in stages III or IV. A study in Nigeria showed that viral load and CD4+ T cells counts are major risk factors for opportunistic infections in HIV/AIDS patients.

The odds ratio (OR) analyzed using the Mantel-Haenszel Common Odds Ratio Estimate test in the table above shows a value of > 1 , namely 65.46 (95% CI; 28.31-151.34), which means that HIV/AIDS patients in advanced stages (clinical stages III-IV) have a risk of opportunistic infections 65.46 times greater than HIV/AIDS patients in early stages (clinical stages I-II). The common odds ratio lower bound and upper bound values show the upper and lower limits of the odds ratio, that advanced-stage HIV/AIDS patients have the slightest risk of 28.31 times and the most significant risk of 151.34 times experiencing opportunistic infections compared to early stage HIV/AIDS patients. The results of this analysis are in

line with the research of Mitiku et al. (2015), which revealed that patients in clinical stage IV are about four times (AOR = 3.856; 95% CI = 2.691-10.390) and patients in clinical stage III are about three times (AOR = 2.801, 95% CI = 1.958-7.165) more at risk of developing opportunistic infections compared to patients in stages I and II.

The immunological status of HIV/AIDS patients is generally assessed using a CD4+ T cells count. However, if this test is unavailable, the immunological status can be assessed by examining the patient's clinical signs, which are then grouped based on their clinical stage. According to Edathodu et al in Viyani and Kurniasari's (2025) study, it was stated that HIV patients in clinical stage I have a higher number of CD4+ T cells, while HIV/AIDS patients in stage IV have a lower number of CD4+ T cells. Advanced-stage HIV/AIDS patients have also been reported to tend to the number of CD4+ T cells to be 7 times lower than patients in the early stages (Melku et al., 2020). A low number of CD4+ T cells is known to increase the susceptibility to opportunistic infections as well as an increase in the clinical stage of HIV. The study by Viyani and Kurniasari (2025) concluded that there was a significant relationship between the number of CD4+ T cells and the clinical stage of HIV ($p < 0.001$). The number of CD4+ T cells

< 200 cells/mm³ is most often found in advanced-stage HIV/AIDS patients (clinical stages III and IV), while the number of CD4+ T lymphocytes > 500 cells/mm³ is generally found in early stage HIV patients.

Determining the clinical stage of HIV plays an essential role in the management of HIV patients, including the timing of initiation of therapy, changes in the type of therapy, administration of prophylactic therapy, and other interventions. Antiretroviral therapy (ARV) is the primary pharmacological therapy given to HIV/AIDS patients. Based on WHO recommendations, ARV therapy must be given to all patients who are confirmed positive for HIV regardless of the clinical stage or the number of CD4+ T cells they have. ARV therapy is reported to increase life expectancy and reduce the risk of opportunistic infections (Viyani and Kurniasari, 2025).

According to Melku et al. (2020), factors such as poor adherence to ARV therapy, immune status in the form of low initial CD4+ T cell count, low body mass index (underweight), advanced HIV stage, and short duration of ARV treatment can negatively impact immunological status and virologic suppression, resulting in failure of targeted treatment in HIV/AIDS patients.

Conclusion

The prevalence of HIV/AIDS at Banten Regional Hospital in 2020-2024 was 0.06%, with the highest proportion being stage I and stage III of all confirmed HIV/AIDS patients. The prevalence of opportunistic infections was 45.45%, with a total incidence of opportunistic infections is 141 types of infections. Opportunistic bacterial infections and opportunistic parasitic infections dominated the proportion of opportunistic infections based on etiology. The most common opportunistic infection was tuberculosis, and the second most common was toxoplasmosis. There was a significant relationship between the clinical stage of HIV and the incidence of opportunistic infections in HIV/AIDS patients at Banten Regional Hospital in 2020–2024.

Further research, including multicenter studies and the use of primary data sources (directly examining HIV/AIDS patients), is needed to produce more representative epidemiological data. The relevant government is also expected to support and facilitate hospitals in conducting better laboratory tests to definitively diagnose opportunistic infections, thus providing more adequate therapy. Furthermore, mass screening of populations at risk of HIV transmission in Banten Province is needed to reduce the prevalence of AIDS and

contribute to the government's HIV/AIDS response program in Indonesia.

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Farmers' Perceptions and Experiences on Family Nutrition Fulfillment and Mental Health Management in Rural Indonesia

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ARTICLE INFO	ABSTRACT
Keywords: Agricultural Workers; Diet; Family Nutrition; Mental Health; Stress Submitted: July 1st 2025 Reviewed: July 14th 2025 Accepted: Aug 19th 2025	Introduction: Farmers in rural Indonesia face challenges in maintaining nutritional adequacy and mental health due to economic instability, crop failure risks, and fluctuating commodity prices. Limited empirical evidence exists on how these factors intersect within farming communities. Objective: This study aims to explore farmers' perceptions and experiences regarding nutrition and mental health among farmer groups in three rural districts of Indonesia. Methods: A qualitative study was conducted with 36 farmers (aged 25–65 years; all males) from Kulonprogo, Boyolali, and Bogor, selected purposively. Data were collected through focus group discussions and analyzed using inductive qualitative content analysis based on Graneheim and Lundman's framework and processed with enVivo® software. Results: The main stressors identified were economic hardship, crop failure, debt and unstable commodity prices. Food decision-making was largely determined by wives, with children's needs prioritized. While severe food insecurity was not reported, mild to moderate food insecurity characterized by limited dietary diversity was common. Coping strategies included additional income-generating activities, utilizing homegrown produce, and borrowing from relatives or neighbors. Conclusions: Findings indicate a strong interrelation between food insecurity and mental distress among farmers. Interventions that integrate nutrition improvement and mental health support alongside economic and agricultural policy reforms are essential to enhance farmers' well-being.

Introduction

Mental health disorders are one of the most significant psychosocial hazards in today's society, given their widespread impact on individuals' quality of life, productivity, and physical health (Edú-Valsania et al., 2022; Salvagioni et al., 2017). Various studies have focused on

professional groups such as healthcare workers, teachers, and social workers, but research on the agricultural sector, particularly farmers in Indonesia, remains relatively limited (Hagen et al., 2021). In fact, workers in this sector face economic pressures, crop failure risks, climate change, and price uncertainty, which can

trigger stress and burnout. Indeed, individuals working in this sector often experience financial strain, exposure to climate variability, risks of crop loss, and market price instability all of which can contribute to heightened stress levels and emotional exhaustion (Irawan & Wicaksono, 2016).

In addition to psychosocial factors, dietary patterns and nutritional status are closely linked to mental health (Markus et al., 2021). In addition to psychosocial influences, dietary habits and nutritional status play a crucial role in maintaining mental health. Poor nutrition, such as low intake of omega-3 fatty acids, vitamins, and minerals, has been associated with an increased risk of depression, anxiety, and cognitive decline. Conversely, balanced diets rich in fruits, vegetables, whole grains, and lean proteins can enhance mood regulation and cognitive function by supporting neurotransmitter synthesis and reducing inflammation (O'Neil et al., 2019; Marx et al., 2021). Research in various countries shows that poor nutrition can increase the risk of depression, anxiety, and cognitive decline. But, most of these studies focus on high-income countries, so the availability of empirical evidence describing conditions in rural Indonesia, especially among farming communities, is still very limited. This needs to be further

investigated, because farmers are not only food producers, but also consumers who are potentially vulnerable to household food insecurity.

The selection of research locations in Kulonprogo, Bogor, and Boyolali was based on differences in socioeconomic characteristics, types of agricultural commodities, and varying levels of vulnerability to food crises and environmental pressures. So, this study aims to explore farmers' perceptions and experiences regarding nutrition and mental health in farmer communities. It is hoped that the results of this study will be useful for creating programs to help achieve quality nutrition and prevent mental health problems in farmers.

Methods

Qualitative study data were obtained through Focus Group Discussions (FGD) conducted from March to May 2024 in Kulonprogo, Boyolali, and Bogor, exploring the perceptions and experiences of 36 farmers using a content analysis approach based on the framework of Graneheim and Lundman (2004). This approach was chosen because it can systematically identify the meaning contained in participants' statements, maintain context, and allow findings to emerge naturally from the data. The

analysis was conducted inductively, so that themes and categories were developed directly from field data without using a strict initial theoretical framework.

Respondents were farmers who were selected purposively based on the following criteria: being a farmer (farmers, livestock breeders, fish cultivators, fishermen, and communities around forests); residing in the research location; and being willing to provide information related to perceptions and experiences regarding eating patterns, diet, and psychological stress experiences, particularly burnout. All respondents were males, with age range of 25–65 years.

The analysis process was carried out in the following stages: (1) verbatim transcription of the FGD recordings, (2) repeated reading to gain a comprehensive understanding, (3) identification of meaning units relevant to the research focus, (4) condensation of meaning units into shorter narratives without changing the meaning, (5) coding each meaning unit, (6) grouping codes into subthemes, then main themes, and (7) verifying themes by the research team to enhance credibility. Data management was carried out using enVivo® software, while data validity was strengthened through member checking with several participants and peer debriefing among researchers. The research was conducted with ethical approval

obtained from the Ethics Committee of IPB University, certificate number 1190/IT3.KEPMSM-IPB/SK/2024, and informed consent provided by all respondents.

Results and Discussion

Nutrition and Food Security

Perceptions regarding healthy food

The following are several quotes that show respondents' understanding of healthy food:

"Food that is suitable for cooking, fresh vegetables, fresh fish, does not contain formaldehyde, reduce instant food"

(FGD1, R2, Male, KP)

"Clean, hygienic food should not use pesticides for vegetables, but in Indonesia there are no regulations. Organic food, not overcooked. I used to be a former chef."

(FGD 3, R1, Male, BGR)

The theme of healthy food, namely four healthy five perfect foods, appears in Boyolali and Bogor but not in Kulon Progo. In Kulon Progo, the theme of fresh food or food without preservatives was predominant. In Boyolali, the emphasis was on unflavoured food, while in Bogor, the theme of clean or hygienic food free of pesticides emerged. These findings align

with the World Health Organization's (WHO) in 2020 statement encouraging people to eat a variety of fresh and minimally processed foods every day to maximize nutrition and support immunity (WHO, 2020). The theme of balanced nutritious food did not appear in data collection.

"Basically, four are healthy, five are perfect, namely there are staple foods, side dishes, vegetables, fruit and milk"
(FGD 2, R2, Male, BY)

Practices Related to Diet

In the three data collection locations, respondents very rarely eat out or eat in restaurants, generally only once a month.

"When I go to sea, I bring at least 6 pieces of bread, water and cigarettes, I rarely bring food, I don't have time in the morning..."
(FGD 1, R1, Male, KP)

The definition of eating out varied significantly across the locations. Eating together was rarely practiced and mostly occurred during breakfast or dinner, as many men ate lunch at work sites. "Eating out" was not associated with restaurants but with eating in the fields or gardens using food brought from home. These practices

reflect the working conditions and routines of agricultural families and are consistent with findings from previous studies (Siregar and Mukhsinuddin, 2020).

In all study locations, the habit of eating together is also rarely done, eating together is sometimes done in the morning or evening, never at lunch.

"Yes, it's rare, they work in other ways, some work on projects, some are farmers, eating together is very rare, yes, they don't eat together, they mostly eat out. In the evening and afternoon, eat at home, in the morning or afternoon, at work"
(FGD 2, R3, Male, BY)

Menu, Allocation of Food and Side Dishes

The types of food consumed by adult respondents are more or less similar, namely the main staple food in the form of rice accompanied by vegetables, these two types of food are always available.

"What is often consumed is egg tofu tempeh; vegetables are rare, nowadays farmers rarely eat vegetables, I myself never because they don't cook them; Eating with children is different, if the child likes fish, meat, maybe chicken or eggs, so if vegetables are rare, eggs, chicken are the most common, if beef is the most, if there is Eid al-Adha;"

(FGD 2, R2, Male, BY)

Menu planning was generally the responsibility of wives, and husbands respected their decisions. Food was prioritized for children, reflecting traditional gender roles and maternal focus on child nutrition (Aditianti *et al.* 2016). An understanding of a good children's diet emerged in Boyolali, where it was stated that children's food should include sufficient protein from eggs, fish, tempeh, tofu, and green beans. However, fruit consumption was very rare in all locations due to purchasing power, habit, and lack of knowledge (French *et al.*, 2019).

The limited consumption of fruits and the general reliance on simple, repetitive meals suggest a gap in understanding the concept of balanced nutrition. According to the Ministry of Health of Indonesia guidelines, balanced nutrition not only includes adequate protein, but also sufficient intake of vegetables, fruits, carbohydrates, and healthy fats (Kemenkes, 2014). The low intake of fruits and the tendency to consume monotonous, simple meals indicate a lack of awareness regarding the principles of balanced nutrition. As outlined by the Indonesian Ministry of Health, a balanced diet should consist not only of adequate protein but also include sufficient portions of vegetables,

fruits, carbohydrates, and healthy fats to maintain optimal health (Ministry of Health of the Republic of Indonesia, 2021). The application of “*gizi seimbang*” emphasizes dietary diversity, appropriate portion sizes, regular physical activity, and clean living habits.

Experience of Food Insecurity

In Bogor, the respondent group did not experience severe food insecurity, but it was still found in farming families who were not members of farmer groups. All respondents stated that they had never experienced severe food insecurity, as defined by the Household Food Insecurity Access Scale (HFIAS), which indicates experiencing hunger or sleeping with a hungry stomach due to a lack of food (Salman *et al.*, 2023).

"It's rare, it's not that I haven't slept yet because I don't have any, but I've slept because I haven't eaten...."

(FGD 2, R2, Male, BY)

"So far, if you are part of a serious farmer group, no one has gone so far as not to eat, but if you are outside the farmer group, you can still hear about it."

(FGD 3, R2, Male, BGR)

Coping Mechanisms for Severe Food Insecurity

Mechanisms for fulfilling food needs that emerged from discussions with respondents include; the wife's involvement in earning a living, food produced from her own garden, consistent adoption of a simple diet and borrowing from relatives or neighbors. These coping mechanisms are common in rural settings facing economic challenges (Gultom and Harianto, 2021).

"Fulfilling the needs of the family is for the head of the family, the father. But yes, not just the father, the mother also came along..."

(FGD 1, R2, Male, KP)

"Here you get your own rice from the rice fields, you also get your own vegetables from the garden, the most you buy is chicken, cut if you want, with spices, like garlic from the market, you get your own fish."

(FGD 1, R3, Male, KP)

"Where I eat, it's a need for energy, even if you have a lot of money, you just eat normally. Just to be safe, if you don't have any money, then you'll have debt. There are a lot of workers here, there are two or three farmers, if you're a farmer, right?..."

(FGD 2, R2, Male, BY)

The role of traditional knowledge and practices in promoting health and nutrition was also evident. Many respondents relied on traditional dietary practices and locally sourced ingredients, which are often nutrient-rich and beneficial for health. These practices were more pronounced in Kulon Progo, where there was a strong emphasis on using homegrown vegetables and herbs (Abdoellah *et al.*, 2020).

Experience of Mild to Moderate Food Insecurity

Based on the findings from focus group discussions with respondents, the three locations experienced mild to moderate food insecurity.

"Well, eating is eating, but for meeting nutritional needs, it's lacking. A diet doesn't have to be nutritious; what's important is that it's filling and healthy"

(FGD 2, R4, Male, BY)

Mild to moderate food insecurity was reflected in the inability to access desired food and a monotonous eating pattern, particularly in Boyolali and Bogor. This is consistent with other studies showing that economic constraints often lead to a lack of dietary diversity (Grimaccia and Naccarato, 2019). Families with stable incomes or additional sources of revenue, such as small

businesses or livestock, were better able to maintain diverse and nutritious diets.

Table 1. Summary of Nutrition and Food Security Themes

No	Topic	Theme and Findings	Location
1	Healthy food	Fresh food without preservatives	KP
		Food without flavour	BY
		Hygienic food free of pesticides	BGR
		"4 healthy 5 perfect" foods	BY, BGR
2	Eat together and eat out	Rarely done. Eating out is eating at work, gardens, rice fields	KP, BY, BGR
3	Determining the menu and food allocation	In the hands of wife and children come first	KP, BY, BGR
4	Severe food insecurity	Never experience hunger or sleep hungry because there is no food	KP, BY, BGR
5	Mild and moderate food insecurity	Ever experienced not being able to eat the foods you want or nutritious foods	KP, BY, BGR
6	Coping mechanism for severe food insecurity	Wife's involvement in earning a living	KP, BGR
		Consistently simple meals even during harvest season	BY, BGR
		Debts to relatives, neighbors or shops	BY, BGR
		Utilize your own agricultural and garden products	KP
7	Consume vegetables and fruit	Consuming vegetables frequently but consuming fruit rarely	KP, BY, BGR

Mental Health

Stress Experiences and Their Triggers

Respondents in all three locations stated that they had experienced stress with various triggers. Economic hardship was the dominant source of stress among farmers, followed by family concerns and environmental factors.

"When it's quiet, it's empty, there aren't any fish, when it's fast, the current is fast, when farmers are planting, it continues to flood, so there's no produce..."

(FGD 1, R3, Male, KP)

"Stress is pressure, but there are other types of stress, there is stress thinking about children, stress thinking about work, maybe a failed panel can cause stress, if

*you spend a lot and then the harvest
fails....”*

(FGD 2, R2, Male, BY)

"As for burn out, I experienced chronic stress. Once in my pond there were 8 ponds filled with catfish, at that time when the flood was big, my pond all collapsed, all my catfish disappeared, so that's when I experienced stress... "That's up to 7 days, I rarely slept, only 2 or 3 hours at most, if I could sleep at all."

(FGD 2, R1, Male, BY)

"During PMK (Hoof and Mouth Disease), the cows had already been sold and then they got sick, on the 19th they were going to sacrifice, there were 27 cows that hadn't been sold yet, I had a headache, sir, so I couldn't sleep."

(FGD 2, R3, Male, BY)

"For me, one thing that influences stress is if I don't have money. If the stress trigger is mainly in the family environment first, then environmental triggers, if it's in the family the main trigger... As for the weather, for coffee farmers, if there's high rainfall and wind, there's fog, it has an impact, "It all fell out bro, it was a crop failure, that's what stresses farmers, their income is reduced, that was last year."

(FGD 3, R1, Male, BGR)

Environmental factors such as climate change, erratic rainfall, and flooding negatively impacted agricultural productivity, further contributing to farmer stress. These challenges reduced crop yields and complicated food availability, particularly in areas with fragile ecosystems. Such environmental stressors amplified the psychological burden already faced by farming communities (Yang *et al.* 2024).

Coping Mechanism

In the three study locations, the coping mechanism included seeking additional work to solve problems and diverting attention, as well as relying on family support. This finding aligns with literature on stress and coping among agricultural workers (Yazd *et al.*, 2019).

"If I respond like this, if I want to do another job then it won't work, yes, whether we like it or not, that's what we'll do, no matter how much the results are, the important thing is that we work instead of sitting at home and it will cause more stress."

(FGD 2, R2, Male, BY)

"Drinking coffee, smoking, gathering together with friends, going to the barn...."

(FGD 2, R3, Male, BY)

"Actually, personally, we are okay with it, just surrender, because this is not our will, this is because of nature, so we have a lot to be grateful for, that's the point. Moreover, if we sleep more, bro, it will become even more stressful, we are better off doing positive things that produce results... Usually here we often get together, if there is a problem, we look for a solution together."

(FGD 3, R1, Male, BGR)

Social support and community networks were important factors in managing stress and maintaining mental well-being among farmers. In rural areas, strong social ties—such as group gatherings, cooperative work, and informal peer support—helped farmers cope with economic and environmental stressors. This reinforces the idea that social capital plays a buffering role against psychological pressure in agricultural communities (Cassidy and Carswell, 2024).

Hopes

Regarding future hopes related to efforts to reduce stress among farmers, because the root of the problem is often harvesting failure and selling prices that do not match the "labor and capital investment" that has been spent, the hopes that emerge from

respondents are mostly related to increasing farmer welfare. Especially in terms of income and ensuring price stability for agricultural or plantation products. In addition, it is also hoped that there will be a policy that regulates the selling prices to stabilize the price of products and farmers get profits that match the labor and capital investment that has been spent (Ganindha and Sukarmi, 2020).

"The hope is, firstly, the government must be consistent with what is promised, make the highest retail prices, so that they are willing to buy farmers' products, then secondly, fertilizer subsidy should not be reduced, then if possible, there will be outreach, the aid will be delivered correctly so that it reaches its destination..."

(FGD 2, R2, Male, BY)

"For me, the most important thing is stable prices, good production, if I am providing farmer extension treatment, post-harvest processes to down streaming, don't combine them with the same person, it won't be good, this is also a dilemma in farmers' associations in Java, even at the national level."

(FGD 3, R1, Male, BGR)

Table 2. Summary of Mental Health Themes

No	Topic	Theme and Findings	Location
1	Stress experiences and their triggers	Crop failure	KP, BY, BGR
		Weather	KP, BY, BGR
		Debt charged	KP, BGR
		School needs	BY, BGR
		Failed to sell livestock products	BY
		Invitation needs	BGR
2	Coping Mechanism	Divert with other activities	KP, BY, BGR
		Support system of family and friends	KP, BY, BGR
3	Hopes	Improving farmers' welfare with fertilizer assistance and price policies	BY
		Prices stabilized and labor wages increased	BGR

Intersection of Nutrition and Mental Health

To clarify the relationship between food security and mental health, the results of this qualitative analysis are visualized in the form of a thematic diagram with the aim of showing the relationship between levels of food insecurity, triggers of mental distress, and the structural factors that influence them.

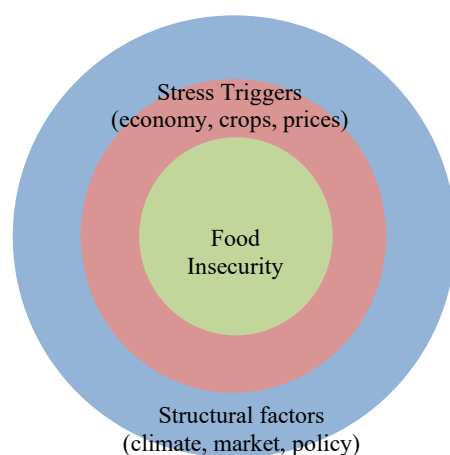


Figure 1. Thematic Diagram: The Relationship Between Food Insecurity and Mental Health

This diagram shows that food insecurity is at the heart of the problem, directly intersecting with various stressors such as crop failure, price fluctuations, and household economic pressures. Structural factors such as climate conditions, markets, and agricultural policies reinforce these impacts. These findings suggest that interventions to improve food security have the potential to positively impact the psychological burden on farming communities.

The intersection between nutrition and mental health emerged as a significant theme across the study locations. Poor nutrition and food insecurity were closely linked to increased stress levels and poorer mental health outcomes. Respondents who experienced mild to moderate food insecurity often reported higher levels of stress and anxiety, primarily due to the

uncertainty and struggle to meet daily food needs (Maynard *et al.*, 2018). Theoretically, these findings are consistent with Maslow's hierarchy of needs framework, which places physiological needs, including food, at the base of the pyramid of human needs. When these basic needs are disrupted, the achievement of higher-level needs such as safety, social affiliation, and self-actualization becomes hampered, ultimately increasing the risk of mental distress (Kenrick *et al.*, 2010).

Conversely, those with better access to nutritious food reported lower stress levels and better overall mental health. This highlights the role of adequate nutrition in supporting mental well-being, suggesting that efforts to improve food security could have positive mental health benefits (Kris-Etherton *et al.*, 2021). From the perspective of Social Determinants of Health (WHO), food security is one of the structural determinants that directly affects physical and mental health. Adequate access to nutritious food not only determines nutritional status, but also contributes to the psychosocial stability of individuals and communities, so that reducing food insecurity can be an important strategy in efforts to improve public mental health (WHO, 2023).

In addition to large-scale interventions to improve food security, educational

initiatives are also needed as a more feasible and sustainable strategic measure. Educational initiatives aimed at improving nutrition also had mental health benefits. Increased awareness and knowledge about healthy eating and sustainable practices not only improved dietary habits but also empowered individuals, reducing feelings of helplessness and stress (Grajek *et al.*, 2022).

In summary, addressing food insecurity and improving nutritional practices can have far-reaching benefits for mental health. Conversely, efforts to support mental health through community and educational programs can enhance food security, creating a positive feedback loop that supports overall well-being in rural communities.

Conclusion

The responsibility for food expenses typically lies with the father or husband in farming families, while the mother usually decides on the daily menu. Food is prioritized for children first, followed by the parents. The experience of severe food insecurity was never experienced, where the farmer family has never experienced hunger or gone to bed hungry because there was no food, but has not been able to provide a nutritionally balanced diet. In addition to agricultural problems such as crop failure

and unpredictable weather, the economy is the biggest trigger of stress in farmers. Coping stress that farmers do in dealing with this problem is trying to find other income opportunities and asking for help from family or neighbors. It is suggested that the government pay attention to the welfare of farming families both in terms of nutrition and mental health with clearly defined policies related to agriculture and other assistance programs for farming families.

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Characteristics of Bronchial Asthma Patients at The Pulmonary Polyclinic Dr. H. Chasan Boesoirie Ternate Hospital

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ARTICLE INFO	ABSTRACT
Keywords: Bronchial, Asthma, Patients, Pulmonary Submitted: June 26th 2025 Reviewed: July 19th 2025 Accepted: Sept 5th 2025	Introduction: Bronchial asthma is a reversible obstructive airway disease characterized by lung inflammation and airway hypersensitivity. In 2018, the incidence of bronchial asthma in North Maluku Province reached 4,723 cases. Patient characteristics are thought to contribute to the occurrence of bronchial asthma. Objective: This study aimed to identify the characteristics of bronchial asthma patients at the Pulmonary Polyclinic of Dr. H. Chasan Boesoirie Hospital in Ternate. Methods: This research used a retrospective descriptive design with a cross-sectional approach. The variables studied included asthma severity, gender, age, occupation, and education level. Secondary data were collected from medical records at Dr. H. Chasan Boesoirie Hospital between 2019 and 2022. Results: Among the 40 samples, most patients had moderate persistent asthma (47.5%). The majority were female (70%), aged 26–45 years (42.5%), self-employed (55%), and had completed high school education (70%). Conclusions: The study concludes that bronchial asthma at Dr. H. Chasan Boesoirie Hospital in Ternate is more prevalent among females, individuals aged 26–45 years, those who are self-employed, and those with a high school education level. Moderate persistent asthma was the most common severity observed. These results highlight the importance of considering demographic and occupational characteristics in the management and prevention of bronchial asthma.

Introduction

Bronchial asthma is included in the disease of obstruction of the respiratory tract in the lungs, which is reversible and characterized by inflammation of the respiratory tract and increased response of the airways to various stimuli (hypersensitivity). Bronchial asthma can affect people of all ages with symptoms that vary greatly from one person to another.

Obstructions that occur in the airway show common clinical symptoms, including coughing, wheezing, and shortness of breath. Bronchial asthma can also occur due to various factors such as a history of dust allergy, cold allergy, pet fur allergy, smoking, and so on (Ginanjari, 2014).

The Global Initiative for Asthma (GINA) divides asthma into three types, in the form of asthma controlled, partially

controlled, uncontrolled. Based on the type of degree, bronchial asthma is divided into four parts, including intermittent asthma, mild persistent asthma, moderate persistent asthma, and severe persistent asthma (GINA, 2021).

The World Health Organization (WHO) stated that the incidence of bronchial asthma in 2019 in the world amounted to 235 million people, with the mortality rate exceeding 80% in developing countries. WHO projects that bronchial asthma cases by 2025 will reach 300 million patients (GINA, 2021). In 2018, Basic Health Research (Riskesdas) reported that around 1 million people in Indonesia were living with bronchial asthma. The incidence was higher in women than in men, and based on place of residence, the percentage of bronchial asthma cases was higher in urban areas. The incidence of bronchial asthma in North Maluku Province in 2018 according to the Riskesdas report reached 4,723 people (Balitbangkes, 2018).

Research conducted by Dwiyana, Eryati, and Irvan in 2017, at Dr. M. Djamil Padang Hospital, found that bronchial asthma was 70.9% found in women. Based on the age of the patient, the most occurrence of bronchial asthma was found at an average age of 46 years. Based on the degree of severity, it was found that the highest incidence rate in moderate persistent

asthma was 64% (Roselin, 2017). Fadhilah, et al., who conducted research at the Harum Melati Clinic and Wisma Rini Hospital in Pringsewu Regency, explained that the majority of asthma patients work as self-employed, namely 71 people (56.3%). The results of the study based on education, the highest number of bronchial asthma patients are high school students, totaling 49 people (38.9%). Findings from the study indicated that individuals with a high school education comprised the largest group of bronchial asthma patients, accounting for nearly 39% of the total cases (Putri et al., 2017). A study conducted in Pringsewu Regency reported that most asthma patients were self-employed, accounting for over half of the participants, while individuals with a high school education represented the largest proportion of bronchial asthma cases (Rahmawati et al., 2017).

Based on the background and literature review, bronchial asthma is known to have a significant impact on public health. However, there is a lack of research data regarding the characteristics of bronchial asthma patients in North Maluku Province. Therefore, this study aims to describe the Characteristics of Bronchial Asthma Patients at the Pulmonary Polyclinic of Dr. H. Chasan Boesoirie Ternate Hospital.

Methods

This research employed a retrospective descriptive design with a cross-sectional approach. Data for this study were collected from Dr. H. Chasan Boesoirie Ternate Hospital from May to July 2023.

In this study, the population comprised all bronchial asthma patients at pulmonary polyclinic. A total sampling technique was applied, resulting in 40 samples that met the inclusion criteria. Source of data was secondary, retrieved from medical records of the selected patients.

Data analysis was performed using univariate analysis to present the frequency and percentage distributions of all variables studied. Ethical aspects of the research were strictly upheld. Throughout this study, strict measures were implemented to safeguard patient confidentiality, including the omission of full patient names and the use of only initials and medical record numbers for identification. Additionally, prior to initiating data collection, the research team secured formal authorization from the hospital administration, supported by an official research permit issued by the affiliated institution

Results and Discussion

Research samples obtained from the results of data collection in the medical records section Dr. H. Chasan Boesoirie Ternate Regional Hospital in 2019–2022. There were 6 cases in 2019, 1 case in 2020, 20 cases in 2021, 13 cases in 2022. Data has been collected consists of various variables which are then presented in the following table. The characteristics of the patients in the study included the degree of bronchial asthma, gender, age, occupation, and education. Evaluation in this study is described descriptively in the form of a presentation. The characteristics of Bronchial Asthma patients at Dr. H. Chasan Boesoirie Ternate Hospital based on the degree of bronchial asthma, gender, age, occupation, and education can be observed in the table.

Table 1. Characteristics based on the degree of bronchial asthma

Degree of Bronchial Asthma	Frequency (n)	Percentage (%)
Mild Persistent	13	32,5
Moderate Persistent	19	47,5
Intermittent Persistent	5	12,5
Weight Persistent	3	7,5
Total	40	100

Source: original research

Based on table 1, the characteristics based on the degree of bronchial asthma were obtained, the most were patients who had a moderate degree of persistent asthma

as many as 19 patients (47.5%). Meanwhile, the least degree of bronchial asthma was patients who had intermittent asthma degrees as many as 3 patients (7.5%).

Based on table 2, characteristics were obtained based on age with the degree of bronchial asthma, namely teenagers patients (12-25 years) suffered the most from mild persistent bronchial asthma as

many as 4 patients (10%), adults (26-45 years) and the elderly (46-64 years) more suffered from moderate persistent bronchial asthma as many as 9 patients (22.5%) and 7 patients (17.5%). Meanwhile, patients who are senior (>65 years old) have the most mild persistent bronchial asthma as many as 2 patients (5%).

Table 2. Distribution of Patient Frequency Based on Age Characteristics with Degree of Asthma

Age	Degree of Bronchial Asthma				Total
	Persistent Mild	Persistent Moderate	Persistent Weight	Persistent Intermittent	
Teenagers (12-25 years)	4	2	0	0	6
Adults (26-45 years)	5	9	2	1	17
Elderly (46-65 years old)	2	7	3	2	14
Senior (>65 years)	2	1	0	0	3
Total	13	19	5	3	40

Source: original research

Based on Table 3, the gender distribution of bronchial asthma patients showed a predominance of women, with 28 patients (70%), while male patients accounted for 12 individuals (30%). Regarding age characteristics, the highest proportion was found in adults (26–45 years) with 17 patients (42.5%), followed by elderly (46–65 years) with 14 patients (35%). The smallest group consisted of seniors (>65 years) with only 3 patients (7.5%). In terms of occupation, most patients were self-employed (22 patients, 55%), while no patients were found working as fishermen,

farmers, or police/military personnel. The majority of patients in the education category had completed high school, totaling 28 individuals (70%). Meanwhile, patients who did not go to school were not found.

Based on the results of the study, these results are in line with the research carried out by Pratama et al with a sample of 604 outpatients of the Poly Asma Hospital which totals 604 people, with 272 people with moderate persistent asthma (45%). The difference was found in a study conducted by Khoman at the Asthma Polytechnic of

Haji Adam Malik Hospital Medan with 50 subjects, the majority of whom were intermittent asthma patients, namely 18 people (39.1%). This is because patients come to the polyclinic with asthma symptoms experienced in a mild to moderate state. Where the symptoms of mild to moderate asthma patients last every day and disrupt activity and sleep and require bronchodilators every day.

Table 3. Frequency distribution of bronchial asthma patients by gender, age, occupation, education

Sample Characteristics	Frequency (n)	Percentage (%)
Gender		
Man	12	30
Woman	28	70
Age		
Teenagers (12-25 years)	6	15
Adults (26-45 years)	17	42.5
Elderly (46-65 years old)	14	35
Senior (>65 years)	3	7.5
Work		
PNS	10	25
Fisherman	0	0
Farmer	0	0
Police/TNI	0	0
Housewife	8	20
Self employed	22	55

Sample Characteristics	Frequency (n)	Percentage (%)
Education		
No School	0	0
Elementary School	4	10
Junior High School	2	5
Senior High School	28	70
College	6	15

Source: original research

According to the study findings, asthma cases were predominantly observed among adults aged 26–45 years and elderly aged 46–64 years. This aligns with previous data showing that asthma prevalence is highest among individuals aged 18–64 years, with an estimated rate of 50 cases per 1,000 population (National Heart, Lung, and Blood Institute, 2009). Similarly, recent studies have reported that asthma commonly affects adults in their productive age group due to continuous exposure to environmental triggers and occupational risk factors (To et al., 2021; Dharmage et al., 2019). The respiratory system under normal conditions achieves maximum growth and development up to the age range of 20-25 years. After passing that age, lung function will decline rapidly. This causes a lower change in total compliance, a decrease in the capacity of a given vital capacity, a decrease in the volume of forced

expiration in one minute, an increase in residual volume, an increase in the ventilation of the dead chamber, an increase in perfusion, an increase in the partial pressure of the arteries of the CO₂ does not change, the partial pressure of the O₂ arteries is lower, the maximum oxygen consumption decreases, the lung loss chamber that exerts an effect on atrial oxygen without affecting carbon Dioxide. With advancing age, the sensitivity to dyspnea tends to decline, and the physiological responses to hypoxia and hypercapnia become blunted, increasing the risk of ventilatory failure in elderly (LoMauro & Aliverti, 2018).

Another study said that asthma that affects adults becomes more dominant when it is inherited in women who are obese, non-atopic, have smoked, or are white. The prevalence over time of disease onset in adults was greater in subjects with non-atopic asthma than in atopic asthma in both sexes. In addition, asthma that affects adults has a tremendous difference in risk factors related to sex (Akshay Sood, 2013).

The results were obtained that most respondents were female. These results are in accordance with the research carried out by Afiani et al regarding "Factors Affecting the Quality of Life of Asthma Patients in the Pontianak Lung Disease Treatment Unit" which states that there are more female

respondents with a percentage of 76.7%. Another study that had the same results was a study conducted by Andriani et al on "Overview of the Characteristics of the Control Level of Asthma Patients Based on BMI in the Pulmonary Poly of RSUP. Dr. M. Djamil Padang in 2016" where women are more inclined to be asthma patients. than men with a percentage of 50.8%. This is because women experience menstruation, pregnancy and menopause which are the cause of changes in the amount of estrogen which results in an inflammatory response as a trigger for the appearance of asthma (Chowdhury, 2021). It is theoretically that airway epithelial cells, lymphocytes, eosinophils and mast cells have the ability to express estrogen receptors that have an important role in the mechanism of asthma occurrence (Natalia, 2022). Another cause is because the diameter of the respiratory tract and lung function in men are larger than in women. The resistance of the respiratory tract is inversely proportional to 4 times the diameter of the respiratory tract, so the resistance of the airway increases when the size of the airway diameter is small. In addition, the influence of genetic polymorphisms that are only found in women, such as cyclooxygenase-2-765C. With this genetic polymorphism, the capacity of monocytes can increase with the aim of creating prostaglandins that are able

to aggravate inflammation that occurs in the respiratory tract (Chowdhury, 2021).

Based on the results of the study, characteristics were obtained based on age, most patients were adults (26-45 years). These results are in accordance with the research carried out by Hamdin et al on "The Relationship between Body Mass Index and Control Status of Asthma Patients at Mataram City Hospital" where asthma is more common in adults (29-39 years). In this study, asthma was found in all age groups. The most age is in the range of 26-45 years, this is due to the possibility of a history of asthma since childhood or s that occurs continuously or reappears after the remission period but can also be found in the age range of > 65 years or the category of elderly. Asthma that occurs in the elderly based on its clinical nature is divided into two groups, in the form of people who become asthma patients in childhood or teenagers and slow-onset asthma. In addition, the incidence of asthma has also increased in line with increasing age. In this study, patients aged > 65 years decreased by 3 people (7.5%). This condition is often attributed to the frequent underdiagnosis of asthma in elderly, largely resulting from reduced symptom perception, non-specific clinical manifestations, and the presence of multiple

comorbidities that obscure diagnosis (Yáñez et al., 2018).

Based on the results of the study, characteristics were obtained based on occupation, with most patients working as self-employed. This result is the same as the results of a study carried out by Fadhilah et al at the Harum Melati Clinic and Wisma Rini Hospital in Pringsewu Regency in 2021, where asthma patients were most found in patients who worked as self-employed people (56.3%). According to the literature, more than 25% of all asthma cases in adults are work-related. Current studies reveal that more than 80% of cases become asthmatic after years of exposure to the agent in the workplace. Although, the main causative agents are dust, textiles, welding fumes, and chemicals such as isocyanates, artificial mineral fibers, and solvents (Wortong, 2015). Occupational exposure to dust, especially mineral and inorganic particles, has been shown to exacerbate asthma symptoms and increase disease severity among workers (Kogevinas et al., 2019).

Based on the results of the study, the majority of patients had education at the high school level. Meanwhile, patients who did not go to school were not found. These results are in accordance with the results obtained by Fadhilah et al at the Harum Melati Clinic and Wisma Rini Hospital in

Pringsewu Regency in 2021, where based on education, most bronchial asthma patients have education up to the high school level, totaling 49 people (38.9%). Explaining that education is an example of efforts in developing personality and abilities inside and outside school and is carried out throughout a person's life. In this study, more asthma patients were found at the high school education level, this is due to the uneven distribution of research data. It may also be due to the fact that education alone is not enough to create improvements in the control behavior of asthma patients. The level of high school education is not necessarily able to be used as a reflection of having good knowledge about asthma (Caragih, 2013).

Conclusion

Based on the research findings, the characteristic of bronchial asthma suffers at the Pulmonary Polyclinic of Dr. H. Chasan Boesoirie Ternate Hospital have been successfully identified. The results indicate that the most common profile of an asthma sufferer is female gender (70%) of adult age 26-45 years (42.5%) with moderate persistent asthma, who are self-employed occupation (55%) and have a high school education (70%). Understanding this demographic and clinical profile is essential for developing

targeted public health interventions and improving clinical management for the most affected groups in the Ternate region.

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Online Reality Therapy for Frontline Healthcare Workers during the COVID-19 Pandemic

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ABSTRACT

Introduction: Healthcare workers (HCWs) in Indonesia face a high risk of exposure and psychological distress during the COVID-19 pandemic. This situation underscores the urgent need for accessible psychological support to prevent burnout and maintain healthcare system functionality.

Objective: This study aims to explore the effectiveness of delivering psychological assistance through online reality therapy to frontline HCWs during the COVID-19 pandemic.

Methods: A qualitative study was conducted involving eight HCWs from a COVID-19 referral hospital in Surabaya, Indonesia. Participants received regular online group counseling over three months using reality therapy principles. Data were collected through semi-structured interviews, transcribed verbatim, and analyzed thematically.

Results: Six major themes emerged: (1) shared understanding of COVID-19 conditions; (2) psychological changes during the pandemic, including uncertainty and loneliness; (3) challenges related to misinformation and conspiracy beliefs; (4) adaptation strategies focused on survival, joy, and faith; (5) perceptions of social support; and (6) feedback on online counseling methods. Online psychological assistance was perceived as accessible, supportive, and effective in promoting emotional resilience among HCWs.

Conclusions: Online reality therapy provides a feasible and effective model for delivering psychological support to HCWs during a pandemic. It offers psychological flexibility and strengthens coping mechanisms in the face of uncertainty and occupational stress.

Introduction

Coronavirus Disease 2019 (COVID-19) is known for its exceptionally rapid transmission. In Indonesia, the number of confirmed cases increased more than thirtyfold in just one month—from 172

cases on March 17, 2020, to 5,923 cases by April 17, 2020 (Lidwina, 2020). COVID-19 spreads through respiratory droplets released when infected individuals cough, sneeze, or speak nearby (CDC, 2024b). Preventive measures include proper cough

and sneeze etiquette and maintaining physical distancing of at least 1 to 3 meters (CDC, 2024).

Indonesia recorded a COVID-19 mortality rate of 8%, with approximately 5% of the fatalities being healthcare workers (Bernie & Taher, 2020). Healthcare workers are among the most vulnerable due to their direct contact with patients. Around 35.5% of healthcare workers who treat COVID-19 patients experience symptoms within 14 days, and 7% test positive via PCR (Heinzerling et al., 2020). Continuous exposure even without direct patient contact can increase transmission risk. For example, being in the same room for three hours with an intubated COVID-19 patient increases the likelihood of infection. To reduce this risk, the Indonesian Medical Association (IDI) recommended that hospitals avoid assigning double shifts to frontline doctors (Fikri, 2020). Alarmingly, 36% of infected healthcare workers remain asymptomatic, unknowingly spreading the virus.

Providing psychological support to frontline healthcare workers during the pandemic has been increasingly challenging. Both counselors (e.g., psychiatrists) and clients are at high risk of infection. In-person assistance may contribute to the “ping-pong phenomenon” of indoor transmission, where the source of

infection becomes untraceable, necessitating temporary facility closures for full disinfection (Qian et al., 2020). In this context, online psychological support has emerged as a practical and safer alternative (Sultana et al., 2020).

Social media and online platforms have previously been used to deliver remote counseling (Ward-Ciesielski et al., 2018). While such platforms are suitable for general counseling, education, and group therapy, they are less effective for in-depth psychotherapy, especially for complex cases involving comorbid conditions such as COVID-19 (Chavooshi et al., 2017).

Given these circumstances, this study aims to explore the effectiveness of online psychological assistance using reality therapy for frontline healthcare workers during the COVID-19 pandemic. The findings are expected to serve as a foundation for developing future models of network-based psychological support for healthcare workers.

Methods

This study employed a qualitative in-depth approach involving a group of frontline healthcare workers who regularly participated in online counseling sessions. Participants were healthcare workers employed in a private hospital designated as a COVID-19 referral facility in Surabaya, East Java, Indonesia. They voluntarily

participated in the online psychological assistance program and provided consent to be recorded. The psychological assistance sessions were conducted through an online meeting platform.

Ethical Considerations and Procedures

This study was approved by the Hospital's Health Research Ethics Committee. The hospital provided a list of potential participants, from which samples were selected randomly. The researchers contacted candidates via WhatsApp to confirm their willingness to participate. Inclusion criteria included active healthcare workers (not on leave or in self-isolation), not currently COVID-19 positive during the study, or previously confirmed positive. Still, they declared recovered (with or without post-COVID complications). Exclusion criteria included healthcare workers with severe mental health conditions such as organic mental disorders, substance use disorders with complications, schizophrenia, delusional or hallucinatory disorders, unstable mood disorders, or other severe health conditions directly or indirectly related to COVID-19.

Participants received an explanation of the study via a Google Form, which included informed consent information. They were also asked to complete two standardized instruments as part of therapy evaluation: the Patient Health

Questionnaire (PHQ) ultra-brief with four items and the Self-Reporting Questionnaire (SRQ) consisting of 20 items.

Each participant selected their preferred session schedule via the form. The counseling sessions were held once a week in group format, conducted over three months through an online meeting platform.

Participants

The study involved a maximum of ten participants. However, two individuals withdrew: one due to limited phone storage preventing app installation, and another due to having recently given birth. The remaining eight participants included both males and females, aged 25–45 years, with the majority (50%) between 25–30 years old. Half were general practitioners, while the others consisted of nurses, radiographers, and medical laboratory technicians.

Guided Interviews

Group counseling was conducted using semi-structured interviews developed based on systematic reviews and meta-analyses relevant to telemedicine-assisted psychological support. To build therapeutic alliance, the facilitator (who was also one of the researchers) began by introducing themselves and encouraging participants to do the same. This approach helped reduce participant resistance and promoted trust

within the group. The interview questions were designed to be open-ended and casual, without right or wrong answers.

Reality Therapy techniques were used to help participants reflect on their expectations and real-life conditions during the pandemic. Questions explored participants' perceptions of the current COVID-19 situation, psychological changes, common challenges, beliefs in conspiracy theories, adaptive strategies, and expectations for psychological support. Participants were encouraged to develop realistic plans and provide feedback on the support received. All sessions were recorded and transcribed verbatim for analysis.

Data Analysis

Researchers conducted thematic analysis by identifying and reviewing segments of text related to the core themes of psychological assistance. The process included systematic coding and validation to ensure each theme was strongly supported by the dataset.

Results and Discussion

In-depth interviews with eight participants revealed six major themes that reflect the psychological experiences of healthcare workers during the COVID-19 pandemic and their perceptions of the online psychological support provided.

These themes include: (1) general understanding of COVID-19 issues; (2) psychological changes during the pandemic; (3) challenges related to conspiracy theories; (4) adaptation strategies; (5) perceptions of social support; and (6) feedback on the online psychological assistance method.

General Understanding of COVID-19 Issues

Most participants noted that the number of COVID-19 cases remained high, even after more than six months into the pandemic. Some described the situation as a “second wave.” Emergency rooms (ERs) were often overwhelmed, requiring patients to be referred to other hospitals. This led to increased workload and emotional exhaustion. Several participants also observed the emergence of family clusters due to overconfidence in underestimating the virus's risk.

These findings align with previous studies (Fikri, 2020; Heinzerling et al., 2020), which highlight the evolving nature of COVID-19 transmission and the critical need for continuous public health vigilance. The reports from participants that case counts stayed high more than six months into the pandemic — and in some places resembled a “second wave” — mirror empirical findings showing repeated surges of COVID-19 infections that strained

hospital capacity and disrupted emergency care. Studies across various countries revealed that emergency departments (EDs) experienced overwhelming patient inflows during peak waves, leading to ambulance diversions and inter-hospital referrals due to limited ICU and bed availability (Chen et al., 2021; Tsai et al., 2022). These system-level pressures were not only logistical but also affected the quality of care and patient safety, highlighting the vulnerability of healthcare systems in prolonged pandemics (Janke et al., 2021). The situation described by participants aligns with the global patterns of fluctuating transmission rates influenced by community behavior, policy responses, and virus variants (Rajan et al., 2022).

Such sustained workload and critical care demands significantly contributed to emotional exhaustion among healthcare workers. Several studies documented heightened burnout and psychological distress among frontline staff, particularly in emergency and intensive care settings, where high case volumes and mortality rates persisted (Prasad et al., 2021; Morgantini et al., 2020). Emotional fatigue and moral injury were exacerbated by prolonged exposure to crisis conditions and uncertainty (Panagioti et al., 2022). Additionally, the observation of emerging family clusters corresponds with epidemiological evidence showing

substantial household transmission rates due to close contact and risk underestimation (Madewell et al., 2020; Li et al., 2021). Overconfidence and relaxed adherence to preventive measures within households were recognized as major contributors to intra-family spread during the later pandemic phases (Zhou et al., 2022).

Psychological Changes During the Pandemic

Participants commonly experienced uncertainty and loneliness. Uncertainty was associated with inconsistent health policies and pandemic duration, while loneliness stemmed from the need for isolation. Some participants reported experiencing stigma and social rejection, although others felt supported by neighbors during isolation periods.

These experiences reflect earlier research, which notes that frontline workers often struggle with the fear of infection, emotional isolation, and fluctuating health policies (Ellepola, 2020; Santarone et al., 2020). Social support was seen as an important factor in emotional recovery (Polizzi et al., 2020; Saltzman et al., 2020).

Challenges Related to Conspiracy Beliefs

Participants shared that some patients and families denied the existence or severity of COVID-19, considering it a conspiracy.

This created significant barriers to diagnosis, treatment, and funeral protocol compliance, occasionally leading to legal disputes. In certain cases, healthcare workers required institutional support and legal protection to enforce COVID-19 protocols. According to Kalam and Ulya (Kalam & Ulya, 2020), belief in conspiracy theories can lead to defensive and irrational behaviors, which obstruct healthcare delivery and public health efforts.

Adaptation Strategies During the Pandemic

Participants identified five basic needs relevant to their adaptation: survival, love and belonging, freedom, power, and fun. Most emphasized survival as the most essential, not only for themselves but also for their families and colleagues. Strategies included adherence to health protocols, maintaining a healthy lifestyle, spiritual practices, and stress management.

These findings support the view that maintaining protective behaviors and psychological resilience is crucial for navigating prolonged health crises (Chavarria et al., 2021).

Perception of Social Support

Healthcare workers acknowledged institutional support from hospitals, including the provision of personal protective equipment (PPE), free medical

check-ups, and logistical assistance. Peer support and team solidarity also played a vital role in maintaining their mental well-being and motivation. Studies have shown that adequate PPE supply and institutional safety protocols significantly reduce anxiety and perceived vulnerability among frontline healthcare workers (Shaukat et al., 2020; Gómez-Ochoa et al., 2021). Moreover, organizational interventions, including health monitoring and welfare support, have been associated with increased job satisfaction and lower burnout levels (Khalid et al., 2021). In parallel, peer support and team solidarity have emerged as essential protective factors against psychological distress, enhancing resilience and collective efficacy within clinical teams (Maunder et al., 2021; Labrague, 2021). These findings underscore that both tangible institutional resources and interpersonal connectedness within teams are indispensable components for sustaining healthcare workers' mental health and motivation amid prolonged crises such as the COVID-19 pandemic.

Feedback on Online Psychological Assistance

Participants gave positive feedback on the online group counseling. They valued the opportunity to share experiences, solve problems collectively, and make joint decisions. Reality Therapy techniques

helped them identify realistic goals, evaluate personal coping strategies, and improve emotional adaptability.

The use of online platforms was perceived as an accessible and flexible means of psychological support during the pandemic. These findings reinforce earlier evidence that digital psychological interventions can be effective during health emergencies (Sultana et al., 2020; Ward-Ciesielski et al., 2018).

Conclusion

The rise in COVID-19 cases throughout 2020 required healthcare workers to quickly adapt to intense psychological stress and field-related challenges. One of the major barriers they faced was the persistence of conspiracy beliefs in society, which hindered diagnostic procedures and disrupted the implementation of health protocols.

This study demonstrated that online psychological assistance—particularly when combined with reality therapy—was beneficial in providing emotional support to frontline healthcare workers. It helped improve their psychological flexibility, strengthen coping mechanisms, and offer a safe space for reflection and mutual support during the crisis.

Although the pandemic has now subsided and the number of COVID-19 cases has significantly decreased, the need

for accessible mental health services remains relevant. Online-based psychological counseling continues to offer flexible, low-risk support, especially for healthcare workers in high-demand environments or remote areas. The infrastructure developed during the pandemic should not be discontinued but rather optimized and integrated into long-term mental health strategies.

Future studies should examine the long-term psychological impacts of pandemic-related stress on healthcare workers and evaluate the effectiveness of hybrid (online and in-person) mental health services. Quantitative or mixed-method approaches may be used to strengthen generalizability and measure specific psychological outcomes, such as resilience, burnout, and job satisfaction.

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Distribution of Hepatitis B Infection in Cleaning Services in Manado City, North Sulawesi

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ABSTRACT

Introduction: Hepatitis B is a disease caused by a viral infection and can be easily transmitted. Hospitals can be one of the places where Hepatitis B is transmitted. Hospitals produce waste that can be a source of transmission for several professions, both health workers and cleaning services or cleaning staff in hospitals because they are in direct contact with the source of Hepatitis B virus transmission.

Objective: This study aims to determine the description of the results of Hepatitis B examinations on cleaning service staff at hospitals in Manado, North Sulawesi.

Methods: This type of research is descriptive. With a random sampling technique. The samples found were 164 samples that met the sample criteria, then examined using the ELISA method. The results were declared positive for HBsAg if they exceeded the cut-off value obtained from the average value of the negative control. The data obtained are presented in table form and narrated descriptively.

Results: The research results show that there are more female respondents than male respondents, namely 94 people (57.3%) with a greater age range above 36 years (60.4%) with a working period of less than 10 years (62.8%). More respondents with less knowledge of hepatitis B and many have not been vaccinated (82.9%). And it was found that the use of complete PPE was around 108 (65.9%) respondents. 4 (2.4%) respondents obtained the results of the examination using the ELISA method that exceeded the cut-off value.

Conclusions: The conclusion of this study is that 2.4% of respondents were positive for Hepatitis B and all worked at Prof. Dr. R. D Kondou Hospital.

Introduction

Hepatitis is a disease characterized by inflammation of the liver. One important type of hepatitis is hepatitis B. It is estimated that around 240 million people suffer from chronic hepatitis B. The hepatitis B virus (HBV) is the main cause of hepatitis B, which attacks the liver, is acute

and highly infectious, and has infected many people worldwide (Siswanto, 2020).

Hepatitis B is a global health problem. Based on WHO data, 44 countries reported 14,000 cases of acute hepatitis B infection in 2020 (WHO, 2020). Based on Riskesdas, the prevalence of hepatitis B virus in Indonesia in 2018 was around 7.1% (around

18 million people). This virus is highly contagious, which can cause liver cirrhosis, liver cancer, and even death. Based on the results of the 2018 Basic Health Survey (Riskesdas) in North Sulawesi, the number of hepatitis cases was 0.47% (25,661 people), and specifically Manado City had a hepatitis case rate of 0.59% (4,467 people). The fourth largest city in North Sulawesi.

Hospitals pose occupational risks to workers through substantial medical and infectious waste production. Judging from the nature of hospital work, it can be said that health workers are workers who are at risk of contracting occupational diseases because they come into contact with sick patients every day. However, workers outside the medical field can also contract occupational diseases even though they do not have direct contact with patients.(Setiawan, 2019). Cleaning service workers are at risk of exposure to hazardous biological materials (biohazards) through contact with disposable medical equipment when cleaning laboratories or rooms containing viruses and bacteria, and through injuries from sharp objects such as injection needles when handling medical waste, which can lead to infections such as hepatitis (Amalia and Sari, 2020a).

Based on research conducted by Agussamad (2019), it was found that 17 cleaning service workers were pricked by

needles because the workers did not comply with the use of Personal Protective Equipment (PPE).(Assen et al., 2020). Cases that can occur in hospitals are needle stick injuries (NSI). NSI is a term for work accidents caused by needle stick injuries or sharp medical objects that have been contaminated with infectious fluids from patients. This incident is very risky for contracting infectious diseases when the skin is pricked by a used needle and contaminated with the patient's blood.(Suksatan et al., 2022). Comparable research at Nairobi Hospital found 5/185 (2.7%) cleaning staff HBV-positive, linked to PPE non-compliance (Kangethe & Komu, 2021), while BCM Pelaihari Hospital reported 1/24 positives (Amalia & Sari, 2020a). Based on the preceding background, this study aims to describe the prevalence and distribution of Hepatitis B surface antigen (HBsAg) positivity among cleaning service personnel across hospitals in Manado City, North Sulawesi.

Methods

This research is descriptive and was conducted from January to May 2023. Sampling was taken from 5 hospitals in Manado City, North Sulawesi Province, namely Prof. Dr. RD Kandou General Hospital, GMIM Pancaran Kasih General Hospital, Robert Wolter Mongisidi Hospital, Eye Hospital, and Bhayangkara

Hospital. Ethical approval was obtained from the Ethics Committee of the Manado Health Polytechnic, Ministry of Health (No. KEPK.01/04/028/2023). In the study, blood specimens were taken aseptically using a serum separator tube and the samples were placed in a safety box at a temperature 4°C to be taken to the Immunoserology Laboratory of the TLM Department of the Ministry of Health, Manado Health Polytechnic. The population in this study was Cleaning Service officers who worked at hospitals in Mando, North Sulawesi. A total of 164 participants were recruited via random sampling.

The materials used in this study were washing solution and distilled water (aquadest). The tools used were SST tubes, tube racks, tourniquets, alcohol swabs, plaster, disposable syringes, labeling/markers, dry cotton, centrifuges, micropipettes, timers, ELISA readers, incubators, microwells, micro tubes, coolboxes and ice packs.

HBsAg examination was conducted based on the ELISA method using the ELISA Reader Vidas tool. The examination procedure used the KIT Insert tool. Cut-off values of more than 0.107 were declared positive and those less than 0.107 were declared negative. The data obtained are presented in a table and explained descriptively.

Results and Discussion

Among 164 cleaning service workers screened in this study, 4 participants (2.4%) tested positive for hepatitis B surface antigen (HBsAg), while 160 (97.6%) tested negative (Table 1). All four positive cases were asymptomatic (100%), with no participants reporting clinical symptoms of hepatitis B infection. Regarding gender distribution, female respondents predominated, accounting for 94 individuals (57.3%), compared to 70 males (42.7%). In terms of age, the majority of participants were over 36 years old (99; 60.4%), exceeding those aged 36 years or younger (65; 39.6%).

Table 1. Examination results, Symptoms, Gender, and Age

Variable	Category	n	%
Check-Up Result	Positive	4	2.4
	Negative	160	97.6
Symptoms	Symptomatic	0	0.0
	Asymptomatic	164	100.0
Gender	Men	70	42.7
	Women	94	57.3
Age Group	≤ 36 Years	65	39.6
	> 36 Years	99	60.4
Total respondents		(N) = 164	

Based on the results in Table 2. Based on the length of service, it was found that there were more workers under 10 years, namely 103 (62.8%) compared to workers over 10 years, namely 61 (37.2%), while based on knowledge about Hepatitis B, it was found that 98 (59.8%) did not know and 66

(40.2%) already knew about Hepatitis B, based on Hepatitis B vaccination 136 (82.9%) had not been vaccinated and 28 (17.1%) had been vaccinated, based on the use of complete PPE during work, it was found that 108 (65.9%) used complete PPE and 56 (34.1%) did not use complete PPE at work.

Table 2.Based on length of service, Hepatitis B knowledge, vaccination and use of complete PPE

Variable	Category	n	%
Length of Service	< 10 Years	103	62.8
	≥ 10 Years	61	37.2
Hepatitis B Knowledge	Yes	66	40.2
	No	98	59.8
Hepatitis B Vaccination Status	Already Vaccinated	28	17.1
	Not Vaccinated Yet	136	82.9
Complete Use of PPE	Yes	108	65.9
	No	56	34.1
Total respondents		(N) = 164	

From the results above, 4 of 164 respondents (2.4%) tested positive for hepatitis B but showed no symptoms. Hepatitis B causes symptoms ranging from asymptomatic to severe cases like hematemesis (vomiting blood) or coma (Salsabila et al., 2020). Over 65% of infected individuals remain asymptomatic or exhibit mild flu-like symptoms, allowing undetected chronic infection (Dwi Yulia, 2020).

Although more female respondents participated than males, the 4 positives

included 2 males and 2 females. Males showed a higher positivity rate (2/70 vs. 2/94). This aligns with 2013 Ministry of Health data indicating higher male hepatitis B prevalence (Libangkes Ministry of Health, 2013), and studies linking elevated testosterone to increased liver cancer risk and higher viral loads in males versus females (Rambe et al., 2022). Most workers were over 36 years old—a productive age with elevated risk factors (Rambe et al., 2022)—though infection is rarer in the elderly due to viral clearance post-acute phase (Kolou et al., 2017).

Meanwhile, based on length of service, more people have worked for less than 10 years, as well as respondents who tested positive for hepatitis B, all 4 of whom have worked for less than 10 years, which means that length of service does not guarantee that someone can get hepatitis B or not. This is also related to workers' knowledge of Hepatitis B, where the level of knowledge of Hepatitis B still tends to be lacking among Cleaning Service workers in Hospitals. In a study conducted by Suantika, et al. in 2022, it was stated that there was a relationship between knowledge and community behavior about hepatitis. Researchers argue that knowledge about hepatitis can help the community identify risks and take appropriate steps to prevent hepatitis (Suantika, et al. 2022). This is in contrast to a study conducted by Dwiartama

et al. in 2022, where the level of knowledge of hepatitis was not directly proportional to the prevention behavior in the community. It is said that one possible reason why respondents' knowledge does not match prevention practices is that knowledge itself does not guarantee a person's compliance with preventive measures.

Most participants (136; 82.9%) remained unvaccinated against hepatitis B, compared to only 28 (17.1%) who had received vaccination. The hepatitis B vaccine provides essential protection and significantly reduces the incidence of chronic liver disease and hepatocellular carcinoma. The recombinant hepatitis B vaccine used in adults—widely adopted globally—contains only the virus's surface antigen protein produced through recombinant DNA technology, ensuring safety without using the live virus itself (Ministry of Health of the Republic of Indonesia, 2023). Vaccines function as antigens that stimulate the body's immune system; once vaccinated, individuals produce specific antibodies that rapidly neutralize invading viruses upon exposure, deploying lymphocytes to destroy and eliminate them effectively (Ministry of Health of the Republic of Indonesia, 2023).

Although most workers (108; 65.9%) reported using complete personal protective equipment (PPE), 3 of the 4 hepatitis B-positive cases still claimed consistent PPE

use. Johana et al. (2022) demonstrated that knowledge levels and attitudes toward PPE critically influence its effectiveness, as physical discomfort often leads to improper or incomplete application despite having full equipment, while inadequate hygiene maintenance further compromises protection against viral exposure. Standard operating procedures (SOPs) for PPE—comprising detailed, step-by-step written instructions for routine and repetitive tasks—are therefore essential to ensure proper implementation (Puti Khairunnisak, 2019).

Notably, 3 of 4 HBsAg-positive cases (75%) reported complete PPE use, suggesting compliance alone is insufficient against occupational HBV exposure. Possible explanations include micro-tears in gloves during prolonged use, inadequate PPE hygiene between shifts, or unrecognized percutaneous injuries during waste segregation (Johana et al., 2022). This study's 2.4% prevalence closely mirrors Nairobi Hospital's 2.7% (5/185) among cleaning staff (Kangethe & Komu, 2021) but exceeds BCM Pelaihari's 4.2% (1/24) (Amalia & Sari, 2020a), indicating consistent moderate HBV burden in hospital cleaning personnel across diverse settings and underscoring need for facility-specific transmission control beyond PPE reliance.

Hepatitis B examination in this study employed the enzyme-linked immunosorbent assay (ELISA) method, one of the primary immunological techniques designed to determine or measure levels of protein activity as well as the immune reaction status in individual samples. The ELISA method offers notably high sensitivity and specificity, attributed to the precise and specific binding between antigens and antibodies. This technique detects the presence of antigens and antibodies through visible color changes generated by enzyme-linked conjugates reacting with appropriate substrates (Andayani, 2023).

This study provides baseline Hepatitis B prevalence data among an understudied group—hospital cleaning service workers—in Manado City, with its multi-hospital design capturing diverse occupational exposure patterns. Key strengths include standardized ELISA testing and comprehensive variable assessment (demographics, knowledge, vaccination, PPE). However, the descriptive cross-sectional design precludes causality inference due to the absence of statistical analysis. Self-reported PPE compliance and vaccination data risk recall bias, while lack of viral load testing limits chronicity assessment. Future analytical studies with multivariate statistics and

objective exposure measures are recommended.

Conclusion

This study identified a 2.4% Hepatitis B surface antigen (HBsAg) prevalence rate among 164 hospital cleaning service workers screened across five facilities in Manado City, North Sulawesi. All four positive cases were asymptomatic and notably clustered at Prof. Dr. RD Kandou General Hospital. Despite majority reporting complete personal protective equipment (PPE) use (65.9%; n=108) and a predominantly productive-age workforce (>36 years: 60.4%), alarmingly low vaccination coverage (82.9% unvaccinated; n=136) coupled with knowledge deficits (59.8% lacking Hepatitis B awareness) underscore the critical need for targeted occupational health interventions, including mandatory vaccination programs and enhanced training for this high-risk, understudied population.

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Effect of Kratom (*Mitragyna speciosa*) Hydrogel on Liver Function in Diabetic Burn Injury

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Keywords: Burns, Kratom, Hydrogel, Liver, Histopathology. Submitted: Nov 2nd 2025 Reviewed: Nov 3rd 2025 Accepted: Dec 3rd 2025	Introduction: Burns are serious injuries that not only damage the skin but can also affect internal organs such as the liver. Severe inflammation following burn injury increases hepatocyte vulnerability, especially in diabetic conditions. Objective: This study aimed to evaluate the effect of topical kratom (<i>Mitragyna speciosa</i>) hydrogel on liver histopathology in streptozotocin-induced diabetic mice with burn injuries. Methods: An in vivo experimental study with a post-test-only control group design was conducted using 15 male mice (<i>Mus musculus</i>). Diabetes mellitus was induced prior to burn injury, and hyperglycemia was confirmed before further procedures. The diabetic mice were then randomly assigned into three groups: diabetic burn injury without hydrogel treatment (K), diabetic burn injury treated with 5% kratom hydrogel (T1), and diabetic burn injury treated with 15% kratom hydrogel (T2). The respective treatments were applied for four weeks. Following the intervention period, liver tissues were collected for histopathological analysis. Hepatocyte damage was quantitatively assessed and analyzed using one-way ANOVA followed by Dunnett's post hoc test. Results: The diabetic burn injury control group exhibited the greatest extent of hepatocyte damage ($66.5 \pm 5.0\%$). Application of 5% kratom hydrogel ($49.5 \pm 4.0\%$) and 15% kratom hydrogel ($52.5 \pm 4.0\%$) resulted in a statistically significant reduction in hepatocyte injury compared with the diabetic control group ($p = 0.0043$ and $p = 0.0131$, respectively). Conclusions: Topical administration of kratom hydrogel significantly attenuated hepatocyte damage in diabetic mice subjected to burn injuries, suggesting a hepatoprotective effect and potential benefits for preserving liver function under diabetic burn conditions.

Introduction

Type 2 diabetes mellitus is a chronic metabolic disease characterized by persistent hyperglycemia due to peripheral insulin resistance and pancreatic β -cell

dysfunction. In Indonesia, diabetes mellitus is the third leading cause of death with a prevalence of approximately 10.3 million cases, and this number is estimated to jump to 21.3 million by 2030 (Nababan et al,

2023). In this context, complications of type 2 diabetes mellitus include both microvascular and macrovascular complications. In addition to microcellular and macrocellular complications, type 2 diabetes mellitus also causes complications in the skin, such as wound disorders (Lu et al., 2024).

When patients with type 2 diabetes mellitus suffer burns, the inflammatory response becomes much more complex. Burns trigger the massive release of proinflammatory cytokines and activate systemic inflammatory response syndrome (SIRS), which then develops into a systemic inflammatory and hypermetabolic process (Żwierello et al. 2023). The systemic inflammatory response or Systemic Inflammatory Response Syndrome (SIRS) triggered by burns causes the massive release of proinflammatory cytokines such as TNF- α and IL-6, which serve to maintain the immune system but, when excessive, cause tissue damage. In addition, burns also increase the production of reactive oxygen species (ROS) in large quantities that exceed the body's antioxidant defense capacity. The combination of proinflammatory cytokines and ROS causes progressive hepatocyte damage through mechanisms of lipid peroxidation, DNA damage, and immune response dysregulation. In the long term, this

condition leads to liver vulnerability to metabolic dysfunction and multiple organ failure (Siu, Ma, and Leung 2025).

In this context, a dual therapeutic strategy is needed: supporting wound healing in the skin while providing protection for internal organs. Topical hydrogels have been identified as one of the most promising drug delivery systems due to their ability to maintain wound moisture, provide an optimal environment for tissue regeneration, and serve as a reservoir for the controlled and sustained release of active substances (Siu et al. 2025). According to previous research, one potential bioactive candidate that can be formulated in hydrogels is *Mitragyna speciosa* Korth. (kratom), a plant from the Rubiaceae family that has anti-inflammatory and antioxidant activities. The content of indole alkaloids such as mitragynine, as well as polyphenols including flavonoids and phenolic acids, has been shown to provide a protective effect against tissue damage caused by chronic inflammation (Chen et al., 2022). Thus, the development of a topical kratom hydrogel formulation is expected to increase the bioavailability of active compounds while providing a protective therapeutic effect on the liver, which is susceptible to damage due to systemic inflammation in burn conditions with

comorbid diabetes (Tuntiyasawasdikul et al. 2024).

Methods

This study used an in vivo biomedical experimental design with a post-test only control group to assess liver function in mice using histopathological examination after administering a hydrogel made from kratom (*Mitragyna speciosa*) to skin burns in mice (*Mus musculus*) with streptozotocin-induced type 2 diabetes mellitus. This study also aims to evaluate the effects of topical drug administration on internal organs of mice as a potential innovation for type 2 diabetes mellitus therapy.

Materials and Reagents

Ethyl alcohol extract of kratom leaves (*Mitragyna speciosa*), Streptozotocin compound as an inducer, citrate buffer, 0.9% NaCl physiological solution, 10% neutral formalin solution, hematoxylin–eosin dye, 0.5% Na CMC suspension, glycerin, propylene glycol, methyl paraben as a preservative, distilled water, and ketamine and xylazine anesthetics.

Kratom Hydrogel Formulation

The hydrogel production process begins with the extraction of 500 g of kratom leaf powder. Extraction is carried out using the

maceration method with 3500 mL of 96% ethanol (material:solvent ratio of 1:7). The mixture is soaked in a closed container protected from light for five days while being stirred periodically. After the maceration process is complete, the mixture is filtered to obtain the filtrate, then evaporated using a rotary evaporator at a temperature of 50 °C until a concentrated extract is formed. (Antaryani et al., 2019; Ningrum et al., 2020; Zhang et al., 2023).

Table 1. Kratom Hydrogel Formulation

Ingredient	Function	Concentration (g)	
		Kratom 5%	Kratom 15%
Ethanol Extract of Kratom Leaves	Active compound	1.5	4.5
Na-CMC	Gelling Agent	1.25	1.25
Gliserin	Humektan	3.0	3.0
Methylparaben	Pengawet	0.075	0.075
Propilen glikol	Enhancer	1.0	1.0
Etanol 96%	Pelarut. Enhancer	5	5
Aquades	Pelarut	ad 30 g	ad 30 g

In the manufacture of hydrogel, the first step is to prepare formula 1 by dissolving methylparaben in hot distilled water, then dispersing Na-CMC as a hydrophilic polymer and homogenizing it. Formula 2 is prepared by mixing propylene glycol and glycerin, then combining it with formula 1 (Table 1). The ethanol extract of kratom leaves is dissolved in 96% ethanol and added gradually to the mixture. Propylene

glycol and ethanol function as solvents and penetration enhancers (Purwasih et al., 2023). The final step is to add the remaining distilled water until homogeneous, and the mixture is left to stand for ± 24 hours at room temperature before use.

Experimental Animals and Diabetes Mellitus Modeling

This study was a laboratory experimental study with a post-test only control group design. The subjects used were 15 male Swiss Webster mice (*Mus musculus*) aged 6–8 weeks with a body weight of 25–30 grams. All animals were obtained from the Animal Breeding Unit (UPHC), which has been certified as Specific Pathogen-Free (SPF) to ensure their health and quality. The

mice were randomly divided into three treatment groups, namely the positive control group with burns without hydrogel (K), the group with 5% kratom hydrogel (T1), and the group with 15% kratom hydrogel (T2).

All procedures have been approved by the Health Research Ethics Committee of Nahdlatul Ulama University Surabaya (No.0251/EC/KEPK/UNUSA/2025). The study entitled “The Effect of Kratom Hydrogel (*Mitragyna speciosa*) Use on Liver Function in Burn Injuries” was conducted at the Integrated Research Laboratory 3 and the Animal Testing Laboratory of the Faculty of Medicine, UNUSA.

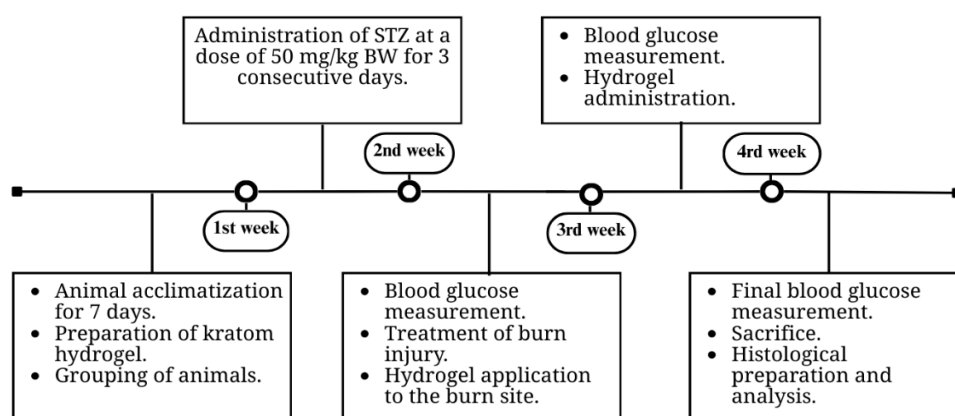


Figure 1. Experimental workflow showing acclimatization, diabetes induction, hydrogel treatment, and histological preparation and analysis.

Prior to treatment, all test animals underwent an acclimatization period of 4–7 days to adapt to the laboratory environment. Subjects were then randomly allocated into three treatment groups as follows:

- Group 1 (Positive Control) : Group induced with STZ and given a burn wound, but not given hydrogel treatment.

- Group 2 (Treatment 1) : Group induced with STZ and given topical kratom hydrogel with a 5% extract concentration every day for 4 weeks.
- Group 3 (Treatment 2) : The group that was induced with STZ and given topical kratom hydrogel with a 15% extract concentration every day for 4 weeks.

In the second week, diabetes was induced by intraperitoneal injection of Streptozotocin (STZ) at a single dose of 50 mg/kgBW three times over three consecutive days. Diabetes status was confirmed 72 hours after the last injection, with mice with fasting blood glucose levels above 200 mg/dL being declared hyperglycemic. In the following week, a second-degree burn was made on the back of the mice. The burn was administered using a 1 × 1 cm iron plate that had been heated to 98°C with a Bunsen burner and placed on the back of the mice for 30 seconds (Afrianti et al., 2016; Gitafitri et al., 2023). Topical treatment with kratom hydrogel was initiated according to each group's allocation. Blood glucose levels were measured using a Gluco Dr GCU device three days after the STZ injection treatment. Subsequently, the mice were sacrificed and their blood glucose levels were rechecked. The examination process was carried out after the animals were

anesthetized using a combination of ketamine 70 mg/kgBW and xylazine 10 mg/kgBW injected intraperitoneally with a volume of 0.03 mL.

Histopathological Analysis

After a four-week treatment period, the livers of the mice were removed and cleaned using a physiological solution. For preservation, the livers were immersed in a 10% Neutral Buffer Formalin (NBF) solution. Next, histological preparations were made using the paraffin embedding method, followed by staining with hematoxylin-eosin (HE) to visualize the cell structure (Dewhurst et al. 2020).

Morphological observation of liver tissue was performed under a light microscope at 100x and 400x magnification using Image Raster software with a light microscope (Nikon Eclipse type Ei) connected to a computer with the assistance of Optilab SIGMA MTN020. Data collection was performed on five different fields of view for each specimen. In each field of view, the total number of liver cells (hepatocytes) and the number of damaged cells (swelling or shrinkage indicating inflammation or necrosis) were counted (Agustini et al., 2019). This study was conducted with the assistance of the ImageJ application.

Mitragynine Bioinformatics Analysis

In silico analysis was conducted to assess the pharmacological potential of the mitragynine compound. The chemical structure of mitragynine was obtained from the PubChem database. Prediction of the compound's biological activity was performed using the Way2Drug platform (PASS Online), while protein target identification and prediction were performed using SwissTargetPrediction. Furthermore, the protein interaction network of the identified targets was analyzed using the STRING Database to evaluate functional relationships between proteins. All data used in this analysis was sourced from public databases and accessed in 2025.

Data Analysis

The research data consisted of the number of normal cells and damaged hepatocytes in five fields of view for each specimen. These values were added together to obtain the total number of normal cells, damaged cells, and total cells in each animal. The percentage of hepatocyte damage was calculated using the formula below (Agustini et al., 2019).

$$\text{Damages(\%)} = \frac{\text{Total damages cell}}{\text{Total damages cell} + \text{Total normal cell}} \times 100\%$$

Summary data for each group are presented as mean $\pm$ standard deviation (Table 3). Statistical analysis was

performed using GraphPad Prism software version 9.0 (GraphPad Software, San Diego, CA, USA). Data distribution normality was tested using Shapiro–Wilk, while homogeneity of variance between groups was analyzed using Bartlett and Brown–Forsythe. If the data were normally distributed and the variances between groups were homogeneous, the parametric One-way ANOVA test was used to assess the differences between groups. The test was followed by a post-hoc Dunnett test to compare the treatment groups (T1 and T2) with the control group (K). The significance level was set at $p < 0.05$.

Results and Discussion

Protein Targets in Type 2 Diabetes

Table 2. Protein Targets in Type 2 Diabetes
KEGG Pathways (STRING DB)

KEGG Pathways	ID	Protein Target
Type 2 Diabetes Mellitus	hsa04930	MTOR, MAPK8, JAK2, NOX4
Insulin Resistance	hsa04931	MTOR, JAK2, MAPK8
AGE–RAGE Signaling Pathway in Diabetic Complications	hsa04933	NOX4, MAPK8, JAK2

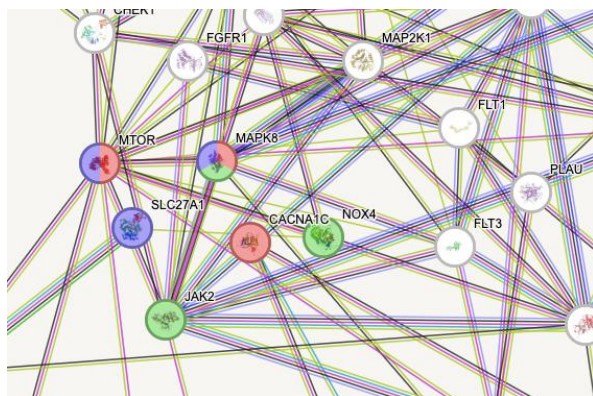


Figure 2. Protein-protein interaction (PPI) Molecular target prediction analysis using the Way2Drug approach via Swiss Target Prediction showed that mitragynine lacks high-probability direct targets for key proteins in type 2 diabetes mellitus.

Insulin regulates glucose metabolism by binding to insulin receptors (INSR) on the cell membrane, triggering the activation of IRS-PI3K-AKT-mTOR, which increases glucose uptake (through GLUT4 translocation), stimulates glycogen synthesis, and suppresses gluconeogenesis in the liver. This pathway is central to the metabolic effects of insulin. In addition, insulin also activates the RAS-MAPK pathway, which plays a role in cell proliferation and growth, as well as the JAK-STAT pathway, which regulates the expression of metabolic genes and growth hormones. In conditions of insulin resistance such as type 2 diabetes mellitus,

IRS and AKT activation is disrupted so that GLUT4 does not move to the membrane, the liver continues to produce glucose, and blood glucose levels remain high even though insulin levels are high. Excessive mTOR activation triggers lipogenesis and oxidative stress, while hyperactive MAPK pathways increase inflammation and liver damage. Consequently, disruption of insulin signaling pathways leads to hyperglycemia, hepatic insulin resistance, and liver complications such as steatosis in DM.

Effects of hydrogel Mitragyna speciosa in Liver Function

Table 3. Summary of normal cells, damaged cells, total cells, and percentage of hepatocyte damage (Mean $\pm$ SD) per group

GROUP	Total N (Mean $\pm$ SD)	Total D (Mean $\pm$ SD)	Total Cell (Mean $\pm$ SD)	Damage % (Mean $\pm$ SD)
K	187.0 $\pm$ 5.0	224.0 $\pm$ 4.0	411.0 $\pm$ 5.0	66.5 $\pm$ 5.0
T1	212.0 $\pm$ 4.0	184.0 $\pm$ 4.0	396.0 $\pm$ 4.0	49.5 $\pm$ 4.0
T2	207.0 $\pm$ 4.0	190.0 $\pm$ 4.0	397.0 $\pm$ 4.0	52.5 $\pm$ 4.0

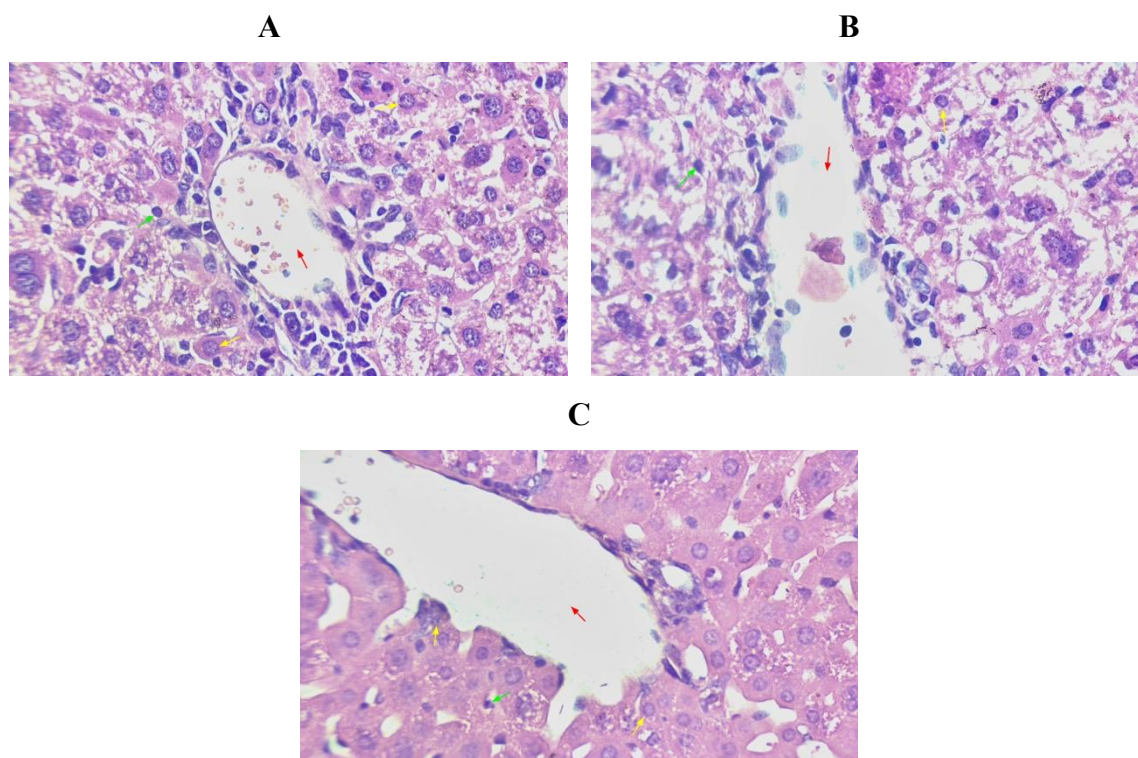


Figure 3. Histopathological image of mice liver stained with HE at 400x magnification. Colors indicate yellow (cell degeneration), red (central vein), and green (necrotic cells). (A) Group K (DM+BI) Severe liver damage with massive necrosis, inflammation, and cholangitis in untreated DM conditions; (B) Group T1 (DM+BI+K5%) A reduction in the degree of hepatocyte damage compared to the pure DM group, indicating the protective effect of 5% kratom hydrogel on the liver; (C) Group T2 (DM+BI+K15%) Kratom hydrogel 15% also reduces liver damage, but histological findings show that damage is still present (degeneration, necrosis) and appears less protective than the 5% dose.

Descriptive analysis of Table 3 shows that group K had the highest mean percentage of hepatocyte damage ($66.5 \pm 5.0\%$), while the 5% kratom hydrogel treatment group ($49.5 \pm 4.0\%$) and 15% kratom hydrogel treatment group ($52.5 \pm 4.0\%$) showed lower values. The total number of normal cells was also higher in the treatment groups than in the diabetic

control group. This indicates that administration of kratom hydrogel, at both 5% and 15% concentrations, has the potential to reduce hepatocyte damage in a diabetic model.

Assumption tests showed that hepatocyte damage data in the three groups (K, T1, and T2) were normally distributed based on the Shapiro–Wilk test ($p > 0.05$)

and had homogeneous variance according to the Bartlett ($p=0.517$) and Brown–Forsythe ($p=0.244$) tests. Thus, the analysis could be continued using the parametric ANOVA test.

The results of the one-way ANOVA test showed that there were significant differences between groups ($F(2,9)=10.05$; $p=0.0051$). Dunnett's post-hoc analysis showed that the control group (K) had a higher percentage of hepatocyte damage compared to the 5% kratom hydrogel treatment group (T1) and 15% kratom hydrogel treatment group (T2). These differences were significant with $p=0.0043$ for K vs T1 and $p=0.0131$ for K vs T2. Overall, these results indicate that administration of kratom hydrogel, at both 5% and 15% concentrations, was able to reduce the level of hepatocyte damage compared to the control group.

The mean percentage of hepatocyte damage (Mean $\pm$ SD) in groups K, T1, and T2. It can be seen that group K showed a higher percentage of hepatocyte damage compared to treatment groups T1 and T2 (Figure 4). The One-way ANOVA test showed a significant difference between groups ($F(2,9) = 10.05$; $p = 0.0051$). The Dunnett post-hoc test showed that hepatocyte damage in the T1 ($p = 0.0043$) and T2 ($p = 0.0131$) groups was significantly lower than in the K group.

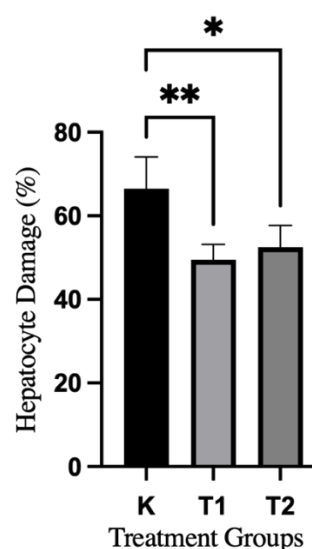


Figure 4. Comparison of the mean percentage of hepatocyte damage in three groups: K (diabetes without treatment), T1 (diabetes + 5% kratom), and T2 (diabetes + 15% kratom). Data are presented as mean $\pm$ SD. An asterisk indicates a significant difference between groups.

This study concluded that the administration of kratom hydrogel was able to reduce hepatocyte damage in a mouse model of diabetes mellitus with burns. The control group showed the greatest reduction in hepatocytes at 66.5%, while the treatment group with 5% kratom hydrogel showed a reduction of 49.5% and 15% showed a reduction of 52.5%, with both groups showing a significant decrease. These differences were statistically confirmed by ANOVA, which showed significant differences between groups, and by Dunnett's post-hoc test, which proved that

both concentrations of kratom hydrogel reduced hepatocyte damage compared to the control group.

The protective effects appear to be correlated with the bioactive components of *Mitragyna speciosa*, particularly the alkaloid mitragynine and several polyphenols such as flavonoids and phenolic acids. These compounds possess anti-inflammatory and antioxidant properties (Chen et al. 2022; Todd et al. 2020). Possible mechanisms include the reduction of reactive oxygen species (ROS), restoration of redox balance, and modulation of the release of inflammation-related cytokines (Pranantyo et al., 2024; Niu et al., 2023). Additionally, trimolecular hydrogels as a depot system for topical and controlled release contribute to wound moisture retention and, thus, enhance the penetration of active ingredients (Gounden & Singh, 2024; Alberts et al., 2025). Interestingly, a 5% concentration appears to provide better protective effects than 15%, which may indicate an optimal effect, where higher doses may cause mildly toxic or unbalanced pharmacodynamic effects.

Comparison with previous research indicates that kratom extract improves oxidative status and profiles in diabetic mice (Chen et al. 2022). Kratom also functions to strengthen its potential as a transdermal candidate (Tuntiyasawasdikul

et al. 2024). Additionally, hydrogels are topical drug delivery systems that effectively maintain moisture for wound healing, accelerate tissue regeneration, and enable controlled release of bioactive compounds (Alberts et al. 2025; Gounden and Singh 2024).

Clinically, the results of this study indicate that kratom hydrogel has the potential to be developed as an adjunct therapy for diabetic patients with burns. The protective effect in group T1 is consistent with previous research findings showing that alkaloids, particularly mitragynine, along with other bioactive components such as flavonoids, phenolics, saponins, tannins, and glycosides, have antioxidant, anti-inflammatory, and antidiabetic activities (Raini, 2017; Salim et al., 2022; Limcharoen et al., 2022; Zhang et al., 2023). This mechanism occurs through the suppression of prostaglandin synthesis by inhibiting COX 2, decreasing iNOS activity, and reducing the formation of free radicals (ROS) (Zulhakim et al., 2025; Ramadhan et al., 2023). This is relevant to the pathogenesis of diabetes mellitus, where hyperglycemia and hyperlipidemia cause metabolic imbalances that lead to increased ROS (Galicia-Garcia et al., 2020). Additionally, kratom has the ability to inhibit the α -glucosidase enzyme, which can reduce glucose absorption and help

control glycemia (Wijayanti et al., 2023; Tuntiyasawasdikul et al., 2024). In silico findings also show the effect of kratom compounds on the modulation of inflammatory regulatory proteins such as MAPK and the control of mTOR activation, which plays a role in inflammatory and metabolic processes (Swaroop et al., 2024; Zhao et al., 2025).

This study has several limitations. The sample size used was relatively small, so the results should be generalized with caution. Liver damage was assessed based on histopathology alone, without involving biochemical biomarkers such as AST, ALT, cytokines, or ROS.

Conclusions

The application of kratom hydrogel on diabetic mice with burns significantly reduced hepatocyte cell damage. This protective effect is most likely due to the antioxidant and anti-inflammatory activities of bioactive compounds and the properties of hydrogel that support controlled release, along with tissue moisture. A 5% concentration had a better protective effect than 15%; therefore, further studies on the optimal dose are urgently needed. These findings reinforce the innovative topical application of kratom hydrogel aimed at protecting the liver from damage occurring during burns, especially in diabetic

conditions. Further research is needed to validate the findings through biochemical analysis and long-term observation.

This study was conducted using a streptozotocin-induced diabetic mouse model, which may not fully reflect the complexity of diabetic burn injuries in humans. Liver function assessment was limited to histopathological evaluation without biochemical or molecular analyses, and the relatively small sample size and short treatment duration may limit the generalizability of the findings.

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The Relationship of HbA1c Levels and Degree of Diabetic Nephropathy in Patients with Type 2 Diabetes Mellitus in RSI Jemursari Surabaya

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ARTICLE INFO	ABSTRACT
Keywords: Diabetes Mellitus Type 2, HbA1c, Diabetic Nephropathy, GFR Submitted: Feb 3rd 2025 Reviewed: Feb 23th 2025 Accepted: July 29th 2025	Introduction: Type 2 diabetes mellitus is a metabolic disorder frequently associated with long-term complications. One of the most common microvascular complications is diabetic nephropathy, a condition that significantly contributes to morbidity and mortality among patients. A reduced glomerular filtration rate (GFR) reflects a more advanced stage of nephropathy, and when accompanied by elevated HbA1c levels, it indicates poor glycemic control and a greater risk of diabetes-related complications. Objective: To prove the relationship between HbA1c levels and the degree of diabetic nephropathy Methods: This study is an analytical observational research with a cross-sectional approach. The population in this study consists of medical record data from patients with type 2 diabetes mellitus at RSI Jemursari, totaling 946 patients. The sample was obtained using the Slovin formula, with a 10% margin of error, resulting in 90 samples. Sampling was done using the nonprobability sampling method of consecutive sampling. The statistical test uses the Spearman test in SPSS. Results: The significance value was <0.001 (<0.1), and the correlation coefficient was 0.416. The results of the Spearman statistical test demonstrate a significant relationship between the two variables, with a moderate quality of the relationship between them. Conclusions: A significant relationship was found between the HbA1c level variable and the degree of nephropathy in patients with type 2 diabetes mellitus, characterized by a correlation coefficient indicating a moderate quality of relationship.

Introduction

Type 2 Diabetes Mellitus, also known as Non-Insulin-Dependent Diabetes Mellitus (NIDDM), primarily affects adults. This form of diabetes is characterized by two

main insulin-related problems: insulin resistance, which impairs the body's ability to regulate blood sugar levels and dysfunction or damage to the beta cells in the pancreas. (Banday et al., 2020)

Complications are a common outcome for individuals who have been diagnosed with Type 2 Diabetes Mellitus for many years. This chronic condition inevitably leads to a variety of complications, including significant issues with blood vessels, both large (macrovascular) and small (microvascular), as well as neurological disorders (neuropathy). Macrovascular complications primarily affect the heart, brain, and larger blood vessels. In contrast, microvascular complications have a direct impact on the eyes, kidneys, and the small blood vessels involved in the nervous system. (Soelistijo, 2021)

Chronic kidney failure is a common microvascular complication associated with Type 2 Diabetes Mellitus, affecting approximately 35 to 45% of patients. Diabetic nephropathy, which refers to chronic kidney failure in these individuals, is a leading cause of death among those with Type 2 Diabetes Mellitus, particularly in cases where Diabetic nephropathy has progressed to end-stage renal failure. (Majid et al., 2020) This condition can significantly affect the lives of individuals with Type 2 Diabetes Mellitus, potentially resulting in disabilities and even death. (Oktaviani, Indriani, Kusuma, & Futriani, 2021) Recognizing these risks is crucial for effective management and prevention of further complications. (Soelistijo, 2021)

HbA1c is the most reliable indicator for managing blood sugar in patients with Type 2 Diabetes Mellitus. Higher HbA1c levels indicate an increased risk of complications associated with Type 2 Diabetes Mellitus. (Majid et al., 2020) The elevated HbA1c levels indicate high blood glucose levels over the past three months. Furthermore, elevated HbA1c levels may suggest that glucose has accumulated in the renal glomeruli through the circulatory system. This condition leads to an increase in pressure caused by hyperfiltration occurring within the glomerulus. Consequently, this leads to an increase in the glomerular filtration rate. This phenomenon signifies the early stage of Diabetic nephropathy. (Tarawifa et al., 2020)

Complications related to Type 2 Diabetes Mellitus can be effectively anticipated right from the moment a patient is diagnosed with Type 2 Diabetes Mellitus. An accurate diagnosis depends on reliable testing methods, particularly the HbA1c examination. By exploring the relationship between HbA1c as a biomarker for Type 2 Diabetes Mellitus and the biomarkers associated with potential complications, we can confidently predict the development of these complications in the future. This study examines a complication of Type 2 Diabetes Mellitus called Diabetic nephropathy. Researchers are investigating the relationship between HbA1c levels and

the glomerular filtration rate (GFR), a key indicator of this condition.

Methods

This research was conducted at the Islamic Hospital Jemursari Surabaya and has obtained ethical clearance from the hospital. The population of this study was obtained from the patient medical records at the hospital, which included patients diagnosed with Type 2 Diabetes Mellitus during the period from September 2022 to 2023, totaling 946 patients. Using Slovin's formula with a 10% margin of error, which is necessary to reduce the number of samples, 90 samples were generated for this study.

Sampling for this study employed non-probability techniques, specifically consecutive sampling methods. The statistical tests used in this study are univariate and bivariate. The univariate test is intended to observe the frequency distribution of each variable. In contrast, the bivariate test employs the Spearman correlation test to assess the relationship between the two variables, HbA1c and GFR. Additionally, cross-tabulation is used to determine the highest frequency of each level of HbA1c at each degree of Diabetic Nephropathy. A cross-sectional study is used for observational analytical studies.

Results and Discussion

Table 1 presents the characteristics of the respondents, including HbA1c levels, serum creatinine levels, age, and gender. In the HbA1c variable, most respondents were in Group 2 (6.1–7.9%), which accounted for 48.9% of the sample, followed by Group 4 ($\geq 9\%$) with 31.1%, Group 3 (8–8.9%) with 13.3%, and Group 1 (5–6%) with 6.7%.

Table 1. Respondent Characteristics

No.	Characteristic	Variable Categories	%
1.	HbA1c (%)	Group 1 (5 – 6%)	6.7
		Group 2 (6.1 – 7.9%)	48.9
		Group 3 (8 – 8.9%)	13.3
		Group 4 ($\geq 9\%$)	31.1
2.	Kreatinin (mg/dL)	Low (< 0.62)	0.9
		Normal (0.62 -1.10)	43.34
		High (> 1.10)	53.34
3.	Age (year)	≤ 59	43.3
		60 – 74	55.6
		≥ 75	1.1
4.	Gender	Women	53.34
		Men	46.67

Note: Both frequency and percentage represent each variable.

This distribution indicates that the majority of patients with type 2 diabetes mellitus in this study had suboptimal glycemic control, with only a small proportion achieving HbA1c levels within

the near-normal range. Clinically, HbA1c has long been recognized as the gold standard for monitoring and evaluating long-term glycemic control over the preceding three months in patients with type 2 diabetes mellitus. In addition, HbA1c is widely used as a biomarker to estimate and detect the risk of chronic complications at an early stage (Kurniawan & Boy, 2024). The predominance of respondents with HbA1c values above the normal range in this study is consistent with the general pattern observed in patients with long-standing type 2 diabetes, who frequently experience difficulties in maintaining stable glycemic control due to progressive β -cell dysfunction and chronic insulin resistance (Banday et al., 2020).

With regard to serum creatinine levels, 53.34% of respondents had elevated creatinine (>1.10 mg/dL), 43.34% were within the normal range (0.62–1.10 mg/dL), and only 0.9% had creatinine levels below 0.62 mg/dL. Creatinine is the end product of creatine phosphate metabolism in muscle and is excreted primarily through the kidneys. Progressive impairment of kidney function in patients with diabetic nephropathy disrupts creatinine excretion, leading to its accumulation in the blood (Gounden et al., 2024). Therefore, elevated serum creatinine in this study reflects reduced renal clearance and supports the presence of various degrees of kidney

dysfunction among patients. Serum creatinine is also an essential parameter in estimating glomerular filtration rate (GFR), which integrates several factors including age, gender, serum creatinine, and body weight. GFR estimation is fundamental to interpreting abnormal clinical and laboratory findings related to kidney disease. Accordingly, Kidney Disease: Improving Global Outcomes (KDIGO) guidelines recommend the measurement of serum creatinine as the initial step in GFR estimation and chronic kidney disease classification (Levey et al., 2020).

In terms of age distribution, the majority of respondents were in the 60–74-year age group (55.6%), followed by those aged ≤ 59 years (43.3%), and only 1.1% were ≥ 75 years old. These findings indicate that most of the study population belonged to the elderly age group. This is in line with the natural history of type 2 diabetes mellitus, in which the risk of developing the disease and its chronic complications increases with age. Elderly individuals are particularly vulnerable to metabolic disorders due to age-related physiological changes, comorbidities, and reduced organ reserve (Francisco et al., 2022). Previous research by Kusdiyah et al. (2021) reported that the incidence of diabetic nephropathy was most common in patients aged 60–64 years, suggesting that this age range represents a critical period during which long-term

hyperglycemia and other risk factors begin to manifest as chronic microvascular complications. The predominance of respondents aged 60–74 years in this study therefore strengthens the hypothesis that advancing age contributes significantly to the risk of diabetic nephropathy.

With regard to gender, 53.34% of the respondents were women and 46.67% were men. Several studies have shown that microvascular complications of type 2 diabetes mellitus, including diabetic nephropathy, may occur more frequently in women (Kautzky-Willer et al., 2023). This pattern is supported by the findings of Kusdiyah et al. (2021), who reported a higher proportion of diabetic nephropathy among female patients compared with males. One possible explanation is that postmenopausal women no longer produce adequate levels of estrogen, a hormone that previously exerted a protective effect against kidney damage. The loss of estrogen in older women may thus increase their susceptibility to kidney injury and accelerate the progression of nephropathy (Wahyuningsih et al., 2019). The higher proportion of female respondents in the present study is therefore consistent with the notion that older women with type 2 diabetes mellitus are at substantial risk of developing diabetic nephropathy.

The correlation analysis between HbA1c levels and GFR, as shown in Table 2,

revealed a Spearman correlation coefficient of 0.416 with a significance value of <0.001 ($p < 0.1$). This finding indicates a statistically significant relationship between HbA1c levels and the degree of diabetic nephropathy, with a correlation of moderate strength (0.26–0.50). In other words, higher HbA1c levels are associated with more advanced stages of nephropathy, as reflected by reduced GFR. From a pathophysiological perspective, persistent hyperglycemia leads to non-enzymatic glycation of proteins, oxidative stress, and hemodynamic changes within the glomerulus. These mechanisms contribute to glomerular hyperfiltration in the early stages, followed by progressive glomerulosclerosis, thickening of the glomerular basement membrane, and eventual decline in GFR (Majid et al., 2020; Tarawifa et al., 2020). The moderate positive correlation obtained in this study is in agreement with previous research demonstrating that poor glycemic control, as measured by elevated HbA1c, is closely related to the occurrence and progression of diabetic nephropathy.

The cross-tabulation between HbA1c groups and GFR categories (Table 3) further illustrates this relationship. In Group 1 (HbA1c 5–6%), most respondents were still in the GFR category 1 (≥ 90 mL/min/1.73 m²), indicating preserved kidney function. In contrast, in Group 2

(HbA1c 6.1–7.9%), there was a notable shift, with respondents distributed across GFR categories 1 to 4, including those with moderately to severely reduced GFR (30–59 and 15–29 mL/min/1.73 m²). This pattern became more apparent in Group 3 (HbA1c 8–8.9%) and Group 4 (HbA1c ≥9%), where a higher proportion of patients were concentrated in GFR categories 3 and 4, which correspond to moderate to severe decreases in kidney function. These findings imply that as HbA1c levels increase, patients are more likely to present with lower GFR values and more advanced stages of diabetic nephropathy. In practical terms, a given HbA1c level can therefore be used as an early indicator to predict the degree of nephropathy in patients with type 2 diabetes mellitus.

The results of this study are consistent with those of Majid et al. (2020), who reported a significant association between HbA1c levels and decreased GFR as well as proteinuria in patients with type 2 diabetes mellitus. Similarly, Tarawifa et al. (2020) found that higher HbA1c levels were associated with an increased risk of diabetic nephropathy. Collectively, these studies support the view that strict glycemic control is essential not only to prevent the onset of nephropathy but also to slow its progression once it has developed. From a clinical standpoint, this underscores the importance of regular HbA1c monitoring as an integral

part of routine care for patients with type 2 diabetes mellitus, especially those with additional risk factors such as advanced age, female sex, long duration of disease, hypertension, and dyslipidemia.

In addition to glycemic control, the present findings highlight the role of routine kidney function assessment in diabetes management. Given that serum creatinine and GFR can reveal early renal impairment even before overt clinical symptoms appear, periodic evaluation of these parameters is crucial. Early detection of reduced GFR enables timely intervention, such as optimization of blood glucose control, blood pressure management, and the use of renoprotective agents, which may delay or prevent progression to end-stage renal disease. However, in routine practice, it is still relatively uncommon to find patients with type 2 diabetes mellitus who regularly undergo both HbA1c and creatinine assessments. Barriers may include limited awareness, financial constraints, or the perception that such examinations are only necessary when symptoms arise.

Overall, the findings of this study reinforce the concept that HbA1c and GFR are interrelated markers that can be used together to stratify the risk of diabetic nephropathy. Higher HbA1c values tend to be accompanied by more advanced degrees of nephropathy, as demonstrated by lower

GFR categories and higher proportions of patients with impaired kidney function. These results strengthen the rationale for integrating routine HbA1c measurement and kidney function tests into standard diabetes care protocols at the primary and secondary healthcare levels. Regular

monitoring, accompanied by appropriate counseling and early therapeutic intervention, has the potential to reduce the burden of diabetic nephropathy, improve patients' quality of life, and decrease diabetes-related morbidity and mortality.

Table 2. Spearman Correlation

Correlations				
		HBA1C		GFR
Spearman's rho	HBA1C	Correlation Coefficient	1.000	.416**
		Sig. (2-tailed)	.	<.001
		N	90	90
	GFR	Correlation Coefficient	.416**	1.000
		Sig. (2-tailed)	<.001	.
		N	90	90

Table 3. Cross Tabulation

Cross Tabulation		GFR								Total	
		1 (≥90)		2 (60-89)		3 (30-59)		4 (15-29)			
HbA1c	1 (5 – 6 %)	4	66.7%	2	33.4%	0	0%	0	0%	6	6.67%
	2 (6.1 - 7.9%)	8	18.2%	20	45.5%	15	34.1%	1	2.3%	44	48.9%
	3 (8 – 8.9 %)	0	0%	4	33.4%	7	58.3%	1	8.34%	12	13.34%
	4 (≥9%)	1	3.6%	8	28.6%	19	67.86%	0	0%	28	31.12%
Total										90	100%

Conclusion

Different HbA1c levels correlate with varying stages of diabetic nephropathy. Understanding the Correlation between these variables is intended to enhance medical professionals' awareness of the risk of developing Nephropathy in

patients with Type 2 Diabetes Mellitus, , emphasizing the need for routine monitoring. It is recommended that patients undergo HbA1c testing every three months alongside creatinine evaluation for early detection of complications, supported by

health promotion programs such as periodic mass screening.

However, this study has several limitations that should be acknowledged to strengthen its academic rigor. The cross-sectional design precludes establishing causality, capturing only associations at a single time point. Reliance on medical records from a single center (RSI Jemursari) with a modest sample size (n=90) limits generalizability, while potential confounders like diabetes duration, hypertension control, and medication use were not fully adjusted. Future longitudinal studies with larger, multi-center samples and comprehensive confounder control are warranted to validate these findings and explore additional risk factors.

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