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Vulnerability and Concern as Key Determinants of HIV Infection among Men Who Have Sex with Men: A Case–Control Study at Anutapura Regional General Hospital, Palu, Indonesia.

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ABSTRACT

Human Immunodeficiency Virus (HIV) remains a major public health problem, particularly among men who have sex with men (MSM), who are at increased risk of infection. Various cognitive, psychosocial, social, and behavioral factors may influence HIV incidence in this population. This study aimed to analyze the determinants of HIV infection among MSM at Anutapura Regional General Hospital, Palu, Indonesia. This study used a quantitative analytical design with a case–control approach. The population consisted of MSM who underwent HIV testing or received HIV treatment at Anutapura Regional General Hospital during 2023–2025. A total of 126 respondents were included, comprising 63 HIV-positive MSM as cases and 63 HIV-negative MSM as controls. HIV-positive participants were selected using total sampling, while HIV-negative participants were selected using purposive sampling. Data were collected through structured questionnaires and medical records. Independent variables included knowledge, vulnerability, concern, social life, and preventive actions. Data were analyzed using multivariate logistic regression. The results showed that vulnerability was significantly associated with HIV incidence (p = 0.001; OR = 3.76; 95% CI: 1.74–8.15) and was the most dominant risk factor. Concern toward HIV acted as a protective factor (p = 0.032; OR = 0.41; 95% CI: 0.18–0.93). Knowledge, social life, and preventive actions were not significantly associated with HIV incidence. In conclusion, vulnerability is the main determinant of HIV infection among MSM, while concern toward HIV plays a protective role. These findings indicate that HIV prevention programs should focus on reducing vulnerability through behavioral interventions, improving access to health services, and strengthening psychosocial support for MSM populations.

Keywords: HIV; Men Who Have Sex with Men; risk factors; case–control study; vulnerability.

INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS), caused by the Human Immunodeficiency Virus (HIV), has evolved from a mysterious disease first identified in the early 1980s into a global epidemic that has reshaped public health policies and highlighted humanity's ongoing struggle against one of the most severe medical and social challenges of the modern era [1]. HIV is a virus that can lead to the development of AIDS by weakening the human immune system, resulting in decreased immune function and increased susceptibility to various diseases [2].

By the end of 2024, the number of people living with HIV worldwide was estimated to reach approximately 40.8 million, with a range of 37.0 to 45.6 million individuals. The global prevalence of HIV among adults aged 15 to 49 years was estimated at 0.7%, ranging from 0.6% to 0.8%. Nevertheless, the distribution and burden of the HIV epidemic vary considerably across countries and regions [3]

Fluctuating trends in the number of people living with HIV are not only observed globally but also at the national level. In Indonesia, data from the HIV/AIDS Information System (SIHA) based on the Quarterly Report on the Development of HIV/AIDS and Sexually Transmitted Infections (STIs) for the third quarter of 2022 indicated that the cumulative number of HIV cases reached 7,036 in 2019, increased to 8,639 in 2020, declined to 5,750 in 2021, and rose again to 6,519 during the period of January to September 2022. Furthermore, 71% of newly identified cases during January to September 2022 occurred among males, and 27.5% of these cases were among men who have sex with men (MSM). This proportion increased compared to the previous year, as WHO data in 2021 reported that the prevalence of HIV among MSM in Indonesia reached 17.9% [4].

According to data from the Palu City Health Office in 2023, a total of 880 HIV/AIDS cases were recorded, of which 564 cases (approximately 64%) occurred among males and 316 cases (approximately 36%) among females. These findings indicate that the prevalence of HIV/AIDS in Palu City is higher among males than females. This situation underscores the need for special attention to male populations, who may face higher risks due to unsafe sexual behaviors, and highlights the importance of strengthening prevention and community education efforts [5]

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The highest number of HIV cases among MSM in Palu City was reported by Talise Community Health Center with 26 cases, followed by Singgani (19 cases), Sangurara (13 cases), Kawatuna (12 cases), Bulili (11 cases), Birobuli (10 cases), Tawaili (8 cases), Mabelopura (8 cases), Nosarara (7 cases), Kamonji (6 cases), Lere (3 cases), Mamboro (3 cases), Pantoloan (3 cases), and Tipo (1 case) [6]. Medical record data from Anutapura Regional General Hospital Palu during the period 2023–2024 showed 127 documented HIV cases, of which 63 cases (44.9%) occurred among MSM. This finding indicates that nearly half of HIV cases treated at the main referral hospital in Palu originated from the MSM population.[7]

These phenomena indicate that MSM constitute one of the key populations contributing substantially to the growing HIV epidemic burden in Palu City, particularly within the service coverage area of Anutapura Regional General Hospital Palu. Moreover, this group has the potential to act as a bridge population for HIV transmission to the general population, either through heterosexual relationships or through extensive and complex sexual social networks, thereby amplifying the spread of HIV within the community.

A study conducted by Hasby and Korib, using data from the 2018 Integrated Biological and Behavioral Survey (IBBS) of the Indonesian Ministry of Health involving 4,284 MSM respondents found that the prevalence of HIV among MSM in Indonesia reached 17.97%. Several factors were significantly associated with HIV infection, including age ≥ 25 years, unmarried status, lack of circumcision, participation in sex parties, and positive syphilis status. The strongest risk factor identified was positive syphilis status, which increased the risk of HIV infection by 3.41 times compared to individuals without syphilis. These results emphasize the importance of addressing behavioral and sexual health factors in HIV prevention efforts, particularly among MSM who are categorized as a high-risk population. The findings further highlight the urgency of expanding access to syphilis testing and treatment, as well as promoting safe sexual practices among MSM. [8]

Another study by Umar et al. conducted at the Banuta Pura Support Foundation in Palu City revealed that social factors play a significant role in HIV/AIDS incidence among MSM communities. The study showed that most participants experienced a lack of parental affection and supportive parenting, as well as discrimination within their families. These conditions encouraged them to seek emotional support from same-sex partners, which subsequently developed into unprotected sexual relationships. In addition, the use of social media applications such as Hornet, Grindr, and MiChat facilitated partner-seeking among MSM, thereby increasing the likelihood of engaging in high-risk sexual behaviors without protection. Limited knowledge regarding safe sexual practices was identified as a major contributor to the high vulnerability to HIV infection among MSM. These findings underscore the importance of educational interventions and family support in preventing the spread of HIV/AIDS among vulnerable populations. [9]

A healthy social environment plays an important role in reducing high-risk behaviors, such as unprotected sexual intercourse and shared injection drug use. Individuals with strong social networks tend to have better coping mechanisms for stress, psychological pressure, and stigma, enabling them to avoid behaviors that increase the risk of HIV infection. In addition, community-based education and the involvement of community leaders are effective in shaping social norms that support HIV prevention behaviors.[10]

The selection of social life and concern variables in this study was based on behavioral and psychosocial theories, particularly the Health Belief Model and Social Cognitive Theory, which emphasize perceived risk, emotional responses, and social interactions as important determinants of health-related behaviors. Previous studies have shown that social relationships and levels of concern toward HIV influence risk perception, preventive practices, and health-seeking behavior among MSM. In addition, in the local context of Anutapura Regional General Hospital, social networks and personal concern were observed to play an important role in shaping HIV-related decision-making. Therefore, these variables were considered relevant for understanding HIV vulnerability among MSM in this setting, alongside other commonly studied factors such as stigma and access to health services.

This study focuses on five key variables hypothesized to determine HIV incidence among MSM: knowledge, vulnerability, concern, social life, and preventive actions. These variables represent interconnected cognitive, psychosocial, social, and behavioral dimensions that influence HIV risk. Limited knowledge about HIV transmission and prevention may hinder informed decision-making related to sexual behavior. Physical and psychosocial vulnerability, combined with inadequate social support and limited access to accurate information, increases exposure to high-risk situations. In addition, concerns related to stigma and social rejection often discourage MSM from accessing HIV-friendly health services. Closed social environments and weak community support may further reinforce norms that are not conducive to HIV prevention, while preventive practices such as consistent condom use and routine screening are frequently neglected.

Unlike most previous studies in Indonesia that primarily focus on behavioral and demographic factors, this study emphasizes the psychosocial aspects of HIV risk, particularly vulnerability and concern. By integrating the

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Health Belief Model and Theory of Planned Behavior, this study aims to provide a deeper understanding of how perceived risk, emotional responses, and social influences interact in shaping HIV occurrence. This approach is expected to contribute novel and context-sensitive insights for strengthening HIV prevention strategies among MSM populations.

Therefore, it is essential to conduct research to better understand the determinants contributing to the increasing number of HIV cases among MSM at Anutapura Regional General Hospital Palu. Identifying the factors influencing HIV incidence in this population is a strategic step toward strengthening prevention and control efforts. This study is expected to provide important evidence to support the development of more effective and targeted interventions.

MATERIALS AND METHODS

This study was a quantitative analytical observational study using a case-control design. The case-control approach was applied to estimate the magnitude of risk factors associated with HIV incidence by comparing individuals with the outcome (cases) and without the outcome (controls), followed by retrospective assessment of prior exposures. This design is appropriate for identifying determinants of disease occurrence, particularly for conditions with relatively low incidence but significant public health impact.

The study was conducted at Anutapura Regional General Hospital (RSUD Anutapura) Palu, Central Sulawesi, Indonesia. Data collection took place from September to December 2025. The hospital is a regional referral center providing specialized services, including HIV/AIDS care, and serves patients from Palu City and surrounding districts, making it a suitable setting for recruiting the target population of men who have sex with men (MSM).

The study population consisted of all MSM who underwent HIV testing or received HIV treatment at Anutapura Regional General Hospital Palu during the period 2023–2025. A total of 126 respondents were included, comprising 63 HIV-positive MSM as the case group and 63 HIV-negative MSM as the control group with a 1:1 ratio. All HIV-positive MSM were included using total sampling, while HIV-negative MSM were selected using purposive sampling based on their willingness to participate.

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Health Research Ethics Committee, Institute of Health Sciences Pelamonia (Approval No: REK/061/KEPK-IIKP/IX/2025). Written informed consent was obtained from all participants prior to data collection. Participants were informed about the purpose of the study, their voluntary participation, and their right to withdraw at any time without any consequences. All data were anonymized and treated confidentially to protect participants' privacy.

Cases were defined as MSM who had undergone HIV testing using a rapid test and obtained a positive result at Anutapura Regional General Hospital Palu. Controls were MSM who had been tested using the same method and obtained a negative result. Exclusion criteria included refusal to provide written informed consent, uncooperative behavior during data collection, and individuals who were not identified as MSM based on hospital medical records.

The dependent variable was HIV incidence among MSM. The independent variables included knowledge, vulnerability, concern, social life, and preventive actions related to HIV risk. Demographic variables such as age, educational level, and area of residence were also collected. Knowledge was measured using a 10-item questionnaire, vulnerability and concern using 5-item Likert-scale instruments, social life using a 5-item dichotomous questionnaire, and preventive actions using structured behavioral questions.The questionnaire was adapted from a validated instrument developed by Izzulhaq 2018 [11]. To ensure its suitability for the study context, content validity and reliability testing were conducted before data collection.

The research instruments were tested for validity and reliability prior to data collection. Item validity was assessed using correlation analysis, and all items met the acceptable criteria. Reliability testing was conducted using Cronbach's Alpha. The results showed that the knowledge variable had an Alpha value of 0.700, vulnerability 0.621, concern 0.635, social life 0.679, and preventive actions 0.739. These values indicate acceptable internal consistency, suggesting that the instruments were sufficiently reliable for measuring the study variables.

Primary data were collected through face-to-face interviews using structured questionnaires administered by trained enumerators. Secondary data were obtained from hospital medical records, including HIV test results and patient registration data from 2023 to 2025. Enumerator training was conducted prior to data collection to ensure standardized interviewing techniques, ethical conduct, accurate questionnaire administration, and protection of participant confidentiality, particularly considering the sensitivity of the MSM population.

Data analysis was performed in three stages. Univariate analysis was used to describe the frequency distribution of all variables. Bivariate analysis was conducted to examine associations between each independent variable and HIV incidence using odds ratios (OR) with a 95% confidence interval and a significance level of 0.05.

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Multivariate analysis using logistic regression was applied to identify the most dominant risk factor after controlling for other variables. Results were presented in tables and narrative form.

RESULTS

Table 1. Distribution of Respondent Residence

Location	Case Group		Control Group	
	n	%	n	%
Palu	33	52.4	36	57.1
Sigi	10	15.9	13	20.6
Toli-toli	3	4.8	0	0
Luwuk Banggai	1	1.6	2	3.2
Morowali Utara	1	1.6	0	0
Parigi Moutong	2	3.2	4	6.3
Donggala	5	7.9	1	1.6
Tojo Una-una	2	3.2	1	1.6
Buol	1	1.6	0	0
Poso	5	7.9	2	3.2
Makassar	0	0	4	6.3
Total	**63**	**100**	**63**	**100**

Based on Table 1, among the 63 respondents in the case group, most resided in Palu City, totaling 33 respondents (52.4%). Similarly, among the 63 respondents in the control group, the majority also lived in Palu City, accounting for 36 respondents (57.1%).

Table 2. Respondents' Age Distribution

Age	Case Group		Control Group	
	n	%	n	%
20 – 30 Years old	53	82.5	50	79.4
31 – 40 Years old	10	15.9	13	20.6
> 40 Years old	1	1.6	0	0
Total	**63**	**100**	**63**	**100**

Based on Table 2, among the 63 respondents in the case group, the majority were aged 20–30 years, totaling 53 respondents (82.5%). Likewise, among the 63 respondents in the control group, most respondents were also aged 20–30 years, accounting for 50 respondents (79.4%).

Table 3. Frequency Distribution of Respondents' Education Level

Education Level	Case Group		Control Group	
	n	%	n	%
No Schooling	3	4.8	1	1.6
Elementary School	0	0	2	3.2
Junior High School	4	6.3	1	1.6
Senior High School / Vocational School	24	38.1	15	23.8
Collage/University	32	50.8	44	69.8
Total	**63**	**100**	**63**	**100**

Based on Table 3, among the 63 respondents in the case group, the majority had a college/university education, totaling 32 respondents (50.8%). Similarly, among the 63 respondents in the control group, most respondents also had a college/university education, accounting for 44 respondents (69.8%).

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Table 4. Distribution of Independent Variables between Case and Control Groups among MSM at Anutapura Regional General Hospital Palu

Variable	Category	Case n (%)	Control n (%)
Knowledge	Poor	32 (50.8%)	31 (49.2%)
	Good	31 (49.2%)	32 (50.8%)
Vulnerability	Not Vulnerable	19 (30.2%)	41 (65.1%)
	Vulnerable	44 (69.8%)	22 (34.9%)
Concern	Not Concerned	30 (47.6%)	18 (28.6%)
	Concerned	33 (52.4%)	45 (71.4%)
Social Life	Poor	29 (46%)	20 (31.7%)
	Good	34 (54%)	43 (68.3%)
Preventive actions	Poor	25 (39.7%)	33 (52.4%)
	Good	38 (60.3%)	30 (47.6%)

Based on Table 4, in terms of knowledge, most respondents in the case group had poor knowledge (50.8%), whereas the control group predominantly demonstrated good knowledge (50.8%). Regarding vulnerability, the majority of cases were classified as vulnerable (69.8%), while most controls were not vulnerable (65.1%). With respect to concern, more than half of the case group was categorized as concerned (52.4%), with a higher proportion observed in the control group (71.4%). In terms of social life, most respondents in both the case group (54.0%) and the control group (68.3%) reported having good social life. Concerning preventive actions, the majority of cases demonstrated good preventive behaviors (60.3%), whereas poor preventive behaviors were more common among controls (52.4%). Overall, these findings indicate that vulnerability and concern show clearer differences between case and control groups compared to knowledge, social life, and preventive actions, suggesting their potential role in influencing HIV occurrence among MSM.

Table 5. Frequency Distribution of Knowledge as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

Knowledge	HIV Incidence among MSM				Total		*P value*	OR 95% CI
	Case		Control					
	n	%	n	%	n	%		*(min-max)*
Poor	32	50.8	31	49.2	63	50	0,859	1,066 (0,530-2,143)
Good	31	49.2	32	50.8	63	50		
Total	**63**	**100**	**63**	**100**	**126**	**100**		

Based on Table 5, among the 126 respondents, poor knowledge was predominant in the case group, accounting for 32 respondents (50.8%), whereas good knowledge was more common in the control group, also comprising 32 respondents (50.8%). The estimated Odds Ratio (OR) was 1.066 (95% CI: 0.530–2.143), crossing the null value of 1, which indicates no statistically meaningful difference in HIV occurrence between respondents with poor and good knowledge. Thus, knowledge level was not identified as a risk factor or a protective factor for HIV incidence among MSM in this study.

Table 6. Frequency Distribution of Vulnerability as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

Vulnerability	HIV Incidence among MSM				Total		*P value*	OR 95% CI
	Case		Control					
	n	%	n	%	n	%		*(min-max)*
Not Vulnerable	19	30.2	41	65.1	60	47.6	0,000	1.00

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Vulnerability	HIV Incidence among MSM				Total		*P value*	OR 95% CI *(min-max)*
	Case		Control					
	n	%	n	%	n	%		
Vulnerable	44	69.8	22	34.9	66	52.4		4.31 (2.04-9.09)
Total	**63**	**100**	**63**	**100**	**126**	**100**		

Based on Table 6, vulnerability was more frequent among cases (69.8%) than controls (34.9%). The analysis showed that vulnerable MSM had 4.31 times higher odds of HIV infection compared to those who were not vulnerable (OR = 4.31; 95% CI: 2.04–9.09; p < 0.001). This indicates that vulnerability is a significant risk factor for HIV infection among MSM.

Table 7. Frequency Distribution of Concern as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

Concern Level	HIV Incidence among MSM				Total		*P value*	OR 95% CI *(min-max)*
	Case		Control					
	n	%	n	%	n	%		
Not Concerned	30	47.6	18	28.6	48	38.1		1.00
Concerned	33	52.4	45	71.4	78	61.9	0,028	0.44 (0.21-0.92)
Total	**63**	**100**	**63**	**100**	**126**	**100**		

Based on Table 7, among the 126 respondents, the majority in the case group were concerned, totaling 33 respondents (52.4%), and in the control group, most respondents were also concerned, accounting for 45 respondents (71.4%). The odds ratio (OR) was 0.44 with a 95% confidence interval (CI: 0.21–0.92), which does not cross the value of 1, indicating that respondents who were concerned had a lower likelihood of experiencing HIV compared to those who were not concerned. Thus, concern was identified as a protective factor against HIV incidence among MSM.

Table 8. Frequency Distribution of Social Life as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

Social Life Level	HIV Incidence among MSM				Total		*P value*	OR 95% CI *(min-max)*
	Case		Control					
	n	%	n	%	n	%		
Poor	29	46	20	31.7	49	38.9		1.834
Good	34	54	43	68.3	77	61.1	0,100	(0,887-3,790)
Total	**63**	**100**	**63**	**100**	**126**	**100**		

Based on Table 8, most respondents in both the case (54.0%) and control groups (68.3%) had good social life. The odds ratio was 1.834 (95% CI: 0.887–3.790). Although this suggests a possible higher odds of HIV among respondents with poor social life, the association was not statistically significant because the confidence interval includes 1 and the p-value was greater than 0.05. Therefore, social life cannot be considered a significant risk factor for HIV incidence among MSM in this study.

Vol. XXI No. 1 June 2026
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Table 9. Frequency Distribution of Preventive Actions as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

Preventive Actions	HIV Incidence among MSM				Total		*P value*	OR 95% CI *(min-max)*
	Case		Control					
	n	%	n	%	n	%		
Poor	25	39.7	33	52.4	58	46.6		0,598
Good	38	60.3	30	47.6	68	53.4	0,153	(0,295-1,212)
Total	**63**	**100**	**63**	**100**	**126**	**100**		

Based on Table 9, among the 126 respondents, most individuals in the case group had good preventive actions, with 38 respondents (60.3%), while in the control group, the majority had poor preventive actions, totaling 33 respondents (52.4%). The Odds Ratio (OR) of 0.598 with a 95% Confidence Interval (CI) of 0.295–1.212 indicates that respondents with good preventive actions had lower odds of experiencing HIV compared to those with poor preventive actions. However, because the confidence interval includes 1 and the p-value is 0.153, this result is not statistically significant.

Table 10. Analysis of the Most Influential Risk Factors for HIV among MSM at Anutapura Regional General Hospital Palu

Variable	B	S.E.	Wald	f	ig.	Exp(B)
Vulnerability	1.325	.394	11.288	1	.001	3.761
Concern	-.885	.414	4.576	1	.032	.413
Social Life	-.591	.412	2.050	1	.152	.554
Preventive Actions	.587	.410	2.047	1	.152	1.798
Constant	-.331	.368	.809	1	.368	.718

In the multivariate logistic regression analysis (Table 10), the “Not Vulnerable” group was used as the reference category, resulting in an odds ratio of 3.761 for the vulnerable group. This indicates that MSM who were classified as vulnerable had significantly higher odds of HIV infection compared to those who were not vulnerable. This finding is consistent with the bivariate analysis, and the difference in odds ratio values reflects the adjustment for other variables in the model rather than a contradiction in the direction of the association.

These findings confirm that vulnerability is the most influential risk factor for HIV occurrence among MSM ($p = 0.001$; OR = 3.761; 95% CI: 1.737–8.147). After controlling for behavioral, social life, and concern variables, MSM with a high level of vulnerability had approximately 3.8 times higher odds of being infected with HIV. In contrast, the concern variable showed a protective effect against HIV infection ($p = 0.032$; OR = 0.413; 95% CI: 0.183–0.929), indicating that MSM who had a higher level of concern about HIV tended to have lower odds of infection. This suggests that high vulnerability, which may be influenced by individual risk perception, exposure to high-risk situations, and limited ability to avoid unsafe practices, increases HIV transmission risk, while adequate concern toward HIV may encourage safer behaviors and reduce the likelihood of infection in this population.

DISCUSSION

Knowledge as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

This finding indicates that among MSM, good knowledge about HIV does not necessarily lead to changes in attitudes or the adoption of safer sexual practices. This condition may be influenced by various contextual factors, including social norms, partner pressure, stigma, and limited perceived behavioral control. Within the framework of the Theory of Planned Behavior, knowledge alone is insufficient to drive behavioral change unless it is supported by favorable attitudes, supportive subjective norms, and individuals’ confidence in their ability to control risky behaviors. In the absence of these supporting components, knowledge tends to remain passive and is not strong enough to consistently promote the adoption of HIV-preventive behaviors.

Previous research among men who have sex with men (MSM) has also shown that knowledge of HIV/AIDS is not significantly associated with HIV incidence ($p > 0.05$), whereas attitudes demonstrate a significant association

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with HIV incidence, which is consistent with the findings of this study [12]. Furthermore, a cross-sectional study conducted in China reported that variations in HIV knowledge across population subgroups were not directly correlated with infection status when health-related behaviors were not considered, indicating that knowledge alone is insufficient to explain HIV risk [13].This finding suggests that knowledge and literacy function as enabling resources that require supportive social, psychological, and environmental conditions to be translated into sustained protective behaviors [14].

The findings of this study are consistent with research conducted by Rahmawati et al. which demonstrated that knowledge or health literacy alone is insufficient to produce meaningful changes in health-related behaviors without support from social, psychological, and environmental factors. In this context, HIV prevention among men who have sex with men (MSM) cannot rely solely on improving knowledge, but should instead focus on promoting safer sexual behaviors, increasing awareness of partners' HIV status, and strengthening health system and social support. Therefore, comprehensive prevention efforts through continuous education, promotion of consistent condom use, routine HIV and sexually transmitted infection (STI) screening, as well as cross-sectoral and community-based collaboration are essential strategies to reduce HIV transmission among MSM [15]

A study conducted by Mansy et al. emphasized that low levels of knowledge are not always associated with changes toward protective behaviors, indicating that knowledge must be integrated with other factors in health interventions[16]. Another study by Alshahrani. among the general adult population showed that determinants of HIV knowledge are strongly influenced by factors such as education and demographic characteristics, reinforcing the notion that knowledge does not automatically translate into protection against HIV infection[17].

Vulnerability as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

This finding indicates that the level of vulnerability is an influential factor in HIV occurrence, with a relationship that demonstrates a risk direction based on the statistical analysis. This condition may be explained by the fact that respondents classified as "vulnerable" tend to be in situations or circumstances that increase their exposure to risk, such as higher intensity of sexual interactions or risk perceptions that are not consistently followed by preventive behaviors. In contrast, respondents who are considered not vulnerable may have limitations in certain activities or exercise greater caution in their sexual behaviors, thereby reducing their risk of HIV exposure.

Recent systematic review studies have shown that perceived vulnerability to HIV is consistently associated with risky sexual exposure and preventive behaviors among sexual minority groups, thereby supporting the finding that MSM who do not perceive themselves as vulnerable have a lower risk of HIV infection compared to those who perceive themselves as vulnerable [18]. Research conducted in Brazil also demonstrated that risk perception is correlated with sexual practices, where experiences of vulnerability influence risk-related behaviors[19].

These findings are consistent with a study by Abdulai et al. which showed that perceptions of risk or vulnerability to HIV are significantly associated with HIV prevention behaviors. The study found that individuals who perceived themselves as vulnerable tended to neglect preventive practices, such as consistent condom use and routine HIV testing, despite having adequate knowledge about HIV. In contrast, respondents who recognized themselves as being at high risk for HIV showed a greater tendency to engage in preventive behaviors, particularly when perceived vulnerability was accompanied by strong self-efficacy[20].

This study also confirms that perceived vulnerability does not always lead to optimal behavioral change, especially when individuals face psychosocial and structural barriers, such as stigma, partner pressure, and limited perceived behavioral control. These findings reinforce the framework of the Health Belief Model (HBM), which posits that perceived susceptibility is a key component of health behavior, but its effectiveness is highly dependent on other supporting factors, including perceived benefits and an individual's ability to control risky behaviors.

Previous research by Gorge. demonstrated that MSM are highly vulnerable to HIV infection due to the predominance of risky sexual behaviors, such as condomless anal intercourse, and social networks that support risky practices. This indicates that MSM experience a high level of vulnerability to HIV as a result of the combined influence of risky sexual behaviors and unfavorable psychosocial factors. These findings are in line with the results of the present study, which confirm a significant association between vulnerability and HIV occurrence, thereby emphasizing that vulnerability is an important determinant of HIV infection among MSM[21].

Within the framework of the Health Belief Model (HBM), perceived susceptibility is a crucial determinant influencing disease prevention behaviors. Individuals with a high perception of vulnerability are theoretically more motivated to adopt preventive actions. However, the results of this study indicate that despite some respondents having

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a high level of perceived vulnerability, HIV occurrence remained high within this group. This suggests that risk perception alone is insufficient to prevent HIV infection without consistent behavioral change.

Furthermore, based on the Theory of Planned Behavior (TPB), health behavior is influenced by the interaction between individual attitudes, subjective norms, and perceived behavioral control. In the context of this study, MSM with high vulnerability may already be aware of their HIV risk but continue to face barriers in controlling risky sexual behaviors, such as partner pressure, sexual relationship dynamics, or social environmental influences. These conditions may lead individuals to persist in engaging in risky behaviors despite being aware of their own vulnerability.

Thus, the findings of this study confirm that vulnerability has a significant association with HIV occurrence among MSM at Anutapura Regional Hospital, Palu. MSM classified as vulnerable were found to have a substantially higher likelihood of HIV infection compared to those who were not vulnerable, as indicated by an odds ratio greater than one. This suggests that vulnerability represents an important risk factor for HIV infection among MSM. These findings highlight that increased exposure to risk factors plays an important role in HIV transmission, even though a good perception of vulnerability does not automatically translate into consistent preventive behaviors. Therefore, HIV prevention interventions should focus not only on increasing risk perception but also on strengthening behavioral control, enhancing safe sexual decision-making skills, and providing social support, so that the elevated statistical risk identified in this study can be effectively reduced and translated into sustainable protection against HIV infection among MSM.

Concern as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

Within the framework of the Health Belief Model (HBM), concern reflects the components of perceived severity and perceived susceptibility, namely the extent to which individuals feel vulnerable and perceive the seriousness of HIV consequences. MSM with higher levels of concern tend to be more aware of the risks and impact of the disease, which in turn encourages them to consider preventive actions. Conversely, low levels of concern may reduce the perceived threat, ultimately diminishing motivation to engage in safer sexual behaviors, even when individuals possess adequate knowledge[22].

A study conducted by Mbilizi Chimwaza et al. demonstrated that individuals who are aware of their risk of HIV infection are generally more cautious in their sexual behaviors. Perceived concern motivates respondents to consider safer behavioral choices as a form of prevention. However, the consistent adoption of safe sexual practices does not always occur optimally, as it is still influenced by external factors such as partner pressure or the surrounding social environment. Certain situational conditions may also limit individuals' ability to consistently implement preventive behaviors that they recognize as important [23].

Research by Ramirez et al. revealed that individuals with a high perception of HIV transmission risk tend to be more responsive to prevention efforts. Awareness of the possibility of infection encourages more cautious decision-making, particularly in situations involving sexual exposure. This condition leads individuals to place greater consideration on the use of protective strategies to reduce infection risk. Therefore, risk perception or concern can be utilized as a foundation for designing more targeted and effective HIV prevention interventions[18].

Furthermore, when linked to the Theory of Planned Behavior (TPB), perceptions of vulnerability and disease severity contribute to the formation of attitudes toward behavior, particularly attitudes toward HIV preventive practices. Adequate concern can strengthen positive attitudes toward protective behaviors, such as condom use or routine HIV testing. However, without the support of perceived behavioral control and conducive subjective norms, concern alone may not be fully translated into concrete preventive actions[24].

Thus, these findings underscore that HIV knowledge among MSM needs to be accompanied by the development of a realistic and meaningful perception of risk. Integrating components of the Health Belief Model (susceptibility, severity, benefits, and cues to action) and the Theory of Planned Behavior (attitudes, subjective norms, and perceived behavioral control) is essential in HIV prevention interventions. Approaches that not only enhance knowledge but also strengthen risk awareness and individuals' ability to control their behavior are likely to be more effective in reducing HIV incidence among MSM.

Social Life as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

In this study, social life was not significantly associated with HIV occurrence among MSM. Although the odds ratio was greater than one, this finding should be interpreted cautiously because it was not statistically significant. This result differs from several previous studies that have reported a significant influence of social networks and peer interactions on HIV-related risk behaviors. One possible explanation is that the measurement of social life in this study may not adequately capture the complexity and quality of social relationships. In addition, the relatively limited sample size and the case–control design may have reduced the statistical power to detect a significant association.

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Furthermore, unmeasured confounding factors, such as stigma, access to health services, and partner dynamics, may also have influenced the results. Therefore, the role of social life in HIV risk among MSM requires further investigation using larger samples and more comprehensive measurement tools.

A study by Ekarika et al. analyzed various social determinants of health related to the HIV epidemic, including structural social conditions, and showed that certain social factors do not always have a strong direct correlation with risk behaviors or specific outcomes without considering broader contextual influences. These findings emphasize the need for a holistic approach, as the evidence regarding social determinants varies across settings and populations[25].

Research conducted by Payi et al. highlighted the role of social determinants of health, including socioeconomic conditions, education, and stigma or social exclusion, in HIV outcomes. Although many social determinants are associated with health outcomes, macro-level evidence indicates that social effects are not always consistent across populations and do not necessarily constitute significant risk factors in the absence of interaction with other factors such as individual behaviors or access to health services[26].

Other studies have also reported that social variables, such as social support, do not always show a statistically significant correlation with clinical outcomes among people living with HIV. For instance, a study examining factors associated with antiretroviral therapy adherence found that social support was not significantly associated with medication adherence, whereas knowledge and attitudes showed significant effects.

Within the context of health behavior theories, social life is closely related to subjective norms in the Theory of Planned Behavior (TPB) and cues to action in the Health Belief Model (HBM). Adequate social support has the potential to encourage individuals to adopt HIV preventive behaviors through the reinforcement of positive norms and environmental encouragement. Conversely, poorer social life conditions may limit access to information, emotional support, and social control mechanisms that play an important role in shaping safer sexual behaviors[27].

Thus, although social life was not shown to be a statistically significant risk factor in this study, its role remains important to consider in HIV prevention efforts among MSM. Interventions that emphasize strengthening social support, fostering supportive environments, and promoting social norms that encourage healthy behaviors remain relevant for reducing HIV risk. Community-based approaches that take social aspects into account may serve as complementary strategies in HIV prevention programs.

Preventive Actions as a Risk Factor for HIV among MSM at Anutapura Regional General Hospital Palu

In this study, preventive behaviors were not significantly associated with HIV occurrence among MSM. Although the odds ratio was less than one, this finding cannot be interpreted as evidence of a protective effect due to the lack of statistical significance. This result differs from several previous studies that have reported a significant role of consistent preventive practices in reducing HIV transmission. One possible explanation is that self-reported preventive behaviors may not accurately reflect actual consistency or effectiveness in real-life risk situations. In addition, limitations in sample size and potential reporting bias related to the sensitive nature of sexual behavior may have influenced the results.

Within the framework of the Theory of Planned Behavior (TPB), behavior represents the final outcome of the interaction between attitudes, subjective norms, and perceived behavioral control. The lack of a significant association in this study suggests that even when respondents report good preventive behaviors, other supporting factors such as partner pressure, social norms, and individuals' ability to control risky behaviors continue to play an important role. Therefore, HIV preventive behaviors are not determined solely by intention or knowledge, but are also shaped by the surrounding social and psychological context[28].

Overall, these findings indicate that preventive behaviors alone were not sufficient to demonstrate a statistically significant protective effect against HIV among MSM in this study. Therefore, future research is needed to further examine the complex interaction between individual behavior and social context using larger samples and more robust measurement methods. Such studies are expected to provide a clearer understanding of the role of preventive actions in HIV prevention.

Risk Factors for HIV Occurrence among MSM at Anutapura Regional General Hospital Palu

The results of this analysis indicate that psychological factors particularly vulnerability and concerncontribute more substantially to HIV occurrence among MSM than social factors and reported behaviors. These findings are consistent with the frameworks of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB), which emphasize that risk perception and emotional responses are key determinants in the formation of health-related behaviors.

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The multivariate analysis demonstrates that vulnerability is the most dominant factor associated with HIV occurrence among MSM at Anutapura Regional General Hospital Palu. MSM who are in a vulnerable condition have nearly four times higher odds of experiencing HIV compared with those who are not vulnerable, after controlling for other variables in the model. This finding aligns with the Health Belief Model, which positions perceived susceptibility as a primary determinant in shaping responses to health threats. High perceived vulnerability reflects individuals' awareness of the risks they face; however, under certain conditions, it may also represent sustained and real exposure to ongoing risk.

The concern variable also shows a statistically significant association and exhibits a protective effect against HIV occurrence. Individuals who experience concern about HIV tend to be more vigilant and cautious when making decisions related to sexual behavior, thereby reducing the likelihood of infection. Within the frameworks of the Health Belief Model and Protection Motivation Theory (PMT), concern represents an emotional response to perceived threat that can enhance protective motivation and encourage preventive actions. This underscores the important role of emotional factors in influencing health behaviors, particularly in the context of infectious diseases such as HIV.

In contrast, social life and reported behaviors do not show statistically significant associations in the multivariate analysis. This suggests that social factors and self-reported actions may not exert a direct influence on HIV occurrence once internal risk perceptions are taken into account. Within the Theory of Planned Behavior, social life is closely related to subjective norms, while behavior represents the final outcome of intention and perceived behavioral control. The lack of significance for these variables indicates that social support and reported preventive actions alone may be insufficient to protect individuals from HIV risk in the absence of strong perceptions of vulnerability and sustained vigilance.

Taken together, these findings confirm that internal psychological factors-particularly perceived vulnerability and concern play a more substantial role in determining HIV risk among MSM than social factors and reported behaviors. This highlights the importance of HIV prevention approaches that move beyond increasing knowledge or addressing surface-level behaviors, toward strengthening risk awareness and individual self-regulation. Theory based interventions grounded in the Health Belief Model and the Theory of Planned Behavior are therefore highly relevant for enhancing the effectiveness of HIV prevention programs among MSM populations.

This study has several limitations. The case-control design may be subject to recall bias, and the use of self-reported questionnaires could introduce reporting bias, particularly for sensitive behaviors, which may have influenced the non-significant association between social life, preventive actions, and HIV infection. Given the sensitive nature of sexual behavior and HIV-related practices, respondents may have underreported risky behaviors or overreported preventive actions due to social desirability. Additionally, the single-center setting may limit the generalizability of the findings, and other potential confounding factors were not assessed. Future studies are therefore recommended to employ qualitative approaches, such as in-depth interviews or focus group discussions, to explore social interactions, preventive practices, and contextual factors more comprehensively and to reduce potential misclassification caused by self-reported data.

CONCLUSION AND RECOMMENDATIONS

This study concludes that HIV occurrence among men who have sex with men (MSM) at Anutapura Regional General Hospital Palu is significantly associated with vulnerability and concern toward HIV. Vulnerability was identified as the main risk factor, indicating that MSM who were more exposed to risky situations and had limited protective capacity were more likely to experience HIV infection. Meanwhile, concern toward HIV played a protective role, suggesting that individuals who were more aware and worried about HIV tended to adopt more cautious health-related behaviors. Other variables, including knowledge, social life, and preventive actions, were not found to be significantly associated with HIV occurrence in this study. Although these factors may theoretically influence HIV risk, the present findings indicate that their effects were not statistically demonstrated in this population. This suggests that possessing knowledge or reporting preventive behaviors alone may not be sufficient to reduce HIV risk without being supported by strong risk awareness and perceived vulnerability. Overall, this study highlights that HIV prevention among MSM should primarily focus on reducing vulnerability and strengthening awareness and concern toward HIV. Future research with larger samples and more comprehensive measurements is needed to further explore the complex interaction between cognitive, behavioral, and social factors in shaping HIV risk. Based on these conclusions, it is recommended that Anutapura Regional General Hospital Palu strengthen comprehensive HIV prevention programs that integrate education, counseling, and behavioral support specifically tailored to the needs of MSM. Health education initiatives should emphasize practical understanding of HIV prevention, early testing, and consistent protective behaviors, using inclusive and non-judgmental communication approaches. Health services should prioritize the creation of safe, stigma-free, and confidential environments to reduce fear and encourage early utilization of HIV-related services. Strengthening counseling services that address psychosocial concerns and

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perceived vulnerability is essential to support sustained behavior change. Collaboration with community-based organizations and peer support networks is strongly recommended to improve social support and reinforce positive health norms among MSM. Community engagement strategies should aim to reduce stigma, promote acceptance, and expand access to prevention resources within social networks. For future research, further studies are recommended to explore longitudinal changes in behavior and social dynamics among MSM, as well as to evaluate the effectiveness of integrated psychosocial and behavioral interventions. Such evidence is needed to develop more targeted and sustainable HIV prevention strategies for key populations.

AUTHOR'S CONTRIBUTION STATEMENT

Muhammad Agung: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft.
Munir Salham: Supervision, Methodology, Writing – Review & Editing.
Finta Amalinda: Supervision, Project Administration, Writing – Review & Editing.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this article.

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