PREVENTIF: JURNAL KESEHATAN MASYARAKAT
FAKULTAS KESEHATAN MASYARAKAT UIVERSITAS TADULAKO
http://jurnal.fkm.untad.ac.id/index.php/preventif
ISSN (P) 2088-3536 ISSN (E) 2528-3375

Analysis of Risk Factors for Rabies-Transmitting Animal Bites (RTAB) in the Bulili Community Health Center Work Area

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ABSTRACT

Rabies-Transmitting Animal Bites (RTAB) remain a public health concern in the working area of Bulili Public Health Center because they increase the risk of rabies transmission. In 2025, 99 RTAB cases were reported, with a prevalence of approximately 3.94 cases per 1,000 population. Human behavioral and animal-related factors are suspected to contribute to RTAB occurrence. This study aimed to analyze the risk factors associated with RTAB in the working area of Bulili Public Health Center. A case-control study with a 1:1 ratio of cases and controls was conducted. Of the 99 RTAB cases recorded from January to December 2025, 37 cases involving stray animals were excluded because the variables of animal keeping practices and vaccination status focused on owned animals. A total of 124 respondents participated. Total sampling was used for cases, while controls were selected using purposive sampling. Data were analyzed using the Chi-square test and Odds Ratios (OR) with 95% confidence intervals (CI). Animal provocation was significantly associated with RTAB incidence (OR = 4.552; 95% CI: 2.119–9.779), and vaccination status was also significantly associated with RTAB incidence (OR = 2.317; 95% CI: 1.060–5.065). Animal keeping practices were not significantly associated with RTAB incidence (OR = 1.576; 95% CI: 0.775–3.203). In conclusion, animal provocation and vaccination status were identified as risk factors for RTAB. Public education on safe animal interactions and increased rabies vaccination coverage are recommended to reduce RTAB incidence and prevent rabies transmission.

Keywords: *Animal Bites; Provocation; Animal Keeping; Vaccination; Rabies*

Published by:
Tadulako University
Address:
Jl.Soekarno Hatta KM 9. Kota Palu, Sulawesi Tengah, Indonesia.
Phone: +62 821-9750-5707
Email: preventifjournal.fkm@gmail.com

Article history :
Received : 22 06 2026
Accepted : 26 08 2026

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INTRODUCTION

Zoonotic diseases are infectious diseases that can be transmitted between animals and humans. The risk of zoonotic diseases to public health has increased due to population mobility, land-use changes, climate change, and the evolving dynamics of microorganisms. Zoonoses have become a global concern, particularly with the emergence of new infectious diseases, of which approximately 60.3% originate from animals and 71.8% are associated with wildlife (1). Rabies is a zoonotic disease with a high potential threat to human health and can significantly affect social, economic, security, and public health conditions. Animals capable of transmitting rabies, such as dogs, cats, and monkeys, pose substantial risks to humans. Transmission occurs through animal bites, scratches, or exposure to the saliva of infected animals through mucous membranes or open wounds on the human body (2).

Dogs are the primary reservoir for rabies transmission to humans. Approximately 96% of rabies cases are associated with contact with infected dogs. Rabies remains endemic in most ASEAN countries, and nearly all human rabies cases are caused by dog bites. In Southeast Asia, approximately 3.5% of the population is at risk of rabies infection. According to the World Health Organization (2024), rabies causes an estimated 59,000 deaths annually, with most cases occurring in Asia and Africa. Approximately 40% of these deaths occur among children under 15 years of age, while 99% of human rabies cases are preventable through dog vaccination and effective bite prevention measures (3).

Rabies continues to be a major public health concern in Indonesia, with an estimated mortality rate of 100–156 cases annually. Approximately 98% of rabies transmission occurs through dog bites. Data from the Ministry of Health indicate an increase in rabies-transmitting animal bite cases, reaching the highest number in 2022 with 104,229 reported cases (4). Central Sulawesi Province continues to face challenges related to rabies control. According to the 2023 Central Sulawesi Health Profile, cases of rabies-transmitting animal bites increased from 2,463 cases in 2022 to 4,304 cases in 2023, with the incidence rate rising from 80.3 to 139.4 per 100,000 population. Palu City is among the areas with a high

number of cases, influenced by population density and the abundance of rabies-transmitting animals (5).

Data from the Palu City Health Office in 2024 recorded 588 cases of rabies-transmitting animal bites across 15 public health center service areas, with the highest number reported in the Bulili Public Health Center catchment area. A preliminary study conducted in 2025 identified 99 cases within this area, indicating that the incidence remains high and continues to pose a risk for rabies transmission.

Previous studies have reported that provocation, animal keeping practices, and vaccination status are associated with animal bite incidents and rabies transmission (6). However, evidence regarding the combined influence of these factors on Rabies-Transmitting Animal Bite (RTAB) incidence in the working area of Bulili Public Health Center remains limited, despite the persistently high number of RTAB cases reported in the area. Therefore, this study aimed to analyze the factors associated with RTAB incidence in the working area of Bulili Public Health Center.

METHODS

This quantitative study employed an observational analytic case-control design to analyze risk factors associated with Rabies-Transmitting Animal Bites (RTAB). The case group consisted of individuals who were recorded as having experienced RTAB at Bulili Public Health Center in 2025, while the control group was selected using purposive sampling based on predetermined inclusion criteria. Controls were individuals who had not experienced RTAB during the study period and were matched to cases in a 1:1 ratio based on sex to minimize potential confounding by gender. The study was conducted in the working area of Bulili Public Health Center from December 18, 2025, to February 4, 2026. Of the 99 recorded RTAB cases, 37 cases involving bites from stray animals were excluded because the variables of animal keeping practices and vaccination status focused on owned animals. Therefore, 62 cases were included in the analysis. The total sample comprised 124 respondents, with a case-to-control ratio of 1:1 (62:62). Total sampling was applied to the

case group, while purposive sampling based on predetermined inclusion criteria was used for the control group. The collected data were processed and analyzed using IBM SPSS Statistics version 25.

RESULT

Bivariate analysis was conducted to examine the association between risk factors, including animal provocation, animal keeping practices, and vaccination status, and the incidence of Rabies-Transmitting Animal Bites (RTAB). Comparisons between the case and control groups were performed using the Chi-square test and Odds Ratio (OR) analysis with a 95% confidence interval. The results are presented as follows:

Table 1
Characteristics Respondent

Characteristics Respondent	n	%
Age Group		
≤35	60	48.4
>35	64	51.6
Sex		
Male	60	48.4
Female	64	51.6
Type of Rabies-Transmitting Animal		
Dog	73	58.9
Cat	51	41.1
RTAB Incidence		
Cases	62	50.0
Controls	62	50.0

Source: Primary Data, 2026

Table 1 presents the characteristics of 124 respondents. Based on age group, respondents aged >35 years were slightly more dominant, accounting for 64 respondents (51.6%), compared to those aged ≤35 years with 60 respondents (48.4%). In terms of sex, female respondents were slightly more dominant, with 64 respondents (51.6%), compared to male respondents with 60 respondents (48.4%). Regarding the type of rabies-transmitting animal, dog bites were more common, involving 73 respondents (58.9%), while cat bites accounted for 51 respondents (41.1%).

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Table 2
Risk of Animal Provocation Associated with the Incidence of Rabies-Transmitting Animal Bites (RTAB)

Animal Provocation	RTAB Incidence						OR (95% CI)
	Cases		Controls		Total		
	n	%	n	%	n	%	
High risk	46	74.2	24	38.7	70	56.5	4.552 (2.119-9.779)
Low risk	16	25.8	38	61.3	54	43.5	
Total	62	100	62	100	124	100	

Source: Primary Data, 2026

Table 2 presents that respondents with high animal provocation exposure experienced RTAB in 46 cases (74.2%), which was higher than those in the low-risk group (16 cases, 25.8%). Meanwhile, among respondents who did not experience RTAB, most were categorized as low risk (38 respondents, 61.3%), while 24 respondents (38.7%) were classified as high risk. The odds ratio analysis showed that respondents with high-risk animal provocation had 4.552 times higher odds of experiencing RTAB than those with low-risk provocation (OR = 4.552; 95% CI: 2.119-9.779), indicating a statistically significant association.

Table 3
Risk of Animal Keeping Practices Associated with the Incidence of Rabies-Transmitting Animal Bites (RTAB)

Animal Keeping Practices	RTAB Incidence						OR (95% CI)
	Cases		Controls		Total		
	n	%	n	%	n	%	
High risk	36	58.1	29	46.8	65	52.4	1,576 (0.775-3.203)
Low risk	26	41.9	33	53.2	59	47.6	
Total	62	100	62	100	124	100	

Source: Primary Data, 2026

Table 3 shows that respondents with high-risk animal keeping practices had 36 cases of RTAB (58.1%), which was higher than those in the low-risk category, 26 cases (41.9%). Meanwhile, among respondents who did not experience RTAB, most were classified as low risk, accounting for 33 respondents (53.2%), compared to the high-risk category with 29 respondents (46.8%). Respondents with high-risk animal keeping practices had 1.576

times higher odds of experiencing RTAB than those with low-risk practices (OR = 1.576; 95% CI: 0.775–3.203). However, because the 95% confidence interval included 1, this association was not statistically significant.

Table 4
Risk of Rabies-Transmitting Animal Vaccination Status Associated with Rabies-Transmitting Animal Bite (RTAB) Incidence

Vaccination Status	RTAB Incidence						OR (95% CI)
	Cases		Controls		Total		
	n	%	n	%	n	%	
High risk	48	77.4	37	59.7	85	68.5	2.317 (1.060-5.065)
Low risk	14	22.6	25	40.3	39	31.5	
Total	62	100	62	100	124	100	

Source: Primary Data, 2026

Table 4 presents that respondents with high-risk vaccination status experienced RTAB in 48 cases (77.4%), which was higher than those in the low-risk group (14 cases, 22.6%). Meanwhile, among respondents who did not experience RTAB, most were in the high-risk group, accounting for 37 respondents (59.7%), while the low-risk group consisted of 25 respondents (40.3%). Respondents with high-risk vaccination status had 2.317 times higher odds of experiencing RTAB than those with low-risk vaccination status (OR = 2.317; 95% CI: 1.060–5.065), indicating a statistically significant association.

DISCUSSION

Risk of Animal Provocation Associated with the Incidence of Rabies-Transmitting Animal Bites (RTAB)

Provocation in Rabies-Transmitting Animal Bites (RTAB) refers to human actions that trigger aggressive or defensive responses in animals, such as touching, lifting, hitting, or other physical interactions, whether intentional or unintentional (7). The results of the study indicate that high-risk provocation toward Rabies-Transmitting Animals is associated with an increased incidence of RTAB, as direct interactions such as petting or handling animals can trigger defensive or aggressive responses.

Actions that are considered normal interactions with animals may actually activate self-defense mechanisms expressed through aggressive behavior, such as biting. Aggressive behavior in animals is a defensive response to stimuli perceived as threatening, including territorial disturbance or unexpected contact. In addition, stimuli such as sudden touch or pulling can activate the fight-or-flight stress response, increasing the likelihood of aggressive behavior (8).

The findings of this study are consistent with previous studies conducted by Simbong *et al*., (2022) and Tefa *et al*., (2025), which found that provocation contributes to an increased risk of bites through animal defensive responses. However, different results were reported by Gobbo & Šemrov (2021) and Daigle *et al*., (2022), who stated that bites are not always influenced by provocation, but also by environmental factors, territorial behavior, and animal characteristics.

Prevention of bite incidents should not only focus on animal control but also on improving public understanding and behavior in interacting safely with animals. Proper education can minimize provocative practices and increase awareness during physical contact with animals, thereby reducing the risk of bites (9).

Risk of Animal Keeping Practices Associated with the Incidence of Rabies-Transmitting Animal Bites (RTAB)

Keeping animals that can transmit rabies refers to the activity of caring for animals that live in close proximity to humans, including monitoring their activities and interactions with the environment and other animals (12). The results of this study indicate that high-risk animal keeping practices is not statistically significantly associated with the incidence of RTAB, although such practices still have the potential to increase the likelihood of contact between humans and animals.

The practice of allowing pets to roam freely is generally influenced by limited facilities, such as the unavailability of cages, as well as the perception that animals are more comfortable when not restricted in their movement. This pattern of animal keeping makes their movement difficult to control and increases the chance of interaction with other

animals of unknown health status, thereby potentially serving as a medium for rabies transmission (13). In addition, unmanaged or freely roaming animals tend to be more prone to stress and conflict, which may increase aggressive behavior, including biting (14).

The findings of this study are consistent with previous studies conducted by Gitonga *et al*., (2025) and Aizhar *et al*., (2025), which showed that animal keeping is not directly associated with bite incidents, as such events are more influenced by animal behavior, human behavior, and interaction conditions. However, other studies by Saepudin et al., (2022) and Sogen (2024), reported different findings, indicating that risky management practices, such as allowing animals to roam freely, may increase the likelihood of bites due to increased interaction frequency and reduced supervision.

Therefore, prevention efforts should continue to focus on improving supervision and restricting animal movement, along with active involvement from government authorities and health workers in providing public education. The implementation of more controlled animal keeping is expected to reduce the risk of hazardous contact and decrease the incidence of rabies-transmitting animal bites (13).

Risk of Rabies-Transmitting Animal Vaccination Status Associated with Rabies-Transmitting Animal Bite (RTAB) Incidence

Vaccination of animals that transmit rabies is an important measure in preventing rabies transmission (16). The results of this study indicate that Rabies-Transmitting animal vaccination status is significantly associated with the incidence of RTAB, emphasizing the important role of vaccination in prevention efforts. However, there are still respondents who do not vaccinate their animals due to various reasons, such as the perception that vaccination is not yet necessary, concerns about adverse health effects on animals, limited access to services, as well as time and cost constraints.

The decision not to vaccinate is often influenced by the owner's perception that the animal appears healthy and therefore does not require immediate preventive measures (17). Unvaccinated animals have a higher risk of rabies infection because they do not

possess protective antibodies, thereby increasing the risk of rabies transmission if a bite occurs (6).

The findings of this study are consistent with those of Sogen (2024) and Saepudin *et al*., (2022) which reported that vaccination status is associated with bite incidence, as vaccination plays a role in reducing rabies virus circulation within animal populations. However, studies conducted by Wera *et al*., (2022) and Khan *et al*., (2025) showed that vaccination is not directly associated with bite incidence, as the primary purpose of vaccination is to build immunity rather than to alter animal behavior.

In addition, although most respondents in the control group were classified as having high-risk vaccination status, they did not experience RTAB during the study period. Other factors, such as cautious human behavior when interacting with animals, appropriate supervision of pets, and environmental conditions, could also have contributed to the lower likelihood of bite incidents despite the absence of vaccination (10). This finding suggests that although vaccination status was significantly associated with RTAB incidence, it is not the only factor influencing the occurrence of animal bites.

Vaccination status reflects the level of owner awareness in supervising their pets. Therefore, increasing vaccination coverage and public education remain essential components of rabies prevention efforts, including administering vaccines at an early age and on a regular basis (21).

Overall, the findings of this study should be interpreted in light of several limitations. This study excluded 37 of the 99 RTAB cases because they involved stray animals, while the variables of animal keeping practices and vaccination status were specifically assessed for owned animals. Consequently, the findings represent RTAB cases involving owned animals only and may not fully reflect the overall profile of RTAB cases in the Bulili Community Health Center working area. This exclusion may have introduced selection bias and may have influenced the estimated risk associations between the studied risk factors and RTAB incidence. Therefore, the findings should be interpreted with caution and may not be generalizable to all RTAB cases in the Bulili Community Health Center working area.

CONCLUSION AND RECOMMENDATION

Based on the analysis of risk factors associated with Rabies-Transmitting Animal Bites (RTAB) in the working area of the Bulili Community Health Center, it can be concluded that provocation of Rabies-Transmitting Animals and vaccination status are risk factors contributing to an increased incidence of RTAB, while animal keeping practices is identified as a risk factor but does not show a statistically significant association. Based on these findings, it is necessary to improve public education regarding safe behavior in interacting with animals to avoid provocative actions, implement responsible animal ownership with proper supervision, and enhance vaccination coverage and monitoring through collaboration between the Livestock Office and the Health Center in order to reduce the risk of RTAB in the community.

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