

# Risk Factor Analysis for Dog Bite Victims in Davao City, Southern Philippines



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## Introduction

- Rabies is a serious bite-associated disease that kills 59,000 humans annually worldwide. It is transmitted to humans through bites or scratches of rabid animal and 99% of the reported human rabies cases result from dog bites.
- The treatment given to dog bite victims depends on the severity of the bite wound or rabies exposure categorized by the World Health Organization (WHO) as Category I (no exposure), Category II (exposure), and Category III (severe exposure).
- The Philippines remains rabies endemic over the last decade. In Davao City, the City Health Office (CHO) recorded over 47,000 dog bite victims from 2011 to 2017. Identifying and understanding the risk factors of the dog bite incidence is important in designing prevention strategies.



## Results

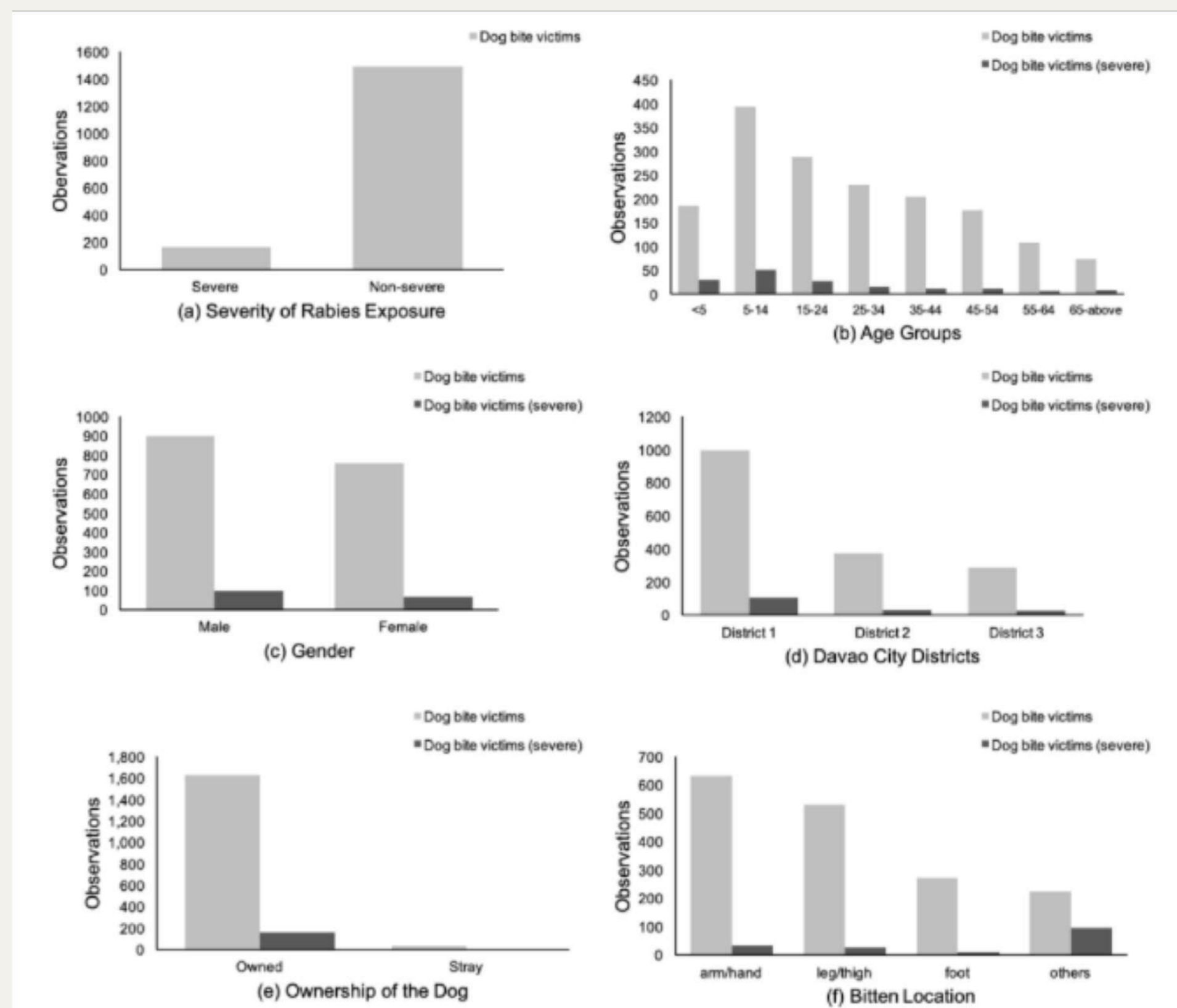


Figure 2. Frequency graph of dog bite victims according to (a) severity of rabies exposure, (b) age groups, (c) gender, (d) location of biting incident, (e) ownership of biting dog, and (f) bitten location.

- This study utilized 1,658 dog bite cases for the analysis. Figure 2 shows the frequency graphs according to the severity and non-severity of rabies exposure of dog bite victims in each variable.
- The maximum likelihood estimates of the parameters and marginal effects of the probit model analysis are summarized in Table 2.

## Objective

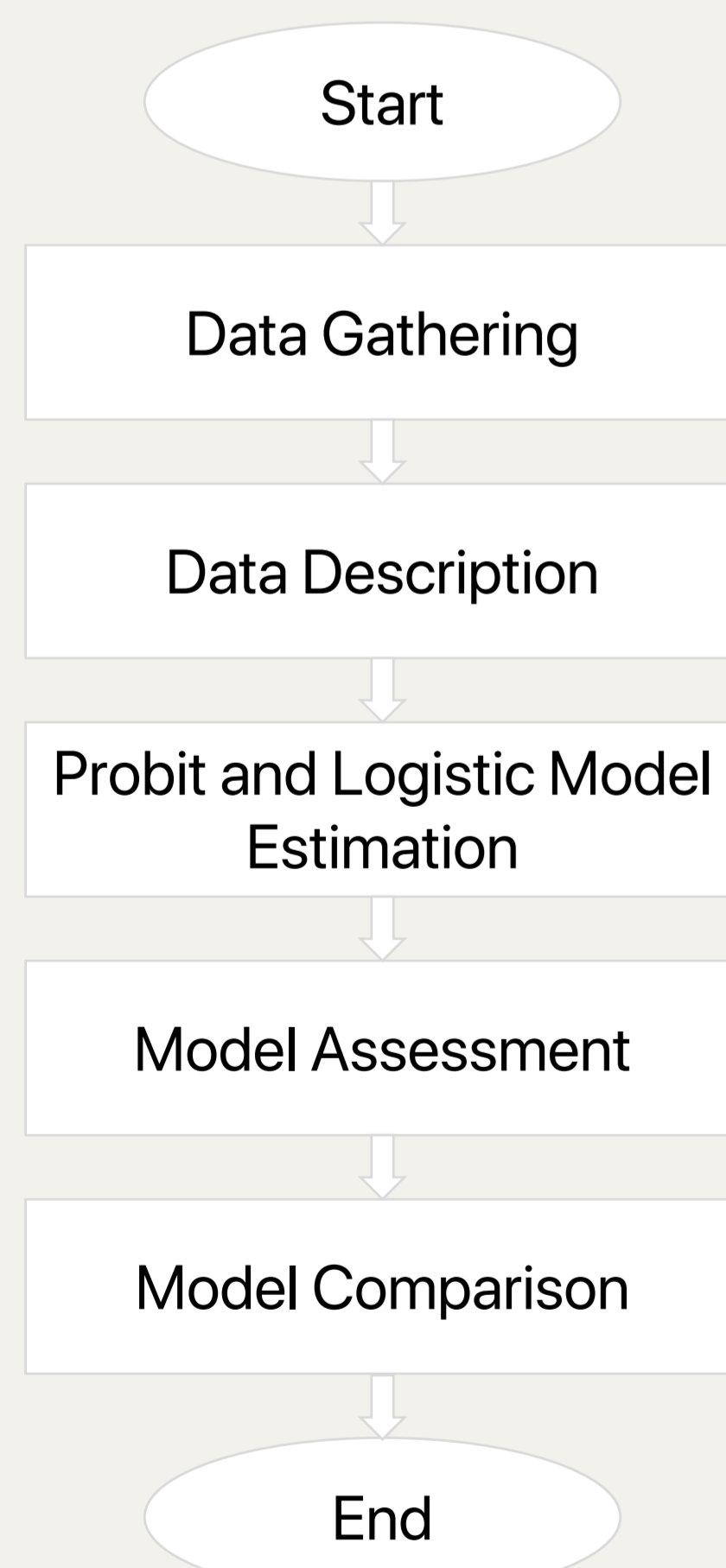
The main objective of this study is to determine the risk factors associated with the severity of rabies exposure of dog bites in humans using probit and logistic regression models in Davao City.

## Methodology

The data on animal-bite incidence in Davao City recorded by the Davao CHO from 2015 to 2017 were used in this study. The variables used in this study (summarized in Table 1) are rabies exposure (dependent variable), age and gender of the dog bite victim, location of the biting incident, ownership of the biting dog, and the bitten location in the victim's body (risk factors). Mathematically, the probit/logistic specification for the severity of rabies exposure of dog bite victim is denoted as:

$$P(q = 1 | X) = \beta_0 + \sum_i \beta_i x_i + \varepsilon$$

where  $q$  is the severity of rabies exposure of the dog bite victim,  $X$  is the vector of variables that are related to the rabies exposure (risk factors),  $x_i$  is the numerical information of risk factor  $i$ , the constant  $\beta_0$  and the coefficients  $\beta_i$  are the parameters to be estimated, and  $\varepsilon$  is the error term. The flowchart of the methodology is shown in Figure 1.



Variable Name	Description
exposure	1 if dog bite wound is Category III; 0, otherwise
age_1 <sup>a</sup>	1 if dog bite victim aged less than 5 yrs; 0, otherwise
age_2	1 if dog bite victim aged 5–14 yrs; 0, otherwise
age_3	1 if dog bite victim aged 15–24 yrs; 0, otherwise
age_4	1 if dog bite victim aged 25–34 yrs; 0, otherwise
age_5	1 if dog bite victim aged 35–44 yrs; 0, otherwise
age_6	1 if dog bite victim aged 45–54 yrs; 0, otherwise
age_7	1 if dog bite victim aged 55–64 yrs; 0, otherwise
age_8	1 if dog bite victim aged 65 yrs and above; 0, otherwise
gender	1 if dog bite victim is male; 0 if female
dist_1 <sup>a</sup>	1 if biting occurred in District 1; 0, otherwise
dist_2	1 if biting occurred in District 2; 0, otherwise
dist_3	1 if biting occurred in District 3; 0, otherwise
ownership	1 if biting dog is stray; 0 if owned
arm_hand	1 if dog bite victim bitten on arm/hand; 0, otherwise
leg_thigh	1 if dog bite victim bitten on leg/thigh; 0, otherwise
foot	1 if dog bite victim bitten on foot; 0, otherwise
bite_others <sup>a</sup>	1 if dog bite victim bitten on other parts of the body such as head, chest, and neck; 0, otherwise

Note: <sup>a</sup> Reference category so as to avoid the dummy variable trap.

Figure 1. Flowchart of the methodology.

Table 2. Parameter and marginal effects estimate of the probit model of rabies exposure.

Predictor	Estimates	Robust Std. Err.	p-value	Marginal Effects	p-value
age_2	-0.0526	0.1488	0.724	-0.0067	0.718
age_3	-0.0312	0.1647	0.850	-0.0040	0.847
age_4	-0.2345	0.1819	0.197	-0.0268	0.139
age_5	-0.4253	0.2052	0.038**	-0.0435	0.006***
age_6	-0.2139	0.2055	0.298	-0.0245	0.231
age_7	-0.3335	0.2328	0.152	-0.0348	0.067*
age_8	0.2443	0.2441	0.317	0.0373	0.388
gender	-0.0438	0.0976	0.654	-0.0057	0.653
dist_2	-0.1641	0.4920	0.165	-0.0199	0.138
dist_3	0.0947	0.1182	0.453	0.0117	0.431
ownership	-0.3243	0.1261	0.510	-0.0332	0.383
arm_hand	-1.4010	0.1203	0.000***	-0.1585	0.000***
leg_thigh	-1.4481	0.1282	0.000***	-0.1438	0.000***
foot	-1.6214	0.1679	0.000***	-0.1068	0.000***
constant	-0.0625	0.1539	0.685		
Number of Observations	1,658				
Wald Statistic (14)	217.03				
p-value	0.000				
Pseudo R <sup>2</sup>	0.2101				
AIC	871.7524				
BIC	952.9529				

\*p-value < 0.10 is significant at 10%, \*\*p-value < 0.05 is significant at 5%, \*\*\*p-value < 0.01 is significant at 1%

- Age.** In general, as a person gets older, he is less likely to acquire severe rabies exposure when bitten by a dog. This means that children, specifically below 5 years old, are more likely to acquire severe rabies exposure relative to other age groups.
- Location of Dog Bite.** A person bitten by a dog in other parts of the body (e.g. head, chest, or neck) is more likely to be severely exposed to rabies. The probability that a dog bite victim will have severe rabies exposure is less by 0.1585 for *arm\_hand*, 0.1438 for *leg\_thigh*, and 0.1068 for *foot*, relative to other parts of the body.

## Conclusion and Recommendation

- The victim's age and bitten location in the victim's body significantly affect the severity of the rabies exposure. Since children are more at-risk of having severe rabies exposure, information and education campaigns on rabies awareness must be strengthened in pre-school and elementary schools. Furthermore, prompt and proper wound handling and care, especially in crucial areas such as head and neck, must be taught and employed in both children and adults.
- The risk factors considered in this study were limited to the information gathered by the Davao CHO. Other potentially important information such as dog gender, breed, and size, other socio-demographic information, and the level of rabies awareness of the bite victim might be significant factors affecting the severity of rabies exposure. The Davao CHO, including health facilities in Davao City, needs to gather these information.

## Main References:

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