

## Epidemiological Characteristics and the Trend of Animal Bites during the years 2014-2018

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### ARTICLE INFO

#### Original Article

Received: 18 October 2021

Accepted: 8 December 2021



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### ABSTRACT

**Background:** Animal bite is a serious and dangerous threat to human health. The highest prevalence rate of animal bite in Iran is in Golestan, Ardabil and, then Khorasan. The present study examined the epidemiological characteristics and the trend of animal bites during 2014-2018.

**Method:** This analytical cross sectional study was conducted on human cases suspected of rabies, which were collected by Shirvan Health Center. Data were described using descriptive statistics indicators (frequency and percentage, mean and standard deviation) and drawing appropriate graphs, and decomposition method was used in SPSS<sub>19</sub> software to estimate the animal bites.

**Results:** In this study, out of 3784 cases bitten by animals, 2821 happened by a sudden attack. Most reports of the animal bite were from dogs. Also, the trend of animal bite during 2014-2018 was increasing and the charts showed that the trend will continue to increase the next year.

**Conclusion:** Due to the increasing trend of animal bites, it is necessary to take basic measures such as training endangered groups, forming a committee to eliminate stray dogs, and strengthening the care system and immunization program.

**Keywords:** Animal Bites, Epidemiology, Rabies, Iran

#### How to cite this paper:

Azari Y, Sadeghi Moghadam M, Khodabandeh J, Hamed A. Epidemiological Characteristics and the Trend of Animal Bite in Northeast of Iran during 2014-2018. J Community Health Research 2021; 10(4): 337-344.

## Introduction

Animal bite is a serious danger in human life. Some infections caused by animal bite, such as rabies, are fatal (1). Rabies is a deadly viral disease that can be transmitted from animals to humans. The causative agent of rabies is a neurodegenerative virus of the Rhabdoviridae family and genus *Lisa* virus, which enters the body through contact with saliva through biting or grabbing, placenta, mucosal tissues and contaminated organs and organ transplants, in the muscles towards. In the muscles, it goes to the terminal nerves and begins to multiply. The mortality rate after the onset of clinical symptoms of rabies is 100%. It is an acute and fatal viral syndrome, often with irritating forms or paralytic syndrome, specific to wild and domestic carnivores. Humans and other warm-blooded mammals become infected accidentally through bite. Rabies epidemiology has two types: urban type that is spread by dogs and a few cases of cats, wild type whose reservoir is fox, wolf, weasel and raccoon(2).

There is no global estimate of the prevalence of animal bite, but according to WHO, more than 2.5 billion people are at risk of rabies, and approximately 10 million people receive rabies prevention treatment each year after the bite, and every year, about 50,000 to 60,000 deaths from rabies are reported worldwide, of which 31,000 are in Asia(3). According to the Centers for Disease Control and Prevention, the highest prevalence rate of animal bite is in Golestan and Ardabil (503-398 per 100,000 people)(4), which is followed by North Khorasan and Chaharmahal Bakhtiari (292-397 per 100,000 people)(5). The trend of the study helps to predict and implement an intervention program to prevent and reduce animal bite, and accordingly, minimize the burden on the healthcare system.

In Shirvan, no study has been done on animal bites so far, and considering the increasing awareness of people about the dangers of animal bites in recent years and the increasing number of visits to receive the required treatments, analysis of data in relevant organizations, especially

regionally, can increase officials' knowledge of the epidemiology of animal bite. This study was designed with the aim of epidemiological study of animal bite and rabies in Shirvan to help identify people at risk and the seasonal pattern of animal bites, and plan for providing the required vaccine and serum.

## Method

This analytical cross sectional study was conducted on human cases suspected of rabies, which were collected by Shirvan Health Center. It was presented to the research ethics committee and approved with the number IR.NKUMS.REC.1397.123. Raw data about the files of these cases, such as patient-related factors (age, sex), time-related factors (month, year, season) were collected from Shirvan Health Center and classified. Information on the type of animal bite, the fate and the status of them were also extracted from Shirvan Health Center.

## Statistical analysis

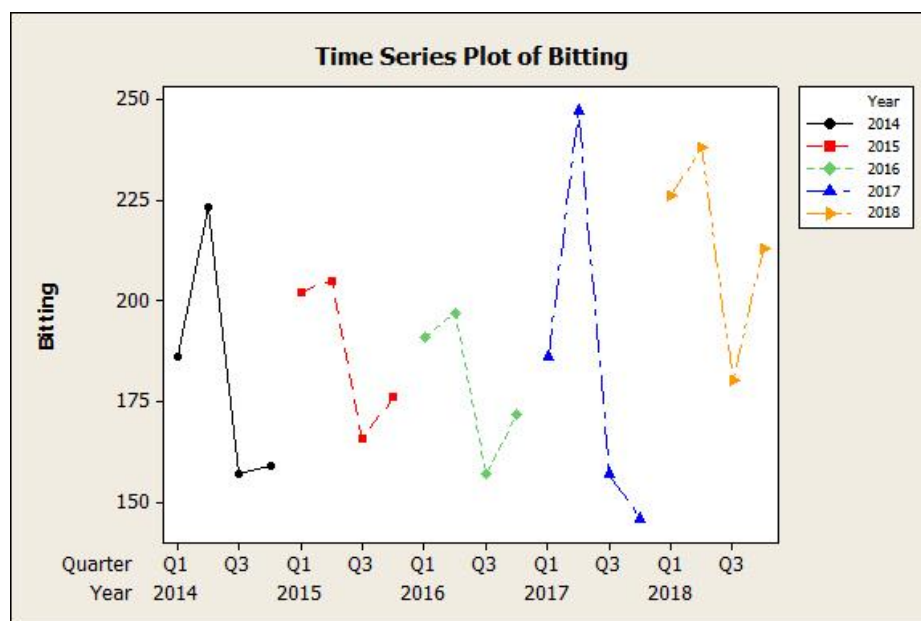
Data were described using descriptive statistics indicators (mean, standard deviation, percentage and ratio). Also, Chi-square test was used to show the relationship between demographic variables and animal bite. Partial Autocorrelation function (PACF) and Autocorrelation function (ACF) plots were used to measure correlation. PACF and ACF plots were used to identify the possible pattern in order to investigate the trend. Three criteria were used to measure the accuracy of the model: mean absolute deviation (MAD), mean squared deviation (MSD), and mean absolute percentage error (MAPE). For all the three criteria, smaller values usually indicated a more appropriate model. Multiplicative Decomposition method was used to estimate the animal bite trend. Because, first, the data were numerical and not normal, and second, the data were statistically collected with respect to the seasons of the year, which may have a seasonal trend, and the correlation of observations within each season would affect the estimation of their standard coefficients and deviations. All statistical analysis were done in SPSS version 19 and

significant level was considered 5 %.

## Results

In this study, 3784 people who suffered from animal bites during 2014-2018 were studied. In general, the number of animal bites was 2689(71.1%) in men, and 1095(28.9%) in women, which is almost three times more in men ( $p<0.05$ ). The mean and standard deviation of the age of the subjects were  $20.1 \pm 34.12$  years old. Furthermore, 984 individuals (26%) lived in urban areas and

2779(73.4%) lived in rural areas. Regarding the season, the higher percentage of animal bite was 1110 individuals (29.3%) in summer, and 817(21.6%) in autumn respectively ( $p<0.05$ ). Also, most cases of animal bites with respect to months in these 5 years were related to July, and then August, and the lowest was related to December ( $p<0.05$ ). The trend of animal bite during 2014-2018 based on the season is shown in figure 1.



**Figure 1.** Seasonal Trend of Animal Bites during 2014-2018

In terms of the cause of the incident, out of 3784 cases bitten by animals, 2821(74.6) cases happened by a sudden attack. Most reports of animal bites were from dogs.

According to the extracted data, the limb most frequently involved was the lower limb, which occurred in 64.2% of cases, and the lowest frequency was related to the head and face. Also, most animal bites occurred before 12 noon. The characteristics of the variables examined are shown in table 1.

In general, the number of animal bite in men

was 2689(71.1%) and in women, 1095(28.9%). The distribution of animal bites and the incidence over the period 2014-2018 in every hundred thousand people is shown in table 2 by gender. During the years 2014 to 2018, we saw an increasing trend of animal bites (Table 2).

PACF and ACF diagrams were used to measure correlation for detecting a possible pattern, as shown in figures 2 and 3.

Forecast of the Animal Bite Time Series showed in figure 4.

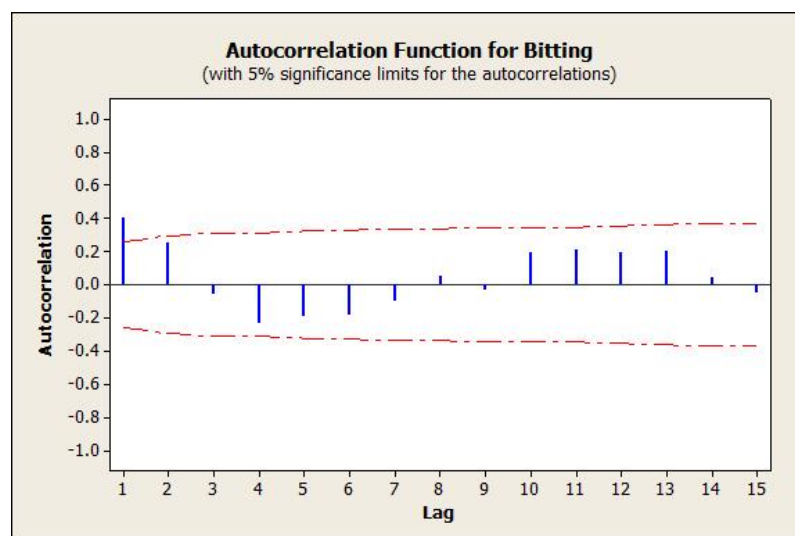
**Table 1.** Characteristics of the Studied Variables

Variables		M±SD
Age		34.12±20.1
Frequency(percentage)		
Sex	Male	2689(71.1)
	Female	1095(28.9)
Type of Job	Manual worker	738(19.5)
	Housewife	885(23.4)
	Student	811(21.4)
	Farmer-Stockman	56(1.5)
	Driver	61(1.6)
	Employee	134(3.5)
	Stockman	155(4.1)
	Farmer	398(10.5)
	Child	196(5.2)
	Vet	4(0.1)
	Shepherd	114(0.4)
	Unemployed	31(0.8)
	Others	301(8)
habitat	Urban	984(26)
	Rural	2779(73.4)
	Suburbs	11(0.3)
	Nomads	10(0.3)
Days of the week	Saturday	541(14.3)
	Sunday	524(13.8)
	Monday	542(14.3)
	Tuesday	486(12.8)
	Wednesday	531(14)
	Thursday	582(15.4)
	Friday	578(15.3)
	Spring	991(26.2)
Season	Summer	1110(29.3)
	Fall	817(21.6)
	Winter	866(22.9)
Month	April	317(8.4)
	May	345(9.1)
	June	329(8.7)
	July	396(10.5)
	August	362(9.6)
	September	352(9.3)
	October	280(7.4)
	November	271(7.2)
	December	266(7)
	January	278(7.3)
	February	270(7.1)
	March	318(8.4)
Time of occurrence	<12	1607(42.5)
	12-16	881(23.3)
	16-20	1047(27.7)
	>20	249(6.6)
Number of injuries	1	1854(49)
	2	1028(27.2)
	3	508(13.4)
	4	394(10.4)
Injured limbs	Lower limb	2428(64.2)
	Upper limb	1095(28.9)
	Head and face	51(1.3)

Variables		M±SD
Animal type	Back	48(1.3)
	Chest-abdomen	42(1.1)
	The sides of the body	23(0.6)
	More than one limb	97(2.6)
	Dog	3416(90.3)
	Donkey	82(2.2)
	Cat	218(5.8)
	Cow	5(0.1)
	Goat	2(0.1)
	Sheep	6(0.2)
	Jackal	24(0.6)
	Hog	7(0.2)
	Horse	5(0.1)
	Wolf	3(0.1)
	Leopard	3(0.1)
	Fox	6(0.2)
Description of the event	Pig	7(0.2)
	A sudden attack	2821(74.6)
	Playing	97(2.6)
	Taking care of	180(4.8)
	Harassing	480(12.7)
	Feeding	194(5.1)
Vaccine history	Defending	12(0.3)
	No	3577(94.5)
	Yes	207(5.5)

**Table 2.** Distribution of Animal Bites in Shirvan by Gender per 100,000 People during 2014-2018

Years	Population			Number of animal bites			The incidence rate of animal bites		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
2014	81987	83690	165677	225	500	725	0.27	0.59	0.43
2015	83697	85283	168980	232	517	749	0.27	0.60	0.44
2016	77819	79388	157207	204	513	717	0.26	0.64	0.45
2017	77234	79535	156869	191	545	736	0.24	0.68	0.46
2018	77380	79572	156952	243	614	857	0.31	0.77	0.54



**Figure 2.** Autocorrelation Function of Animal Bite in Shirvan during 2014-2018

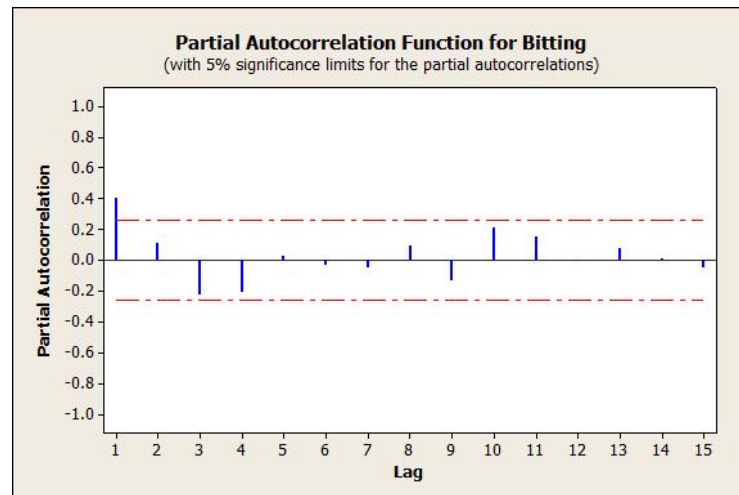


Figure 3. Partial Autocorrelation Function of Animal Bite in Shirvan during 2014-2018

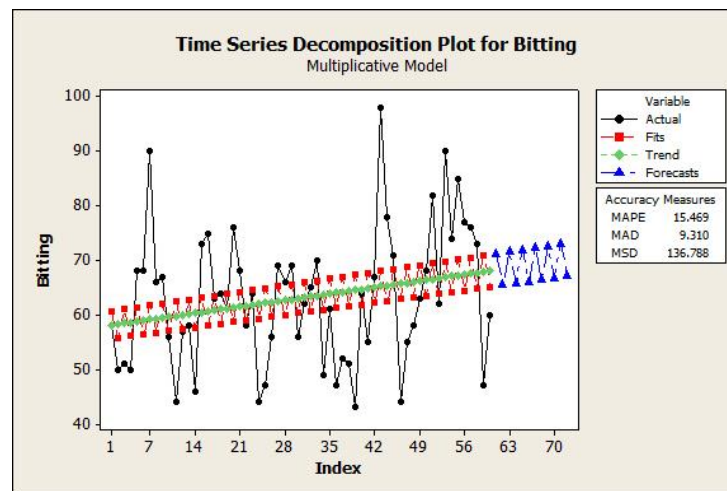


Figure 4. Forecast of the Animal Bite Time Series Chart in 2019

Equation of animal bite process  $\rightarrow Y_t = 57.96 + 0.169 * t$

Since the data were monthly, the next 12 months were predicted, and as can be seen, the trend of animal bite during 2014-2018 has been increasing, and the trend will continue to rise next year.

In the present study, there was no significant

relationship between sex and occupation, and animal bite during 5 years, but there was a significant relationship between habitat and animal bite, which is shown in Table 3.

Table 3. The Relationship between Demographic Variables and Animal bites during 2014-2018

Variables		2014	2015	2016	2017	2018	P-value
Sex	Male	500(69)	517(69)	513(71.5)	545(74)	614(71.6)	0.16
	Female	225(31)	232(31)	204(28.5)	191(26)	243(28.4)	
Habitat	Urban	83(11.4)	217(29)	202(28.2)	240(32.6)	242(28.2)	<0.001*
	Rural	642(88.6)	532(71)	515(71.8)	496(67.4)	615(71.8)	
Job type	Governmental	323(44.6)	335(44.7)	331(46.2)	342(46.5)	356(41.5)	0.44
	Free	296(40.8)	293(39.1)	278(38.8)	270(36.7)	351(41)	
	Stockman and farmer	106(14.6)	121(16.2)	108(15.1)	124(16.8)	150(17.5)	

\* Significance level 0.05



## Discussion

During this study, the epidemiological trend of animal bite (rabies) in Shirvan was investigated. The results of the study showed an increasing trend of animal bite during 2014-2018. However, the reason for this increase could be population growth, increasing public awareness of the dangers of animal bite, reports and increase of the healthcare centers.

According to the results, the number of animal bite in men was 71.1 percent, and in women 28.9 percent, which is consistent with similar studies conducted by Karbayar et al.(6), Nasab et al.(7). It can be argued that men are more likely to be in contact with animals because of their job, and social and economic status.

In this study, the jobs of the bitten people were also examined. The results showed that housewives, workers, and then students, are more at risk of bites, respectively. In a study conducted by Mohammadi et al. it was reported that the self-employed and the students are more likely to be bitten, and the results were consistent with this study(8). This can indicate that in Shirvan, housewives are exposed to animal bite due to their participation in animal husbandry and agricultural activities in villages and economic activities in cities, and consequently their presence outside the home. Most cases of animal bites occurred in rural areas at 73.4%, followed by urban areas at 26%, which is consistent with some studies(4, 9). It was also shown that there was a significant relationship between rural life and animal bite ( $P < 0.001$ ). The reason for this can be related to the more frequent contact of the villagers with the animals due to their working conditions (agriculture and animal husbandry), protecting them from herds and houses, and having more space for keeping animals.

According to the seasonal distribution, the highest number of animal bites is related to summer 29.3% and July, and the lowest is related to autumn 21.6% and December. Because people are more engaged in agricultural activities and animal husbandry in summer, they are more likely to be bitten by animals. Seasonal distribution in different studies varies according to different climatic conditions. For example, in a study

conducted by Moghadam et al., The highest number of animal bites regarding dogs were reported in spring and June, and the lowest in winter and January(10).

In terms of the anatomical location of the injury, most of the bites occurred in the lower limb 64.2% and the fewest occurred in the head and face, which is consistent with the study by Maleka et al.(11). But in the study by Ghasemi et al. , the upper limb was 25.2% and the lower one was 24.3%, which is not consistent with the present study(12).

In this study, most cases of animal bites occurred by dogs (90.3%), which is consistent with the study by Ghafouri et al.(13), Mohammadi(8) and Fayyaz et al.(14). In the present study, the most common case of the incident was reported as a sudden attack, which is in line with the study conducted by Moghaddam et al.(10). One of the limitations of this study was the use of available data, which limited access to many variables. But by trying, and following and reviewing all the offices, information was extracted and the time trend was forecasted.

## Conclusion

Since the trend of animal bite cases in Shirvan is increasing, it seems necessary to take basic measures, such as raising awareness of high risk groups about animal bites and taking prevention and treatment measures by health centers, especially washing right after the animal bite, and steps should be taken to collect stray dogs.

## Acknowledgment

We consider it our duty to appreciate Shirvan Health Center that helped us in this research.

This research was approved with ethics committee code IR.NKUMS.REC.1397.123 in North Khorasan University of Medical Sciences.

## Conflict of interests

The authors declare no conflict of interests for this study.

## Author's contribution

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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