



## Epidemiology of Animal Bites and Associated Factors with Delay in Post-Exposure Prophylaxis; A Cross-Sectional Study

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Received: February 14, 2018

Revised: June 03, 2018

Accepted: June 08, 2018

### ABSTRACT

**Objective:** To address the epidemiology of animal bites and associated factors with delay in post-exposure prophylaxis (PEP) in Nahavand district, western Iran.

**Methods:** Data were obtained from Rabies Treatment Center (RTC) in Nahavand district from March 2015 to March 2017. All of referred cases to RTC include 1448 cases of animal bites using the census method were recruited. Epidemiological profile of participants was demonstrated using descriptive statistics and determinants of PEP was addressed by logistic regression model.

**Results:** The majority of victims were males 1167(80.5%). superficial bites were more prevalent than deep status injuries (1145(79.0%) VS. 303(20.9%)). The biting rate differed according to season in the period of the study ( $p<0.001$ ). Cases who experienced animal biting in the autumn was more likely to refer timely for PEP than cases in spring season (OR, 0.39; 95% CI: 0.26 - 0.59,  $p<0.001$ ).

**Conclusion:** Our findings addressed the pattern of potential delays in PEP including the role of season. Local authorities of Nahavand district should consider preventive activities and educational interventions to reduce animal biting and provide timely prophylaxis.

**Keywords:** Post-exposure prophylaxis; Vaccination; Animal bites; Rabies.

Please cite this paper as:

Khazaei S, Karami M, Veisani Y, Solgi M, Goodarzi S. Epidemiology of Animal Bites and Associated Factors with Delay in Post-Exposure Prophylaxis; A Cross-Sectional Study. *Bull Emerg Trauma*. 2018;6(3):239-244. doi: 10.29252/beat-060309.

## Introduction

Rabies is a vaccine-preventable viral disease which occurs in most countries of the world [1]. Infection causes many deaths every year, especially in Asia and Africa [1]. Dogs have an important role in human rabies deaths, so that up to 99% of all rabies transmissions to humans are attributable to dogs, therefore rabies elimination is reachable among societies through vaccination of dogs and prevention of dog bites [2]. Published literature reveals that animal bite has been reported in all months of the year especially in spring season. Among different age groups, children (5-9 year olds) are more likely to be biting animals [3]. WHO reports show that children under 15 years of age are one of the most important at risk groups of rabies [2]. Immediate, washing of wounds with soap and water after contact with a suspect rabid animal is crucial way to prevent of rabies transmission [2].

Evidence shows more than 95% of rabies human deaths occur in developing countries where the disease is endemic in domestic dog populations [4]. Results of several conducted studies in different parts of Iran indicate that incidence of animal bites in our country has increasing trend during recent years. For example, a study to clarify the associated factors with the delay in post-exposure exposure (PEP) in Tuysekan, West of Iran, reported that cases of animal bites were 423 per 100,000 from February 2011 to February 2012 [4]. Another report from Khalilabad County, Northeast of Iran, also showed that the incidence of animal bites were 1,100 per 100,000 from March 2012 to March 2013 [5]. The same situation has been reported from Fars province (South of Iran) with the prevalence of 154.4 per 100,000 people [6].

Every year, more than 15 million people receive a post-bite vaccination throughout world. Necessity of PEP following animal biting is well known. However published studies showed the evidence of delay or incompleteness in PEP according to standard schedule throughout some areas in Iran [4, 7]. Therefore, this study aims to address the epidemiology of animal bites and determinants of delay in PEP in Nahvand district, western Iran.

## Materials and Methods

### Study Population

All of referred cases of animal biting to rabies

treatment center (RTC) from March 2015 to March 2017 were recruited. During study period, 1448 cases of animal bites were occurred and registered in Nahavand district. Nahavand is located in west of Hamadan province. The Nahavand district with 181,711 populations has 196 villages (2011 census). The majority of inhabitants of rural areas and small towns are farmers and ranchers. The animal bitten person is defined as a person who has been bitten by domestic or wild animal including peck the bare skin, prickle or bloodless abrasion, and wound licking. Accordingly, the animal bitten person should receive a PEP based on the WHO recommendations. Depending on the severity of the contact with the suspected rabid animal, according WHO guideline, administration of PEP is recommended as Table 1 [8].

### Study Protocol

Demographic and clinical information were extracted from RTC using a researcher developed information form including Gender, age group (<5, 5-15, 16-30, 31-45, 46-60, +60 year), residency, season of bits, injury status (deep, superficial), number of wounds (1, 2, 3, 3), type of biting animal (dog, cat, domestic or wild animal), occupational status, time of bite (0-6, 6-12, 12-18, 18-24 O'clock) and time of receiving PEP. The main outcome was the delay in PEP which was divided into two categories: (i) less than 48 hours, and (ii) more than 48 hours.

### Statistical Analysis

Descriptive statistics including frequency table and chart were used to describe demographic and clinical status of bitten cases. Then, univariate logistic regression was used to address determinants of delays in PEP, and we used multiple logistic regression to control for potential confounding factors. A 2-sided *p*-values of less than 0.05 was considered to indicate statistical significance. Data were analyzed with statistical software Stata 12 (StataCorp, College Station, TX, USA).

## Results

During study period, 1448 people were referred to rabies treatment center in Nahavand County. The majority of animal bitten cases were males 1167(80.5%). Cases who categorized among 16-30 age group have experienced the highest percentage 402 cases (27.7%) in comparison to other age groups. Superficial bite was more prevalent than deep status

**Table 1.** Categories of contact and recommended post-exposure prophylaxis (PEP) for bitten victims

Categories of contact with suspect rabid animal	Post-exposure prophylaxis type
Category I – touching or feeding animals, licks on intact skin	None
Category II – nibbling of uncovered skin, minor scratches or abrasions without bleeding	Immediate vaccination and local treatment of the wound
Category III – single or multiple transdermal bites or scratches, licks on broken skin; contamination of mucous membrane with saliva from licks, contacts with bats.	Immediate vaccination and administration of rabies immunoglobulin; local treatment of the wound

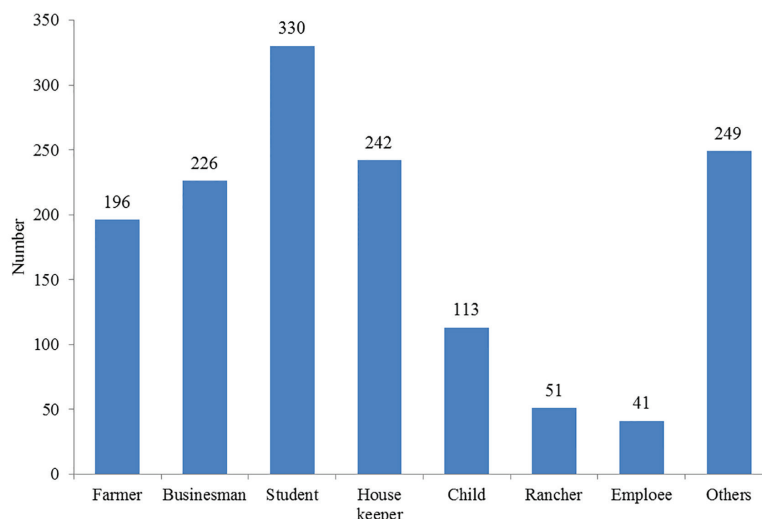
injuries 1145 (79.0%), VS. 303 (20.9). About 81% (1175 cases) of all referred cases came in within 48 hours after bitten by animals. Moreover, about four-fifths (78.6%) of cases were bitten one and two times by animals. In case of time, 39.25% of all bites were occurred between 12-18 O'clock and 31.44% was occurred in 6-12 O'clock. The biting rate differed according to season in the period of the study ( $p<0.001$ ) and a majority of biting was occurred in spring season 938 (64.7%), while the lower rate observed in winter season 106 (7.3%) (Table 2). Figure 1 presents the frequency of animal bitten

cases by occupational status. Findings indicated that most of bitten subjects were students, housekeepers and farmers. Also 75.1% and 21.8% of all bites were occurred by dogs and cats, respectively (Figure2).

The main predictors of delay in PEP among bitten people are shown in Table 3. Among potential determinants in the adjusted model, cases who experienced animal biting in autumn are more likely to refer timely for PEP than cases in spring season (OR, 0.39; 95%CI: 0.26-0.59,  $p<0.001$ ). Also person who have been bitten 4 times or more, have a less chance to delay in PEP when we comparing those

**Table 2.** Distribution of demographic and clinical characteristics of bitten peoples in Nahavand district, 2015-2017.

Variable	Frequency (%)	Delayed time		p value	
		Less than 48 hr	More than 48 hr		
Gender	Male	1167 (80.59)	956(81.92)	211 (18.08)	0.125
	Female	281 (19.41)	219 (77.94)	62 (22.06)	
Residency	Urban	472 (32.60)	390 (82.63)	82 (17.37)	0.316
	Rural	976 (67.40)	785 (80.43)	191 (19.57)	
Age group (year)	<5	76 (5.25)	62 (81.58)	14 (18.42)	0.625
	5-15	314 (21.69)	253 (80.57)	61 (19.43)	
	16-30	402 (27.76)	326 (81.09)	76 (18.91)	
	31-45	302 (20.86)	251 (83.11)	51 (16.89)	
	46-60	231 (15.95)	190 (82.25)	41 (17.75)	
	+60	123 (8.49)	93 (75.61)	30 (24.39)	
Season of bite	Spring	938 (64.78)	801 (85.39)	137 (14.61)	<0.001
	Summer	292 (20.17)	211 (72.26)	81 (27.74)	
	Fall	112 (7.73)	86 (76.79)	26 (23.21)	
	Winter	106 (7.32)	77 (72.64)	29 (27.36)	
Injury status	Deep	303 (20.93)	242 (79.87)	61 (20.13)	0.522
	Superficial	1145 (79.07)	933 (81.48)	212 (18.52)	
N. of injuries	One	625 (43.28)	502 (80.32)	123 (19.68)	0.078
	Two	510 (35.32)	425 (83.33)	85 (16.67)	
	Three	199 (13.78)	151 (75.88)	48 (24.12)	
	≥Four	110 (7.62)	94 (85.45)	16 (14.55)	
Time of bite (O'clock)	0-6	67 (4.63)	54 (80.60)	13(19.40)	0.681
	6-12	455 (31.44)	372 (81.76)	83 (18.24)	
	12-18	568 (39.25)	466 (82.04)	102 (17.96)	
	18-24	357 (24.67)	282 (78.99)	75 (21.01)	



**Fig.1.** Distribution of animal bitten cases by occupational status

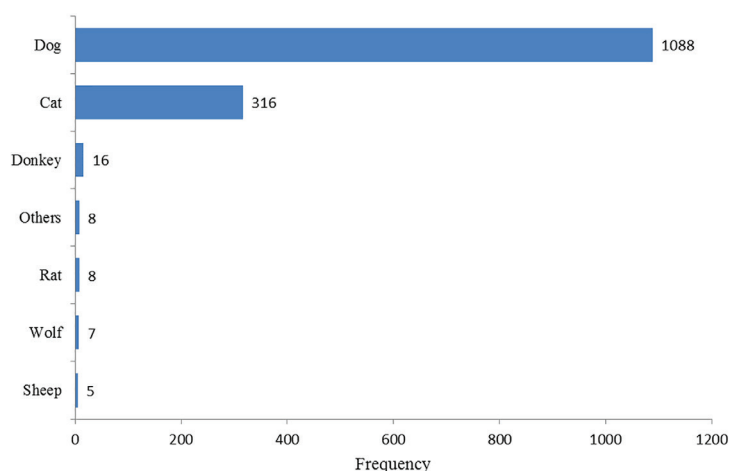


Fig. 2. Distribution of animal bitten cases by animal type

Table 3. Determinants of delay for rabies post-exposure prophylaxis among bitten people.

Variable	Crude model		Adjusted model <sup>a</sup>		
	Odds Ratio (95% CI)	p value	Odds Ratio (95% CI)	p value	
<b>Gender</b>	Male	1	-	1	-
	Female	1.28 (0.93, 1.76)	0.13	1.29 (0.94, 1.78)	0.12
<b>Residency</b>	Urban	1	-	-	-
	Rural	1.15 (0.87, 1.54)	0.32	-	-
<b>Age group (year)</b>	<5	1	-	-	-
	5-15	1.06 (0.56, 2.03)	0.84	-	-
	16-30	1.03 (0.5, 1.94)	0.92	-	-
	31-45	0.9 (0.47, 1.73)	0.75	-	-
	46-60	0.96 (0.49, 1.87)	0.89	-	-
	+60	1.43 (0.7, 2.9)	0.33	-	-
<b>Season of bite</b>	Spring	1	-	-	-
	Summer	1.06 (0.76, 1.46)	0.74	1.09 (0.79, 1.51)	0.59
	Fall	0.38 (0.25, 0.58)	<0.001	0.39 (0.26, 0.59)	<0.001
	Winter	0.81 (0.55, 1.19)	0.28	0.85 (0.57, 1.25)	0.39
<b>Injury status</b>	Deep	1	-	-	-
	Superficial	0.9 (0.66, 1.24)	0.52	-	-
<b>N. of injuries</b>	One	1	-	-	-
	Two	0.81 (0.6, 1.1)	0.19	0.84 (0.61, 1.14)	0.25
	Three	1.29 (0.89, 1.89)	0.18	1.36 (0.91, 1.89)	0.17
	≥Four	0.74 (0.47, 1.08)	0.08	0.67 (0.39, 0.98)	0.047
<b>Time of bite (O'clock)</b>	0-6	1	-	-	-
	6-12	0.92 (0.48, 1.78)	0.82	-	-
	12-18	0.91 (0.48, 1.73)	0.77	-	-
	18-24	1.1 (0.57, 2.13)	0.77	-	-

<sup>a</sup>Adjusted for other variables in model

with cases that had one bite injury (OR, 0.67; 95%CI: 0.39-0.98,  $p=0.047$ ).

## Discussion

Animal bites are an important cause of mortality throughout the world and present a major public health problem in Iran. Therefore, the present study was designed to address epidemiological profile of animal bitten cases in Nahavand district and their geographic distribution with delay in post-exposure prophylaxis. The results of this study show that the distribution of animal bites differed according to certain characteristics of the victims. Further, an investigation of the factors adversely affecting timely anti-rabies treatment showed that the Season of bite and number of injuries were related to delays in treatment. It should be noted that our findings are consistent with those of previous epidemiological studies in other regions which stated that the PEP of the individual cases is not desirable yet [9]. Although there are no global estimates of animal bite incidence, the WHO reported that dogs are responsible for over 90% of the reported cases of rabies [2]. In the present study, 75.1% of our cases were victims of dog bites while 65.1% were of domestic dogs. These data are in agreement with those reported in the literatures which confirm that the most animal bites are from dogs [10-12]. The same findings have been reported from other country [13]. There was also a significant correlation between delayed PEP and type of Season of bite. In concordance with a similar study [5]. According to our finding, a significant relationship was observed between delayed PEP and number of injuries. This variable has not yet been studied in other studies. But we did not find a significant relationship between PEP, gender, residency, injury status and time of bite. In a similar study to determine the delay in post-exposure prophylaxis and associated factors among people bitten by animals in the Northeast of Iran, but they did not find a significant relationship between PEP gender, residency and injury status [4, 14]. In this study the highest cases of animal bites in three years in the spring and summer seasons. Animal bites are more common in spring and summer due to agricultural activities, livestock, more traffic and more people out of the house. The present study showed that during the study period, 1448 cases of animal bites (Incidence of 242 in 100 000) were reported.

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Another study carried out in one of the provinces in west Iran (Hamadan province) showed that 425 cases of animal bites were reported from February 2011 to February 2012 [4]. Furthermore, the study by Khazaei *et al.*, [5]. Another study in Quechan city in 2013 reported an incidence of 442 animal bites per 100 000 people [15]. The number of animal bites in Nahavand district increased during the study years, and during the study period was include 1448 cases of animal biting. The incidence of bites in the city increased from to 242 per 100,000. Because incidence rate of animal bites in Nahavand district is high, it is essential that provide an appropriate intervention programs to prevent and reduce the incidence of animal bites, especially in the rural young men and students and with emphasis on immunization the pets. In this research, we were unable to collect other variables such as educational level or socio-economic status due to the retrospective design of the study, and this was and this was considered as a limitation of this study.

However, the present study was retrospective and we did not have access to data on other important variables such as educational level, the distance between the victims and anti-rabies medical centers and socio-economic status of animal bite victims. Therefore, lack of access to these factors can be regarded as limitations of the present study.

In summary we found that the majority of bites were occurred in males, and 16-30 age groups. According to the occupational status the bitten subjects more prevalent in students, housekeepers and farmers. Moreover, majority of animal biting were attributed to dogs and cats. Animal biting in the autumn and person who have been bitten 4 times or more were more likely to less delay in PEP than cases with one bite injury and cases in spring season, respectively. Provincial and local authorities of Nahavand district should considered preventive activities and educational interventions to reduce animal biting and provide timely prophylaxis.

## Acknowledgement

We would also like to thank the health expert of the Rabies Treatment Center in Nahavand health center who collaborated in data collection.

**Conflicts of Interest:** None declared.

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