

# Geographical Distribution Map and Epidemiological Pattern of Animal Bite in the North of Iran

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## Abstract

**Introduction:** Animal bite is a public health problem in Iran and in the world, and despite the great progress in preventing and treating these cases, it has had high economic, social, and psychological consequences. This study aimed to investigate the epidemiological and geographical status of animal bites in Mazandaran province in 2007-2016. **Methods:** This was a retrospective and longitudinal study conducted in 2018. The population of the study was all animal bitten people in the geographical area of Mazandaran province in 2007-2016. The data collection tool was a checklist based on the documentation available at the animal bite registration offices in disease prevention health centers. **Frequency and**

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percentage descriptive statistics and SPSS software were used for data analysis. Arc GIS software was also used to draw the geographical map. **Results:** A total of 32469 cases of the animal bite were reported in 2007-2016 in Mazandaran province. The prevalence of the disease was 45.2% in the urban area and 54.8% in the rural area. Most cases were in 2015 with 7621 patients and the least in 2013 with 3305 patients. Among the counties of Mazandaran province, Sari was the first with 4623 cases of the animal bite. **Conclusion:** Given the high incidence of animal bite in Mazandaran province, it is necessary to provide appropriate intervention programs for prevention and reduction of the animal bite, especially in summer and spring and rural population and emphasize on immunization of domestic dogs.

**Key words:** Animal Bite, Rabies, Geographical Distribution, ArcGIS, Mazandaran

## Introduction

One of the issues that threaten people's health is an animal bite. An animal bite comes from a scar from the tooth or claw of a pet or wild animal which causes the burden of disease and attenuation. (Bögel and Motschwiller, 1986) The animal bite has always been a major health threat in Iran and other countries around the world. Despite widespread advances in prevention and treatment, animal bites are still increasing and a lot of money is annually spent on vaccination and antibody serum. (Jaindl et al., 2012)

According to the World Health Organization (WHO) estimation, over ten million people in the world are treated for bites each year. (Rezaeinasab et al., 2007) Based on the statistics of disease control and prevention center, nearly 4.5 million people are bitten each year in the United States. (CDC. Dog Bites, 2013) In Iran, in 2013, there were about 150,000 cases of animal bites and 4 cases of rabies. (Goya, 2014) Animal bites are important threats to human health because some of the subsequent infections, such as rabies, are highly fatal so that the highest fatality rate among infectious diseases is rabies. (Willoughby et al., 2005) Rabies is a viral disease transmitted from warm-blooded animals to humans and causes death by creating acute and lethal encephalitis in humans and other mammals. (Madhusudana, 2005) According to the WHO reports, annually, 10 million people receive anti-rabies treatment to prevent the disease, and about 33,000 deaths are caused by rabies worldwide, most of which occur in Asia and Africa. Iran is one of the countries in the world with rabies in both wild and domestic animals. Rabies is still one of the health and economic

problems in Iran and almost all provinces are more or less involved with the disease. (Mazaheri et al., 2010)

According to the Pasteur Institute of Iran, in 2009, 131413 animal bites were reported from all over Iran treated with anti-rabies and 7 cases died from the disease. (Fayaz 2008) Given the increasing trend of stray dog populations and the growing statistics of rabies bites and dispersal in many provinces of the country, it is required to pay more attention to disease control and research in various aspects. (Zeynali et al., 1999)

Rabies is of great importance due to its fatality, the increasing incidence of animal bites in humans, damage to livestock, and economic losses. (Bokaee et al., 2009) In addition to the financial costs of preventing and treating animal bites, the psychological and social consequences of bites, and the remaining scars can also affect people's lives. (Kahn et al., 2003) Therefore, by examining the epidemiology of animal bites in a community and knowing how people are exposed, the number of animal bite cases in emergencies as well as the economic burden thereof can be reduced. (Rahmani et al., 2014; Manouchehrifar et al., 2013) Due to non-compliance with the dog keeping laws and rabies virus in warm-blooded animals in the area, which is mainly transmitted by biting, there is a high cost to vaccinate bitten people annually. Therefore, analyzing the available data can be a useful guide for planning health education and reducing the burden of this disease in the health system of the country. (Fayaz et al., 2011; Mazaheri et al., 2010)

Hence, in this study, the epidemiological and geographical status of bites was investigated. Given that most cases are found in the Caspian Sea, northeast, and southwestern regions of the country, (Jafari-Khounigh et al., 2015) this study was conducted in Mazandaran province.

**Methods**

The present research was a retrospective-longitudinal and routine data-based study conducted in 2018. The population of the study was all animal bitten people in the geographical area of Mazandaran province in 2007-2016. According to disease control centers, an animal bitten person is defined as a person who has referred to health centers for animal bites and fear of rabies for vaccination and serum therapy. Therefore, this definition was considered as a criterion of the animal bite. Other inclusion criteria included residence in urban and rural areas of Mazandaran province and completeness of patient's information. The data collection tool was a checklist based on the documentation available at the animal bite registration offices in disease prevention health centers. The studied characteristics included age, sex, number of bites, type of residence, the month of bite, year of bite, and city. To conduct this study, the required data were extracted from animal bite registration offices at Mazandaran and Babol health centers.

The researchers have adhered to the Helsinki Ethical principles in all cases so that all patients' information was kept confidential. The information was coded without mentioning patients' personal information such as name, surname, etc. Frequency and percentage descriptive statistics and independent t-test and one-way ANOVA were used to analyze the data using SPSS software. ArcGIS software was also used to draw the geographical map.

**Results**

Based on the results of animal bite cases, a total of 32469 cases were reported in Mazandaran province in 2007-2016. The prevalence of the disease was 45.2% in the urban area and 54.8% in the rural area. Most cases were in 2015 with 7621 patients and the least in 2013 with 3305 patients (Chart 1). Among the counties of Mazandaran province, Sari was the first with 4623 cases of animal bites (Table 1). No animal bites were recorded during the study period in the northern Savadkoh, Simorgh, and Kalardasht.

Table 1: Absolute frequency distribution of animal bite cases in Mazandaran province based on region, the season of disease, and residence during 2007-2016

Months												Residence		Total of animal bites	Cities
February-March	January-February	December-January	November-December	October-November	September-October	August-September	July-August	June-July	May-June	April-May	March-April	Urban area	Rural area		
150	225	226	227	319	320	375	374	285	343	317	317	1478	2000	3478	Amol
91	83	67	51	55	74	97	89	71	77	79	97	203	728	931	Babol
75	104	76	99	166	173	194	189	176	179	148	176	1080	676	1756	Babolsar
153	164	190	188	283	271	320	324	306	288	302	259	1780	1268	3048	Behshahr
110	179	188	177	205	288	312	286	248	295	220	254	1120	1642	2762	Tonekabon
45	70	77	57	79	92	119	101	99	95	112	81	328	699	1027	Jooybar
90	119	114	103	148	166	201	172	176	168	183	175	874	939	1813	Chaloos

66	86	93	87	124	121	116	148	149	122	119	148	920	454	1374	Ramsar
231	344	359	349	420	424	479	433	326	425	346	387	1793	2830	4623	Sari
39	51	38	55	40	60	72	78	82	61	50	69	277	418	695	savadkooh
22	26	15	24	24	58	51	51	59	73	56	78	294	243	537	Abbasabad
14	22	21	27	39	53	67	57	53	64	53	65	373	162	535	Freydoonkenar
163	191	173	202	247	302	346	281	266	292	291	259	1518	1495	3013	Ghemshahr
66	67	78	81	86	95	124	100	113	103	105	100	537	581	1118	Galoogah
58	64	71	59	98	100	144	135	117	124	95	112	526	651	1177	Mahmoodabad
18	16	17	11	20	22	40	44	43	54	42	17	53	291	344	Miyandorood
68	97	114	109	151	161	180	157	149	167	147	156	401	1255	1656	Neka
54	72	76	74	100	127	163	143	131	104	125	164	586	744	1330	Noor
61	63	74	75	95	130	135	139	124	131	115	109	535	717	1252	Noshahr
1574	2043	2067	2055	2699	3037	3535	3301	2973	3165	2905	3023	14676	17793	32469	Total

Based on the results of two independent t-tests and one-way ANOVA, there was a significant relationship between season and animal bites. However, there was no significant relationship between residence and animal bites (Table 2).

0.04	478.6	Spring	Season
	516.3	Summer	
	410.1	Fall	
	299.1	Winter	

Table 2: The relationship between animal bites in Mazandaran province and season and type of residence during 2007-2016

Significance level	Mean bite	Type	Variable
0.41	936.4	Rural	Type of residence
	772.4	Urban	

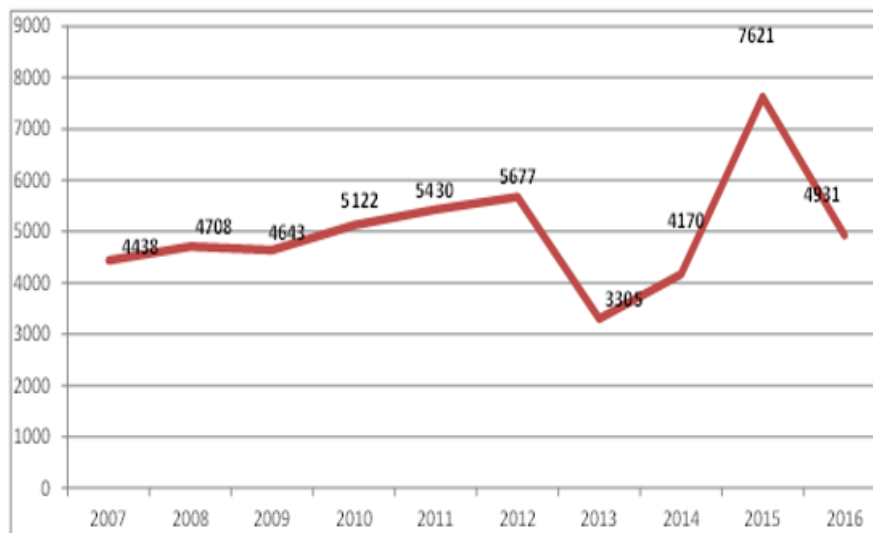


Chart 1: Frequency distribution of animal bites in Mazandaran province in 2007-2016

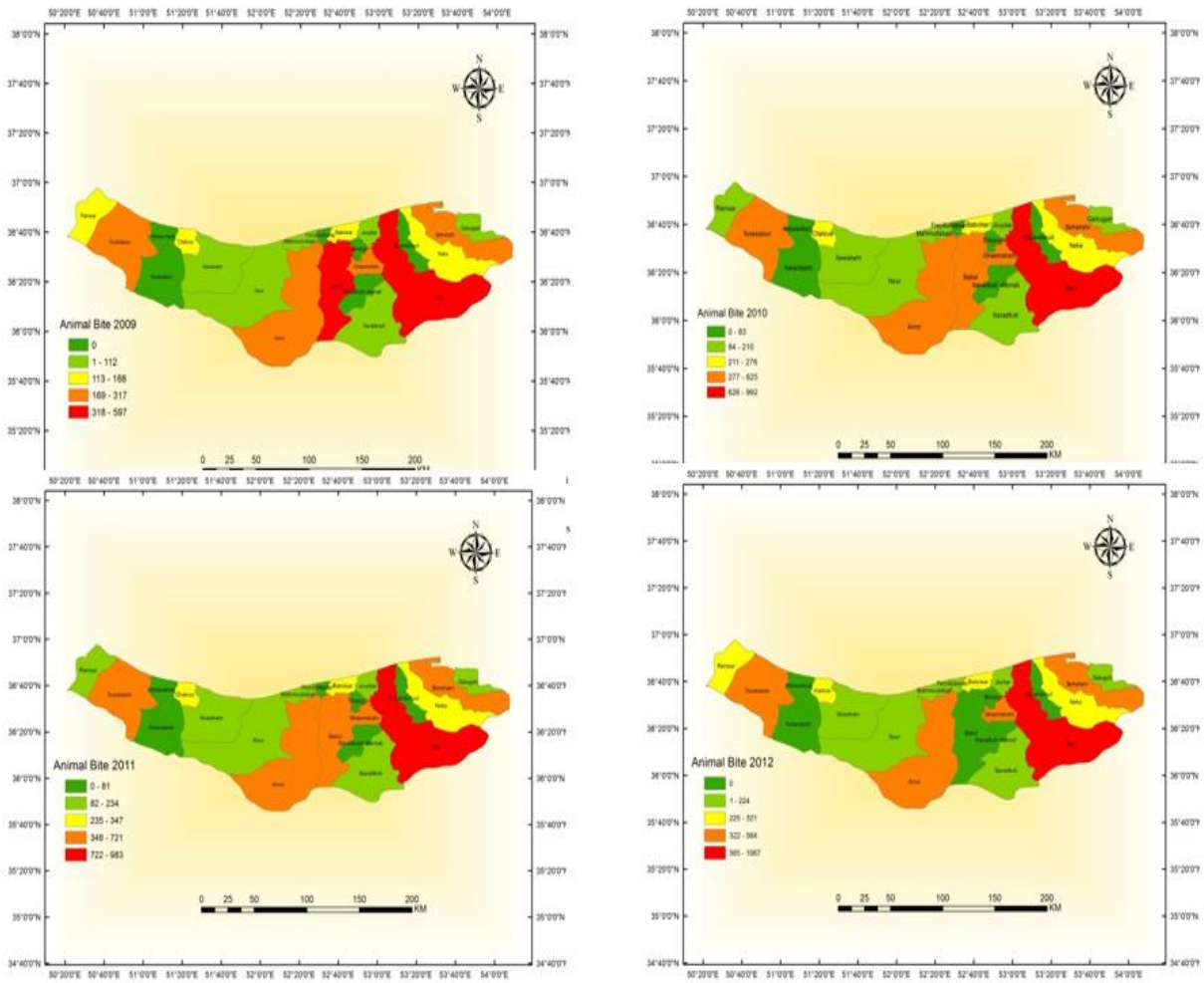


Figure 1: Distribution map of animal bites in Mazandaran province based on the studied years.

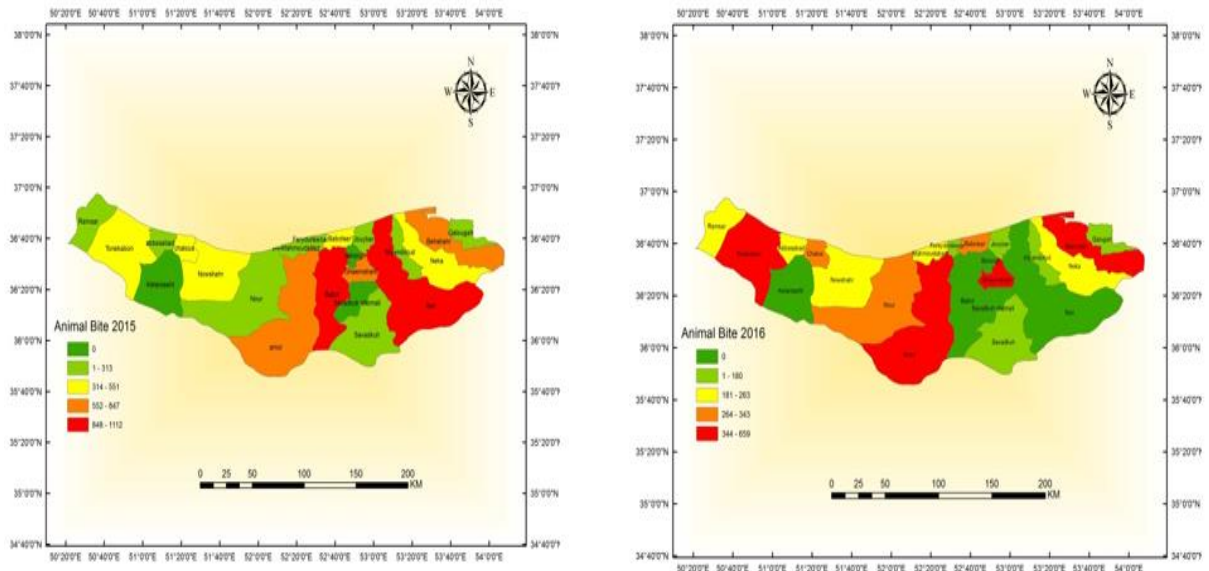


Figure 2: Distribution map of animal bites in cities of Mazandaran province during 2007-2016.

## Discussion

According to the results, there was an average of 5004 animal bites per year in Mazandaran province. The results of Naghibi et al. in Mazandaran province also showed that 25869 animal bites were reported in Mazandaran province in 2008-2012 and the average incidence of bites in the five-year period was 203 cases per 100,000. (Naghibi et al., 2014) A comparison of the incidence of animal bites in the study period shows that the incidence rate is increasing each year. This result can be related to public awareness of the consequences of rabies and their referral to rabies prevention centers, improving the registration and reporting system for animal bites, tourism development, and the presence of families in rural, forest, and recreational areas.

The prevalence of the disease was 45.2% in the urban area and 54.8% in the rural area. The results of the study by Zohrevandi et al. (2014) entitled "Epidemiology of animal bites in Rasht city" also showed that 61.3% of animal bites were in rural areas. The study of Babaeian-Moghaddam et al. (2015) in Quchan city showed that animal bites were more in rural areas. Similar studies conducted by Bahonar et al. in Ilam, Majidpour, et al. in Ardebil, as well as Amiri and Khosravi in Shahrood (2009), have also found that most of the animal bites were in rural areas. Given that in rural areas people are more likely to be in contact with cattle and dogs, it can be inferred that the incidence of bites is higher in these areas.

Most bites occurred in summer and after that in spring. In the study of Zohrevandi et al. (2014), most bites were in spring and summer. The results of Dadipour and colleagues in the North of Iran (Dadypour et al., 2009) and Charkazi et al. in Golestan province (Charkazi et al., 2013) were in line with the results of the present study. Most of the animal bites in the study of Babaeian-Moghaddam (2015) were in spring and May-June. In the study of Bahonar et al. (2008) most bites were also in spring. (Bahonar et al., 2008) Majidpour's study showed that animal bites in summer were more common than other seasons. The cause of the increase in animal bites in summer can be attributed to the onset of the breeding season. More frequency, this is justified in two ways in spring and summer. First, the risk of being bitten in Mazandaran province increases due to holidays and an increased number of passengers. On the other hand, depending on the type of farmers' activity in spring and summer, the risk of being bitten is high, especially in this occupational group.

Generally, the findings of this study suggest the need to control animals, such as dogs and cats through appropriate training in teenagers and adolescents. Moreover, comprehensive educational content should be designed to teach how to treat dogs and provide targeted and principled training using educational theories. Furthermore, adopting proper laws and forcing dog owners to use collars can also reduce animal bites. Finally, it is suggested that by repeating the present study elsewhere in the country and determining the bite pattern of each area, the necessary conditions for the prevention and treatment of bitten patients will be provided.

## Conclusion

The results of the study showed that the number of animal bites increased during the years studied. These results could be due to increased awareness of the dangers of animal bites and increased public access to appropriate treatment, vaccine and anti-rabies serum, and partly due to increased bites. Therefore, it makes the process of vaccine supply difficult. On the other hand, according to the Millennium Development Goals and the Principles of Health for All, one of the concerns of health officials and planners is to reduce health-related problems, such as physical disability, illness and death, mental distress, social problems, and economic losses. Therefore, the results of this study can be used for planning and policy-making by the authorities. In this study, the incidence of animal bites in different seasons and months of year and locations were determined. According to the results of this study, it seems necessary to provide educational and health intervention programs to pet owners, especially dog owners, with emphasis on animal vaccination in order to prevent and reduce animal bite cases. Moreover, the authorities, in May-June and spring, should be prepared for more bitten people referral and provide the necessary vaccine and anti-rabies serum supplies, equipment, and staff.

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