

Access this article online
Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_631_23

Epidemiological characteristics and surveillance of animal bite injuries, in Kerman city, Iran

Fatemeh Rezabeigi Davarani¹, Hakimeh Khaleghi², Narges Khanjani³, Asma Amiri Domari⁴, Rasoul Raesi^{5,6}, Salman Daneshi⁷

Abstract:

BACKGROUND: Animal bites are a major threat to human health. The present study was designed to determine the incidence and epidemiological factors and to investigate the process of referral and treatment of animal bite cases in Kerman city.

MATERIALS AND METHODS: This was a cross-sectional (descriptive-analytical) study. All the cases of animal bites that were referred to rabies treatment and prevention centers under the coverage of Kerman health center during 2019 and 2021 were investigated. The data were collected from the health center of Kerman city in Excel form that was registered in the portal of the Ministry of Health. The Chi-square test and Fisher's exact test were used in SPSS24 software to analyze the data.

RESULTS: In this study, 5407 people (4076 men and 1331 women) were bitten by animals. The average incidence of animal bites was 313 per hundred thousand people. The mean \pm SD age of the injured was 31.38 ± 17.72 years. 73.2% of cases of attacking animals were dogs, and half of those dogs had owners. 58.6% of cases were injured in the hand, and 94.2% referred to rabies treatment and prevention centers in the first 48 h after the bite. No cases of animal-bitten deaths were reported during this period. Between gender ($P = 0.006$), age ($P = 0.013$), place of residence ($P = 0.003$), occupation ($P < 0.000$), history of previous bites and vaccinations ($P = 0.001$), and injured limb ($P < 0.000$) and not going to receive the next round of vaccinations, there was a statistically significant correlation.

CONCLUSION: Animal bites are a major health problem in Kerman, and due to creating health problems and economic losses, it is necessary to take serious action to control and prevent this health threat.

Keywords:

Animal bites, epidemiology, humans, rabies, surveillance

¹Social Determinants of Health Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran, ²Student Research Committee, Kerman University of Medical Sciences, Kerman, Iran, ³Environmental Health Engineering Research Center, Kerman University of Medical Sciences, Kerman, Iran, ⁴Department of Surgery, School of Medicine, Imam Khomeini Hospital, Jiroft University of Medical Sciences, Jiroft, Kerman, Iran, ⁵Department of Nursing, Torbat Jam Faculty of Medical Sciences, Torbat Jam, Iran, ⁶Department of Health Services Management, School of Health, Mashhad University of Medical Sciences, Mashhad, Iran, ⁷Department of Public Health, School of Health, Jiroft University of Medical Sciences, Jiroft, Kerman, Iran

Address for correspondence:

Dr. Rasoul Raesi, Department of Health Services Management, Mashhad University of Medical Sciences, Mashhad, Iran.
E-mail: raesi.br881@gmail.com
Dr. Salman Daneshi, Assistant Professor, Department of Public Health, School of Health, Jiroft University of Medical Sciences, Jiroft, Kerman, Iran.
E-mail: salmandaneshi008@gmail.com

Received: 09-05-2023
Accepted: 08-07-2023
Published: 29-08-2024

Introduction

Animal bites are one of the most serious threats to human health.^[1-3] Animal saliva contains a wide range of potentially pathogenic infectious microorganisms, and any of these animal bites can lead to specific problems.^[4] Rabies is a common disease between humans and animals, which is caused by viruses of the *Rhabdoviridae* family and the lyssavirus genus.^[5] Rabies is mainly transmitted through animal

bites (animal bites) and sometimes through mucous tissue, breathing, placenta, contaminated equipment, and rarely organ transplants.^[2,6,7]

Warm-blooded animals and humans are usually infected by chance and through bites.^[8] Rabies has two types of epidemiology: the urban type, which is spread by dogs and less by cats, and the wild type, whose reservoirs are foxes, wolves, minks, and raccoons.^[9] Rabies is almost always fatal if symptoms occur, but it can be

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Davarani FR, Khaleghi H, Khanjani N, Domari AA, Raesi R, Daneshi S. Epidemiological characteristics and surveillance of animal bite injuries, in Kerman city, Iran. J Edu Health Promot 2024;13:299.

easily prevented through prophylaxis before and after exposure to animal bites.^[5]

According to statistics, 150 countries are infected with the rabies virus in the world.^[10] Every year, 2.5 billion people in the world are at risk of contracting rabies, and about 10 million people receive rabies treatment and prevention services after animal bites.^[8] More than 59,000 deaths occur due to rabies every year.^[11-14] Due to the lack of laboratories to confirm the diagnosis, sporadic epidemiological surveillance, and unreported clinical cases in developing countries, mortality estimates in developing countries are lower than the actual incidence of human deaths from rabies.^[11] The World Health Organization estimates that 31,000 deaths occur annually in Asia due to rabies, which is about 56% of all deaths worldwide. Based on available data, about 350 deaths and 13,100 years of life lost due to disability and premature death occur in the Middle East due to this disease.^[14,15]

This disease is endemic in Iran, and infection occurs frequently among domestic animals.^[16] Still, two–six people per year die from this disease in the country.^[15] Also, more than 150,000 cases of animal bites have been reported annually in Iran with an incidence rate of 200 per 100,000 people.^[17] This category annually imposes heavy costs on the country's health and treatment system to provide prevention and treatment services.^[18] The wide geographical range, climatic diversity, and the dependence of the major risk factors of rabies on wildlife species, along with the population differences in terms of the level of health and knowledge required in Iran, point out the need for separate investigations in different regions of the country.^[19] The present study was designed to determine the incidence and epidemiological factors and to investigate the process of referral and treatment of animal bite cases in Kerman city which is a vast geographical area with different climates (desert and mountains).

Material and Methods

Study design and setting

The current research is a cross-sectional (descriptive-analytical) study. Eligible people in this study were all animal bite cases who were referred to rabies treatment and prevention centers under the Kerman health center during 2019–2021 (from April 2019 to March 2021) and needed rabies treatment and prevention measures based on the national protocol.

Study participants and sampling

There are two rabies prevention and treatment centers in Kerman city and 12 centers in rural and urban areas around Kerman. According to national guidelines,

data are routinely registered online in the portal of the Ministry of Health. To conduct this research, after receiving the code of ethics from the Kerman University of Medical Sciences, the first author obtained the final data of the whole County in the form of an Excel form from the headquarters of prevention and combating diseases of Kerman health center, and then the data are extracted and recorded in a researcher-made checklist and finally recorded in SPSS software version 24. Completed checklists were kept in a safe place, and names of the injured were avoided.

The characteristics investigated in this study include age, gender, occupation, geographic region of residence and place of bite (according to city and village), month and time of bite occurrence, type of invasive animal, vaccination status of the invasive animal, bitten limb, and type of injury, need to receive immunoglobulin, time interval in hours and days between the time of the bite and vaccination and receiving immunoglobulin, status of receiving the anti-rabies and tetanus vaccine, and absence of treatment.

Data collection tool and technique

Quantitative data were shown as mean and standard deviation, and qualitative data were shown as absolute and relative frequency through graphs and statistical tables. The Chi-square test and Fisher's exact test were used to analyze the data. A significance level of less than 0.05 was considered.

Ethical consideration

This study was approved by the Ethics Committee of Kerman University of Medical Sciences (Ethics Approval Number: IR.KMU.REC. 1400.322).

Results

From April 2019 to March 2021, 5407 cases were bitten by animals and referred to rabies prevention and treatment centers covered by Kerman health center. The average incidence of animal bites during two years of study in Kerman city was 313 per hundred thousand population. The mean \pm SD age of the injured was 31.38 ± 17.72 years. The residents of 5011 (92.7%) cases were urban, and 4921 (91%) people were bitten by an animal in the city. 1910 (35.3%) of the injured were unemployed [Table 1], and most cases of bites were related to the age group of 30–39 (22.1%) years and 20 to 29 (21.1%) [Figure 1].

This study showed 3170 (58.6%) injured were bitten on the hand, 1710 (31.6%) on the legs and buttocks, 177 (3.3%) on the head, face, and neck, and 73 (1.3%) on the chest and abdomen. In 277 (5.1%) victims, two or more limbs were bitten. In 3592 (66.4%) of the injured people, the injuries were punctures and scratches. The

history of tetanus vaccination was checked for all the injured. 4074 (75.3%) injured people needed to receive the tetanus vaccine, and all of them were given the tetanus vaccine.

In this study, 5094 (94.2%) injured persons had been referred to rabies treatment and prevention centers in the first 48 h after being bitten. Of the total cases of animal bites, 3434 (%) people needed immunoglobulin injection, and 2515 (73.23%) people had been injected with immunoglobulin before 12 h [Table 2].

In this study, 1613 (29.8%) injured people did not come to receive the second round and 520 (9.6%) injured people did not come to receive the third round of the vaccine, and after follow-up and telephone calls from the staff of the rabies treatment and prevention center, came for the next rounds. No cases of animal-bitten deaths were reported during this period; between gender ($P = 0.006$),

Table 1: Demographic information, species of invasive animal, and bite time

Variable	Number (Percentage)	Variable	Number (Percentage)
Gender		Invasive animal	
Male	4076 (75.4)	Dog	3959 (73.2)
Female	1331 (24.6)	Cat	1172 (21.7)
Occupation			
Student (School)	981 (18.1)	Rodents	211 (3.9)
Student (College)	220 (4)	Horse	18 (0.3)
Employee	399 (7.4)	Fox	15 (0.2)
Rancher	72 (1.3)	Livestock	11 (0.2)
Farmer	90 (1.7)	Donkey	9 (0.1)
Homemaker	526 (9.7)	Wolf	6 (0.1)
Worker	230 (4.2)	Monkey	4 (0.0)
Driver	107 (1.9)	Jackal	1 (0.0)
		Bat	1 (0.0)
		Time of incident	
Self-employed	1910 (35.3)	1–6 AM	272 (5)
Vet	36 (0.6)	7–12 AM	1624 (30)
Military	78 (1.4)	1–6 PM	2037 (37.7)
Others	415 (7.7)	7–12 PM	1474 (27.3)

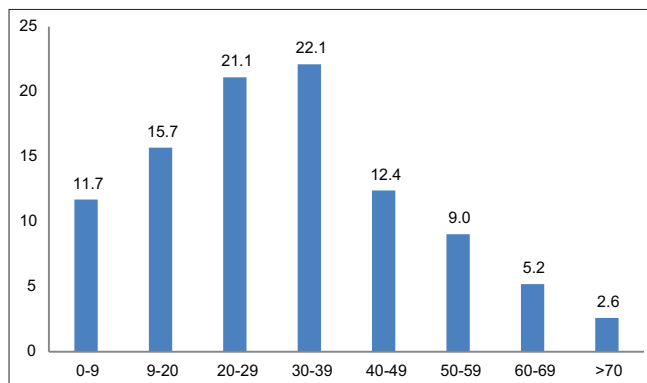


Figure 1: Frequency distribution of animal bites among different age groups in the Kerman County

age ($P = 0.013$), place of residence ($P = 0.003$), occupation ($P < 0.000$), history of previous bites and vaccinations ($P = 0.001$), and injured limb ($P < 0.000$) and not going to receive the next round of vaccinations, there was a statistically significant correlation.

This study showed 468 (8.6%) injured people had received four times of vaccines. Necessary follow-up was done in 4587 (84.8%) injured, and after making sure that the animal was alive, there was no need for the fourth round of vaccine, and three rounds of vaccine had been injected. For 352 people who had been bitten by an animal and had received a vaccine, two doses of booster vaccine were injected within 3 days after being bitten.

This study showed 3959 (73.2%) cases were bitten by dogs and 1172 (21.7%) cases were bitten by cats [Table 1]. 2466 (62.28%) owned dogs (2131 domestic dogs, 276 guard dogs, 59 herding dogs) and 874 (22.07%) stray dogs and 619 (15.63%) domestic dogs without owners. Only 1206 (48.9%) owned dogs had been vaccinated. 903 (77.04%) stray cats and 269 (22.95%) owner cats bit people. Out of 269 owner cats, only 26 (9.66%) cats were vaccinated.

More bites were reported in summer (28.9%) and spring (26.4%). Also, most cases of bites were related to the month of July (9.9%) and the least related to the month of March (6.1%) [Figure 2].

Discussion

According to the results of this study, the average incidence of animal bites during two years of study in Kerman city was 313 per hundred thousand population. This rate in the first year of the study (333 per 100000 people) was higher than the second year (295 per 100000 people), which is higher than the national rate. The study of Ngugi *et al.*^[31] (2018) in Kenya, which was conducted during 2011–2016, reported an incidence of 289 per 100,000 which is almost consistent with the results of this study. Sheikholeslami *et al.*^[20] (2009) reported the incidence of animal bites in Rafsanjan (one of the cities near Kerman) during 2003, 2004, and 2005 as 180, 195,

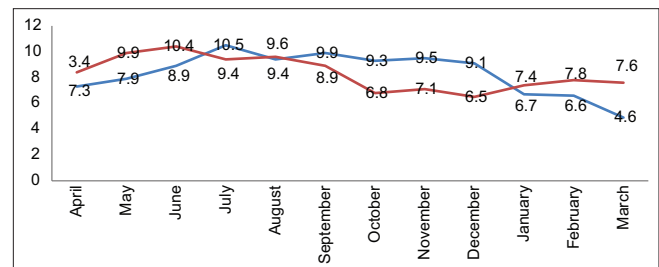


Figure 2: Occurrence time by month among referred to rabies treatment and prevention centers in Kerman, in 2019–2020 and 2020–2021. *The y-axis indicates the percentage

Table 2: Time interval between bite time and receiving the first dose of rabies vaccine and immunoglobulin

Variable	Number (Percentage)	Variable	Number (Percentage)
The interval between the bite and the rabies vaccine injection		The interval between the bite and the immunoglobulin injection	
<48 h	5095 (94.2)	<12 h	2515 (73.2)
48–72 h	241 (4.4)	12–72 h	822 (23.9)
4–10 days	64 (1.2)	4–7 days	97 (2.8)
11–20 days	6 (0.1)		
21–40 days	1 (0.0)		

and 241 per 100 thousand, respectively. In the study by Delam *et al.*^[21] (2023), overall average incidence of animal bites during the years 2015 to 2019 in Fars province in southern Iran was 142.93 per 100,000 people. And during the years of study trend, it reached from 109.92 to 189.33 per 100000 people. In another similar study conducted by Bay *et al.*^[22] in Golestan province in northern Iran, the incidence of animal bites increased from 492 cases in 2013 to 652 cases per 100000 people in 2020.

Probably, the difference in the time and place of conducting the studies is one of the reasons for the different incidences of animal bites. In Kerman, due to long-term droughts due to the lack of water and food in the natural habitat of animals, the abundance of animals in residential areas has increased compared to the past, and this issue may be the reason for the high incidence of animal's bites. Increasing people's awareness to refer to rabies prevention and treatment centers compared to the past and interest in keeping pets, especially dogs and cats, may also be one of the reasons for the increase in the incidence of animal bites in recent years in Iran. One of the reasons for the lower incidence of animal bites in the second year of the present study, which was comparable to the COVID-19 pandemic, maybe the severe quarantine and the absence of people in the open air, or the fear of infection and the non-referral of the injured to rabies treatment and prevention centers.

In the present study, most cases of animal bites occurred in men, which is in line with other studies conducted inside the country and the majority of foreign studies. Abbasi *et al.*^[23] in Golestan province reported 75.48% of cases in men, and Sheikholeslami *et al.* in Rafsanjan city reported the percentage of animal bites to be 87% in men which is consistent with the present study.^[20]

According to the results of this study, the place of residence of the injured and the place of the animal bite were mostly the city, which was studied by Kassiri *et al.* in Khorramshahr city (southern Iran) and 71.8% of the animal bite cases were declared to be the city^[17] and Janatolmakan *et al.*^[24] in Kermanshah province (western Iran) was declared by 76% as equal. Of course, in other studies, including the study of Pourmarzi in Gilan province, Bai in Golestan province,

and Melka in Galiksh and Babaian in Qochan, most of the bites and injuries happened in the village.^[2,14,22,25] Also, houses without fences, doing agricultural and animal husbandry activities that require closer contact with the natural environment and animals may have an impact on the incidence of animal bites in rural areas of northern provinces. In the present study, the higher number of animal bite cases in urban areas can be attributed to the fact that the urban population is about five times higher than the rural population of the city, climate changes, and numerous droughts in recent years that have caused animals to move closer to urban areas to search for food and the presence of more dogs. He attributed it to domestic animals in the city and also the lack of awareness of the city dwellers in the field of treatment of animals.

In the current study, most of the injured were self-employed, which is similar to the study conducted by Mohammadi *et al.*^[26] in Sanandaj, who reported the most cases of injuries among people with self-employed jobs (25.3%) and the study by Janatolmakan *et al.*,^[24] which reported the largest group of injured (34.1%) of self-employed workers declared, which is probably due to the wide range of jobs considered in the category of self-employed jobs.

In this study, most cases of bites were related to the age group of 30–39 years and after that 20–29. In the study by Kassiri *et al.* in Khorramshahr city, the age group was 30–39 years old,^[17] the study by Janatolmakan *et al.*^[24] in Kermanshah, the age group was 27–39 years old, and the study by Riahi *et al.*^[16] in Tabas city, the age group of 20–29 years old reported the highest percentage of injured which is consistent with the results of this study. The reason for this can be seen from the higher frequency of these age groups in the population pyramid and the more active presence of this group in terms of social and economic aspects in society.

In the present study, the most damage was in the hand area, so 56.8% of people were injured in the hand area, which is similar to the study by Mohammadi *et al.* who reported the shoulder and upper limb (42.9%)^[26] are consistent. In the study of Kassiri *et al.* in Khorramshahr, as well as in the study of Amiri and Khosravi,^[17,27] in

Shahroud, it was reported that the most injured area was the leg and lower limb, which is not consistent with the present study.^[17] Probably, biting in the lower limb due to escaping from the attacking animal and biting in the hands and upper limb are more justified due to stimulating the animals or playing with them.

According to the data of the present study, most of the injuries caused by animal bites were in the form of punctures and superficial scratches. In a study conducted by Maleka *et al.*^[25] in Galish city, most of the injuries (90.9%) were reported in Galish city. The study by Riahi *et al.*^[16] in Tabas city reported the extent of injuries in 75.6% of cases as gross, 17.3% as moderate, and 1.7% as large, and the depth of injury in most cases as superficial and 27.9% as deep, which is in line with the present study.

The highest frequency of animal bites in the present study was seen in summer and then spring. In the study of Babaeian-Moghaddam *et al.*^[2] in Qochan, most cases of animal bites were reported in June; also Nyasulu and colleagues in Africa reported the most cases of animal bites in spring and summer,^[11] which is consistent with the present study. The higher number of animal bite cases in spring and summer can be considered due to the beginning of the season of agricultural and animal husbandry activities, school holidays, and the increase in travel and tourism cases in nature, and as a result, more contact between humans and animals.

Most of the injured were attacked by a dog and then by a cat. According to a meta-analysis study conducted by Abedi *et al.*^[15] in Iran, the main cause of animal bites was reported to be dogs. Also, in the study conducted by Salomao *et al.*^[13] in Mozambique, 97.8% of animal bite cases are related to dogs, which is consistent with the present study.

According to the results of the present study, most of the people were bitten between 13:00 and 18:00. In the study by Khazaei *et al.*,^[28] they reported the highest number of bites between 12:00 and 18:00 (39.25%) in the afternoon. Contrary to the present study, Riahi *et al.*^[16] in Tabas city reported the highest number of bites between 9 and 12 before noon, and Azari and colleagues^[8] in Shirvan reported the majority of animal bite cases before noon.

Delay in seeking prevention and treatment services after an animal bite increases the possibility of wound infection and rabies, so increasing public awareness may be effective in seeking timely treatment. In the present study, most of the injured received the anti-rabies vaccine and immunoglobulin in less than 48 h and 12 h, respectively. In the study conducted by Khazaei *et al.*,^[28] 81% of animal bite cases were referred for treatment in

less than 48 h, which is consistent with this study. In the study conducted by Fayaz *et al.*,^[19] 60% of animal bite cases in Tehran were referred in less than 6 h, probably the reduction in a delay time in this study was due to people's higher awareness of the complications of animal bites and greater access to rabies treatment centers in Tehran.

Liu and Cahill,^[29] in the review of rabies epidemiology and recent rabies vaccination guidelines in America, have reported that unvaccinated domestic dogs are responsible for the majority of rabies cases, according to the results of the present study, compared to vaccinating almost half of the dogs and 9.66% of the cats. In the study conducted by Faramarzi *et al.*, it was reported that there are about 900,000–1,100,000 domestic dogs and shepherds in Iran, of which only 25–30% have been vaccinated against rabies,^[30] which indicates that the percentage of rabies vaccination of domestic dogs is higher in Kerman city.

In the present study, 29.8% of the injured did not come to receive the second round of the vaccine and followed up for the next round. Regarding the reasons for not coming in to receive the next rounds, the authors did not find any references to similar articles that investigated this issue. Also, non-referral for subsequent appointments was more in men and the age group of 30 to 39 years and 40 to 49 years than in other groups. The non-referral of men compared to women can be attributed to their more occupational and social conflicts than women, in addition, are psychologically more sensitive to their health compared to men. To justify the absence of treatment in most of the above-mentioned age groups, we can also the higher ratio of active, productive, and busy populations in these groups compared to other age groups.

In the current study, city residents were more absent from treatment than villagers. The fact that there are fewer cases of the absence from treatment in the village compared to the city can be attributed to the efficiency of the system of healthcare networks in rural areas and the greater vicinity of the health centers to the health hazards of the population covered in terms of the limited population and frequent follow-up of the injured in animal bite cases.

People whose injured parts were head, neck, and face or more than two organs were injured were less absent from treatment. Probably because the injured points are more sensitive in these victims, the healthcare personnel have provided them with better training and more sensitization on the complications of animal bites and rabies bites, and the fear of contracting rabies has caused them to be less absent from treatment.

People who had a history of being bitten and received a previous vaccine were less absent from treatment. The reasons for this issue can be attributed to their greater awareness and previous mental background in the field of animal bite complications, which were taught to them by the healthcare personnel when they received the previous prevention and treatment services.

In most of the injured, the necessary follow-up was done, and after making sure that the animal was alive, there was no need for the fourth round of the vaccine and three rounds of the vaccine had been injected. According to the study conducted by Rezaeinasab *et al.*^[31] in Kerman province, 79.3% of the injured received three rounds of treatment. Also, in the study conducted by Janatolmakan *et al.*^[24] in Kermanshah, 82% of the injured required three rounds of treatment. The present study is consistent.

According to the results of this study, in terms of the results of the treatment, all patients were cured. Fortunately, no deaths from rabies were reported during the two years of study.

Limitation and recommendation

In this study, data recorded in the health sector were used. The researchers were not involved in data collection and are not aware of the accuracy of the information.

In this study, the incidence rate was calculated based on cases referred to rabies prevention and treatment centers. Because it is possible that who are repeatedly scratched by pets may not refer to rabies prevention and treatment centers, so it is not possible to determine the actual incidence in an area.

Conclusion

The results of this study showed that the cases of animal bites in Kerman city are high, and the main animal that causes injuries are dogs, only 62.28% of them have owners. Animal bites can impose a heavy financial burden on the healthcare system and a great psychological burden on the injured and their families. Therefore, common policies such as the elimination of stray animals, planning for animal vaccination, as well as extensive education for the community about animal bite prevention, and, if bitten, timely referral to medical centers and receiving vaccines and immunoglobulins should be implemented. It should be considered as the priority of the rabies prevention and control program. Also, due to the high number of bites by dogs, it is recommended to have pet dog vaccinations and dog collars.

Acknowledgement

This study was approved by the Ethics Committee of Kerman University of Medical Sciences (Ethics Approval Number: IR.KMU.REC.1400.322). The authors appreciate

the Student Research Committee of Kerman University of Medical Sciences and also the manager and staff of Kerman Health Center for their collaboration in this research.

Declaration of patient consent

To comply with ethical considerations in this research, the information of the participants was kept confidential and other people were not able to access this information. The names and surnames of the participants were not used for data collection, and data collection was done after obtaining the code of ethics from Kerman University of Medical Sciences.

Financial support and sponsorship

This research is financially supported by the Research and Technology Vice-Chancellor of Kerman University of Medical Sciences.

Conflicts of interest

There are no conflicts of interest.

References

- Hesseini S, Baneshi MR, Khajeh Kazemi R, Mashayekhi M, Gharaei Khezripour Y, Zolala F. Geographical distribution, time trend, and epidemiological characteristics of animal-bite cases in Bardsir, 2010-2014. *J Community Health Res* 2017;6:216-22.
- Babaeian-moghaddam M, Hashemi-Nazari SS, Khodakarim S. Epidemiological study on animal bite cases and its related injury in Quchan district in 2013. *Safety promotion and injury prevention (Tehran)*. 2015;3(1):9-14.
- Ngugi JN, Maza AK, Omolo OJ, Obonyo M. Epidemiology and surveillance of human animal-bite injuries and rabies post-exposure prophylaxis, in selected counties in Kenya, 2011–2016. *BMC Public Health* 2018;18:1-9. doi: 10.1186/s12889-018-5888-5.
- Nikbakht H, Heydari H, Malakzadeh Kebria R, Yegane Kasgari M, Mirzad M, Hosseini SR. Epidemiological patterns of animal bite injuries in victims under 18 year old in Babol, Iran (2010-14). *J Babol Univ Med Sci* 2015;17:67-73.
- Alam AN, Siddiqua M, Casal J. Knowledge and attitudes about rabies in dog-bite victims in Bangladesh. *One Health* 2020;9:100126. doi: 10.1016/j.onehlt. 2020.100126
- Hoseini SM, Asadi Iraee M, Yazdani Rotam MM, Mashayekhnia MJ, Roudaki Sarvandani M, Aghajani A. Some epidemiological features of human rabies referred to the health public centers of Sari, Iran, during 2012-2017. *New Findings in Veterinary Microbiology*. 2019;2(1):26-35.
- Wobessi JNS, Kenmoe S, Mahamat G, Belobo JTE, Emoh CPD, Efiengab AN, *et al.* Incidence and seroprevalence of rabies virus in humans, dogs and other animal species in Africa, a systematic review and meta-analysis. *One Health* 2021;13:100285. doi: 10.1016/j.onehlt.2021.100285.
- Azari Y, Moghadam MS, Khodabandeh J, Hamedi A. Epidemiological characteristics and the trend of animal bites during the years 2014-2018. *J Community Health Res* 2021;10:337-44.
- Mohammadzadeh A, Mahmoodi P, Sharif A, Moafi M, Erfani H, Siavashi M. A three-year epidemiological study of animal bites and rabies in Hamedan province of Iran. *Avicenna J Clin Microbiol Infect* 2017;4:45031.
- Gholami A, Alamdary A. The world rabies day 2020: Collaborate

- and vaccinate. *Iran Biomed J* 2020;24:264.
11. Nyasulu PS, Weyer J, Tschopp R, Mihret A, Aseffa A, Nuvor SV, *et al.* Rabies mortality and morbidity associated with animal bites in Africa: A case for integrated rabies disease surveillance, prevention and control: A scoping review. *BMJ Open* 2021;11:e048551.
 12. Beasley EA, Wallace RM, Coetzer A, Nel LH, Pieracci EG. Roles of traditional medicine and traditional healers for rabies prevention and potential impacts on post-exposure prophylaxis: A literature review. *PLoS Negl Trop Dis* 2022;16:e0010087. doi: 10.1371/journal.pntd.0010087.
 13. Salomao C, Nacima A, Cuamba L, Gujral L, Amiel O, Baltazar C, *et al.* Epidemiology, clinical features and risk factors for human rabies and animal bites during an outbreak of rabies in Maputo and Matola cities, Mozambique, 2014: Implications for public health interventions for rabies control. *PLoS Negl Trop Dis* 2017;11:e0005787. doi: 10.1371/journal.pntd.0005787.
 14. Pourmarzi D, Razi M. Incidence rate of rabies vaccination delay after dog bite in Guilan province. *J Holist Nurs Midwifery* 2015;25:17-26.
 15. Abedi M, Doosti-Irani A, Jahanbakhsh F, Sahebkar A. Epidemiology of animal bite in Iran during a 20-year period (1993–2013): A meta-analysis. *Trop Med Health* 2019;47:1-13.
 16. Riahi S, Latifi A, Bakhtiyari M, Yavari P, Khezeli M, Hatami H, *et al.* Epidemiologic survey of animal bites and causes of delay in getting preventive treatment in Tabbas during 2005-2010. *Toloobehdasht* 2012;11:20-31.
 17. Kassiri H, Khodkar I, Kazemi S, Kasiri N, Lotfi M. A five years record of epidemiological profile and the frequency of animal bites in Khorramshahr county, (2013-2017). *Journal of Preventive Medicine*. 2019;6(2):33-23.
 18. Naghibi SA, YazdaniCharati J, Shojaie J. Epidemiological characteristic of animal-bite cases in Mazandaran, 2004-2011. *Journal of Mazandaran University of Medical Sciences*. 2014;24(117):218-24.
 19. Fayaz A, Fallahian V, Simani S, Eslamifard A, Mohammadian A, Hazrati M, *et al.* Epidemiological characteristics of persons exposed to rabies in Tehran referred to Pasteur Institute of Iran during the years of 1993-1994 and 2008-2009. *Res Med* 2011;35:168-73.
 20. Sheikholeslami N, Rezaeian M, Salem Z. Epidemiology of animal bites in Rafsanjan, southeast of Islamic Republic of Iran, 2003-05. *East Mediterr Health J* 2009;15:455-7.
 21. Delam H, Eidi A, Keshtkaran Z, Soufi O, Rezaei B, Bazrafshan MR. Incidence rate of animal bites in southern Iran during 2015-2019 using Cochran-Armitage trend test. *J Acute Dis* 2023;12:29-34.
 22. Bay V, Jafari M, Shirzadi MR, Bagheri A, Masoudi Asl I. Trend and epidemiological patterns of animal bites in Golestan province (Northern Iran) between 2017 and 2020. *PLoS One* 2021;16:e0252058. doi: 10.1371/journal.pone.0252058.
 23. Abbasi A, Azadfar S, Roshandel G, Golsha R, Naeimi M, Khodabakhshi B, *et al.* Epidemiology of animal bite injuries in Golestan province, Northeast of Iran, during 2011-12. *J Clin Basic Res* 2017;1:20-5.
 24. Janatolmakan M, Delpak M, Abdi A, Mohamadi S, Andayeshgar B, Khatony A. Epidemiological study on animal bite cases referred to Haji Daii health Center in Kermanshah province, Iran during 2013–2017. *BMC Public Health* 2020;20:1-8. doi: 10.1186/s12889-020-08556-1.
 25. Maleka A, Behnampour N, Mirkarimi SK, Khosravi S, Khosravi A. The epidemiologic status of animal bite and the effect of wasting stray dogs on the incidence of animal bites in Galikesh County since 2009 until 2013. *Jorjani Biomed J* 2017;5:91-6.
 26. Mohammadi N, *et al.* Investigation of animal bites prevalence in human population of Sanandajurban and rural areas during the period of 7 years (2008 To 2014). 2017.
 27. Amiri M, Khosravi A. Animal bites epidemiology in Shahroud city. 2009.
 28. Khazaei S, 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;6:239-44.
 29. Liu C, Cahill JD. Epidemiology of rabies and current US vaccine guidelines. *R I Med J* 2020;103:51-3.
 30. MR HH. Relationship between insulin to glucagon ratio and metabolic parameters in primiparous and multiparous dairy cows in transitional period. *Iran J Ruminants Health Res* 2016;1:49-59.
 31. Rezaeinasab M, *et al.* The prevalence of rabies and animal bites during 1994 to 2003 in Kerman province, southeast of Iran. 2007.