Epidemiological study on animal bite cases referred to Haji Daii health Center in Kermanshah province, Iran during 2013–2017

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Abstract

Background: Over thousands of animal bite cases are reported annually worldwide and in Iran placing a large financial burden on the health and economy. The aim of this study was to evaluate the epidemiology of animal bite cases in Kermanshah, Iran through 2013–2017.

Methods: In this cross-sectional study, 5618 animal bite cases in Kermanshah from 2013 to 2017 were studied. Data were analyzed using descriptive and inferential statistics.

Results: In the study period, 5618 animal bite cases were found. The prevalence of animal bites was estimated between 42.55–45.66 per 100,000 populations during 2013–2017. An increasing significant trend was found for prevalence of animal bites (Average annual percent change [AAPC] + 4.9, P-trend< 0.001) over a 5-years’ time period. The mean age of the subjects was 32.7 ± 18.3 years. Of the studied subjects 76.3% were male, and 34% had non-governmental jobs. Dogs were found as the cause of animal bites in 72% of the cases. Of the studied cases, 82% had received rabies vaccination for three times.

Conclusion: The results showed an increasing significant trend for animal bites in Kermanshah. Development of interventional programs, such as limiting stray dogs, vaccination of dogs and raising public awareness are essential.

Keywords: Epidemiology, Animals, Bite, Iran

Background

Animal bites are one of the leading causes of death worldwide [1, 2]. Animal saliva is composed of a wide range of pathogenic infectious bacteria that can transmit several lethal infections, such as rabies to humans [2, 3]. According to the Centers for Disease Control and Prevention, around 4.5 million people worldwide are bitten by animals every year and often postexposure prophylaxis is needed [2]. Epidemiological evidences suggest that more than 2.5 billion people are at risk of rabies, according to the World Health Organization [4, 5]. Each year, about 10 million people receive post exposure rabies vaccination. Around 50–60,000 rabies-related deaths are reported annually worldwide, of which 31–32,000 are occurred in the Asia and Africa [2, 3, 6–8]. The prevalence of animal bites in Iran has been reported between 98 and 450 people per 100,000 populations over the years 2008–2014 [9–13]. Several million dollars are spent annually on preventing
rabies in Iran and no other contagious disease can be found in Iran that costs as much as rabies [14–16]. The growing trend of stray dogs populations and also increasing numbers of animal bite cases and rabies in many provinces of Iran, indicate the importance of paying more attention to their management and investigations on their different aspects [12, 17]. Accurate information regarding the epidemiological status of the disease is needed for effective prevention programs [12, 18]. Given the lack of epidemiological information on animal bite cases in Kermanshah, Iran, a cross-sectional study was conducted to estimate the prevalence of animal bite cases and identify factors associated with higher prevalence of animal bites in Kermanshah, Iran through 2013–2017.

In this study, we sought to answer questions about the demographic information of the bite victims, locations of animal bite, types of animal bite, the season of bite occurrence, the situation of the victims during the animal attack, and the prevalence of animal bites during 2013–2017.

**Methods**

**Study sites**

This study was conducted in Kermanshah province, Iran. Kermanshah province is located in the west of Iran and covers an area of 24,640 km². It is the seventeenth province of Iran in terms of size (Fig. 1). Kermanshah is the ninth most populous province in Iran, with a population of 1,900,000 people (according to the 2016 census) [12]. It is one of the tribal areas in Iran including 14 counties and 84 villages. The counties include Kermanshah, Dalahu, Gilan-e Gharb, Harsin, Eslamabad-e Gharb, Javanrud, Kangavar, Paveh, Qasr-e Shirin, Ravansar; Sahneh, Sarpol-e Zahab, Salas-e Babajani, and Sonqor [19]. Haji Daii Clinic located in Kermanshah is the main site for animal bite registration in Kermanshah province. For all victims, a case is being prepared at this location and necessary medical treatment such as rabies vaccination is provided.

**Study population**

The number of animal bite cases in Kermanshah through 2013–2017 was 5618. Inclusion criteria were whom referred to one of the health clinics and had a history record. The records with incomplete information were excluded if the patient did not answer to fulfill the form.

**Study design/data management**

This cross-sectional study was carried out in Kermanshah, Iran, and was based on the STROBE guideline. The research tool was a researcher-made checklist containing 11

![Fig. 1 Map of Iran; Kermanshah province is marked in red.](https://commons.wikimedia.org/wiki/File:Locator_map_Iran_Kermanshah_Province.png)
questions assessing age, sex, occupation, place of residence, where animal bites happened, affected site, type of animal, frequency of rabies vaccination, the year, the season and the victim situation at the time of bite. After obtaining approval from the University Ethics Committee, the researcher referred to the Haji Dae Clinic for studying all bite-related records between 2013 and 2017 and included the essential information in the checklist (Fig. 2). Chi-square test was used to determine the relationship different between nominal and categorical variables in terms of number of bites. The prevalence of animal bites in each year was calculated as the number of cases divided by the population of that year multiplied by 100,000. It is notable the population number was estimated based on the data of Statistical center of Iran (https://www.amar.org.ir/english) and their census results and growth rate. The trend was tested using the Cochran-Armitage test in Stata software.

Ethical consideration
The study was approved by the Ethics Committee of Kermanshah University of Medical Sciences with the code: KUMS.REC.1397.170. Permission was also obtained from the health center of Kermanshah.

Results
The total of 5618 animal bite cases was recorded through 2013–2017 and there were 14 incomplete records. The prevalence of animal bite was obtained 42.55–45.66 per 100,000 populations, during the studied period, and its average was 44.1. The mean age of subjects was 32.7 ± 18.3 years with the age range of 27–39 years in most subjects (n = 1467, 26.1%) (Table 1). Except for the age group of 1–9 year, an increasing trend of animal bites prevalence was found for other age groups during the study period, which was significant for 30–39 and 40–49 age groups (Table 2). In the age range of 20–29 year, the prevalence of animal bite was 1.40 times higher than that of 1–19 year (Table 3). Of those who had been bitten 4277 subjects (76.3%) were male. The prevalence of animal bites in both genders (Average annual percent change [AAPC] + 4.7 for male and + 5.32 for female) increased significantly over the study time period (Table 2). The prevalence of animal bites in men was 3.15 times higher than in women (Table 3).

In terms of occupation, the highest and the lowest rates of animal bite were recorded for those with non-governmental jobs (n = 1904, 34.1%) and soldiers (n = 68, 1.2%) respectively. According to the results of the post-hoc test, the prevalence of animal bite in victims with non-governmental jobs was significantly higher than the others (p < 0.001). The majority of victims were bitten in the urban areas (n = 4239, 76.0%) (Table 1). The prevalence of animal bites in urban/rural residency increased significantly over the study time period (AAPC for urban + 5.03 and for rural + 4.6)(Table 2). The prevalence of animal bites in the urban population was 1.07 times higher than in rural areas (Table 3). Of the studied cases, 4032 cases (72%) and 1194 cases (21.3%) were bitten by dogs and cats, respectively. The prevalence of animal bites from dogs was significantly higher than others according to the post-hoc test (p < 0.001). In 3304 cases (58.9%) a sudden animal attack were reported which was significantly higher than other situations according to the post-hoc test (p < 0.001). In 1021 cases (18.2%) the animals was stimulated by humans. In our study, 49.5% of bites (2776 cases), had occurred in the upper limbs. There was a significant difference between the prevalence of upper and lower extremity injuries according to the post hoc test. Most victims (n = 4594, 82%) had vaccinated with rabies vaccine for three doses times (Table 1). The highest and lowest frequency of animal bite cases were recorded in 2017 (n = 1237, 22%) and 2013 (n = 1017, 18.1%), respectively. An increasing significant trend was found for incidence of animal bites over a 5-year time period (AAPC + 4.9, P-trend< 0.001).

Fig. 2 Flow diagram of study
The prevalence of animal bite in the year 2017 was 1.21 times higher than in the year 2013 (Table 3). The highest ($n = 1600, 28.5\%$) and the lowest ($n = 1180, 21\%$) number of animal bite cases were reported in spring and winter, respectively. According to the results of post-hoc test, the prevalence of animal bite in spring was significantly higher than in autumn and winter ($p < 0.001$).

**Table 1** Prevalence of animal bites based on the demographic variables  
| Variable                          | Number (%) | Test result |
|----------------------------------|------------|-------------|
| **Occupation**                   |            |             |
| Employee                         | 533 (9.5)  | $X^2 = 564$ |
| Self-employed*                   | 1904 (34.0)| $P < 0.001$ |
| Farmer                           | 347 (6.2)  |             |
| Student                          | 1204 (21.5)|             |
| Unemployed                       | 178 (3.2)  |             |
| Ranchman                         | 87 (1.5)   |             |
| Housewife                        | 812 (14.5) |             |
| Child                            | 310 (5.5)  |             |
| Retired                          | 161 (2.9)  |             |
| Soldier                          | 68 (1.2)   |             |
| **location of wound**            |            |             |
| Upper limbs*                     | 2776 (49.5)|             |
| Lower limbs                      | 2666 (47.6)|             |
| Both limbs                       | 162 (3.0)  |             |
| **Species**                      |            |             |
| Dog*                             | 4032 (72.0)|             |
| Cat                              | 1194 (21.3)|             |
| Livestock*                       | 41 (0.7)   |             |
| Others*                          | 335 (6.0)  |             |
| **Number of vaccination against rabies** |        |             |
| Three                            | 4594 (82.0)|             |
| Five                             | 1009 (18.0)|             |
| **Frequency of animal bite for each Year** |        |             |
| 2013                              | 1017 (18.1)|             |
| 2014                              | 1072 (19.1)|             |
| 2015                              | 1117 (19.9)|             |
| 2016                              | 1161 (20.7)|             |
| 2017*                             | 1237 (22.1)|             |
| **Season**                       |            |             |
| Spring*                          | 1600 (28.5)|             |
| Summer                           | 1495 (26.7)|             |
| Fall                             | 1329 (23.7)|             |
| winter                           | 1180 (21.1)|             |
| **Situation**                    |            |             |
| Sudden animal attack*            | 3302 (58.9)|             |
| Animal stimulation by humans     | 1021 (18.2)|             |
| When feeding the animal          | 412 (7.3)  |             |
| When playing with animals        | 564 (10.1) |             |
| When taking care of animal       | 256 (4.6)  |             |
| During human rest                | 48 (0.8)   |             |
| **Location of animal attack**    |            |             |
| Rural                            | 1365 (24.0)|             |
| Urban*                           | 4239 (76.0)|             |

*Based on the post hoc test, it was significantly higher than the others
*aIncluding donkey, horse, cow and sheep
*bIncluding monkeys, mice, hamster, and other wild animals

**Discussion**

Animal bite is one of the major causes of mortality and also a major health problem worldwide [20]. The aim of
this study was to investigate the epidemiology of animal bite cases in Kermanshah province during 2013–2017. The results showed that in the studied period, 5618 people had been bitten and an increasing significant trend was found for prevalence of animal bites over a 5-year time period. The mean prevalence of animal bites was estimated 44.1 per 100,000 populations during this time. In 2017, the prevalence of animal bites was 1.21 times higher than in 2013. In Holzer et al. study (2019) in the United States, the prevalence of animal bite cases between 2010 and 2014 was 0.25 and 0.19%, respectively [13]. Venkatesan et al. (2014) study in India indicated the prevalence of 81.8% per 1000 population for animal bite [21]. The high incidence of animal bites indicates the need for serious consideration to this issue. In this regard, health authorities should take the necessary measures to limit stray dogs, vaccine dogs, and develop training programs to make people inform about the complications of animal bites and how to prevent them. The animal bite cases have been increasing in Kermanshah through 2013–2017, which is consistent with the results of Frey et al. in Chad [2]. The results of a study by Cuc et al. (2018) in Haiti reported 690 animal bite cases within 6 months [22]. The results of Zohrevandi et al. (2012) study in Gilan, Iran showed that 1014 cases of animal bite were recorded in 2012 [23]. According to the Charkazi et al. (2013) study in Golestan, Iran, through 1998–2009 13,142 animal bites were reported [24]. In Kermanshah province, livestock farming is common and there is a high number of stray animals such as dogs and cats, so the possibility of animal bites is high. On the other hand, the growing number of animal bites shows that despite significant advances in health care in Kermanshah province, it has not yet been effective.

In our study, the prevalence of animal bites in both genders increased significantly over the study time period, which was 3.15 times higher in males than females. This finding is consistent with the results of other studies [9, 11, 25, 26]. The high prevalence of animal bite in male subjects can be associated with the large number of tribes living in Kermanshah. Accordingly, men are more likely to be bitten by animals as they are more active in outdoor activities.

In the current study, the prevalence of animal bites in urban/rural residency increased significantly over the study time period, which was 1.07 higher in urban areas than rural areas. This finding is consistent with the results of the Patel et al. (2017) and Riahi et al. (2012)

**Table 2** Trends of animal bites prevalence (per 100,000) by sex, location of animal attack, and age, during 2013–2017

| Variables          | Number (%) | Years of study | AAPC a | P-value |
|--------------------|------------|----------------|--------|---------|
| Population         |            | 2013 2014 2015 2016 2017 |        |         |
| Sex                | Male       | 4277 (76.3) 79.1 85.6 86.8 87.8 95.0 | 5.0     | 0.005   |
|                   | Female     | 1324 (24.0) 25.1 24.2 27.5 30.3 31.0 | 5.3     | 0.013   |
| Location of animal attack | Rural 1365 (24.0) 52.3 58.5 59.0 60.3 63.7 | 4.6     | 0.002   |
|                   | Urban 4239 (76.0) 53.1 46.6 54.3 57.3 63.1 | 5.0     | 0.010   |
| Age groups (year)  | 1–9 599 (11.0) 38.4 43.1 41.6 45.5 37.3 | –0.7    | 0.513   |
|                   | 10–19 772 (14.0) 55.5 52.5 53.2 54.0 68.0 | 5.1     | 0.115   |
|                   | 20–29 1347 (24.0) 62.2 62.4 70.0 74.0 77.0 | 5.5     | 0.063   |
|                   | 30–39 1050 (19.0) 50.3 53.1 60.4 63.0 64.6 | 6.4     | 0.045   |
|                   | 40–49 706 (13.0) 49.1 46.8 54.1 62.7 61.6 | 5.9     | 0.045   |
|                   | 50–59 576 (10.2) 57.4 67.6 62.3 56.1 68.3 | 4.5     | 0.434   |
|                   | > 60 568 (10.1) 50.1 66.5 56.4 59.0 66.9 | 7.5     | 0.183   |
| Total              | 5618       | 52.4 55.2 57.5 59.4 63.4 | 4.9     | < 0.001 |

*aAverage annual percent change

**Table 3** Prevalence odds ratio for demographic variables

| Variable            | Odds ratio  | 95% confidence interval |
|---------------------|-------------|-------------------------|
| Sex                 | Female      | Reference               |
|                     | Male        | 3.15                    | 2.96, 3.35 |
| Location of animal attack | Rural 1.07 | Reference               |
|                     | Urban       | 1.01, 1.14              |
| Age groups (year)   | 1–19 Reference | 1.40                   | 1.30, 1.51 |
|                     | 20–29       | 1.20                    | 1.11, 1.30 |
|                     | 30–39       | 1.13                    | 1.03, 1.24 |
|                     | 40–49       | 1.26                    | 1.16, 1.36 |
|                     | > 50        | 1.24                    | 1.11, 1.31 |
| Year of study       | 2013 Reference | 1.05                   | 0.96, 1.14 |
|                     | 2014        | 1.09                    | 1.01, 1.19 |
|                     | 2015        | 1.13                    | 1.04, 1.23 |
|                     | 2016        | 1.21                    | 1.11, 1.31 |
studies in India and Iran, respectively [27, 28]. However, in some studies, the higher prevalence of animal bite cases were observed in rural areas [11, 23, 29]. In our opinion, the higher prevalence of animal bites in urban areas compared to rural areas may be due to the fact that urban dwellers do not know how to treat animals.

In the present study, except for the age group of 1–19 year old, an increasing trend of animal bites prevalence was found for other age groups during the study period, which was significant for 30–39 and 40–49 age groups. The prevalence of animal bites in the age groups of 30–39 and 40–49 was 1.2 and 1.13 times higher than that in the age group of 1–19, respectively. In most studies, the age group of younger than 40 years is the most common group that gets bitten by animals [3, 6, 11, 27, 30–32]. Those who are in the age range of 30–49 years are more active and adventurous, so animals can be stimulated to attack. They are also more present in the community, which can make them more vulnerable to animal bites.

In our study, the upper extremities were more involved than the lower extremities, and this difference was significant by the post hoc test. This finding is in line with the results of Shuzhen et al. (2018) study in Shenzhen and Shantou cities in China and also Zohrevandi et al. (2012) in Guilan, Northern Iran [23, 33]. However, some studies reported lower extremities as the most common affected site [8, 26, 27, 30, 34]. During an animal attack, both upper and lower extremities may be affected, which may be related to the position of the victim during the animal attack.

Based on the results, dogs were the most common cause for animal bite, which is similar to other studies [3, 11, 23, 27, 31, 34, 35]. The high prevalence of animal bite by dogs can be associated with the large number of tribes living in Kermanshah as well as the presence of stray dogs through the city. A sudden animal attack was the most common type of exposure to animal bite. Its high incidence can indicate that most cases were occurred without any special reason or stimulation.

Most cases had vaccinated with rabies vaccine for three times. In other studies, vaccination and human Rabies Immunoglobulin (HRIG) vaccination were reported as post-exposure measures [3, 9, 22, 27, 36, 37]. Vaccination and administration of HRIG, along with basic measures, such as washing with water and soap, can prevent the risk of animal bites, including the possibility of rabies [21, 38]. To schedule a rabies vaccination, 0.5 cc of the vaccine is inoculated into the deltoid muscle for five times on the first, third, seventh, fourteenth, and twenty-eighth days post exposure [39].

In the current study, the most common animal bite season was spring, which is consistent with some other studies [23, 40, 41]. The high prevalence of animal bites in the spring can be due to the presence of more people in recreational areas and outdoors, which makes them more likely to face animals.

In terms of occupation, the most victims had non-governmental jobs, however in some studies, students and university students were shown as the most common victims [11, 27]. The high incidence of animal bites in people with non-governmental jobs may be due to their working conditions, since they actually spend more time outdoors and are more likely to be exposed by animals.

Incomplete information recorded in victims’ documents was one of the main limitations of this study. Accordingly, they were contacted to answer incomplete information as far as possible. Other possible limitation was related to the possibility of inaccurate transferring the records data into the checklist, herewith the researcher tried to recheck all the information at least twice. The differing health status of different countries as well as laws related to animals affect the generalizability of our results.

**Conclusion**

The prevalence animal bites in the studied period was estimated between 42.55–45.66 per100000 populations. The highest and lowest number of animal bites had recorded in 2017 and 2013, respectively, indicating it upward trend. An increasing significant trend was found for prevalence of animal bites over a 5-years’ time period. The highest prevalence of animal bites was observed in those with non-governmental jobs and also in male subjects, youth and urban residents. Spring was the most common season for animal bites. Similar studies are recommended to be conducted in other areas. Health authorities should take measures to limit stray dogs and vaccinate dogs. Broadcasting educational programs through mass media about the complications of animal bites and how to prevent is recommended. Further studies are recommended in other regions.

**Abbreviations**

AAPC: Average annual percent change; HRIG: Human Rabies Immunoglobulin; KUMS: Kermanshah University of Medical Sciences

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**Authors’ contributions**

MJ, MD, AA, SM, BA, and AK contributed in designing the study. MD and SM collected the data, and analyzed by BA and AK. The final report and manuscript were written by MJ, AA, BA, and AK. All authors reviewed and approved the final manuscript.

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**Availability of data and materials**

Data is available by contacting the corresponding author.
Ethics approval and consent to participate
The study was approved by the Ethics Committee of Kermanshah University of Medical Sciences with the code: KUMS.REC.1397.170. In the current study, information was obtained from the patients’ records and their data were kept confidential. Therefore, according to the regulations of the University Ethics Committee, there is no need to obtain a consent from these patients.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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References
1. Wilde H, Lumlertdacha B, Meisol FX, Ghasi S, Hemachudha T. Worldwide rabies deaths prevention-a focus on the current inadequacies in postexposure prophylaxis of animal bite victims. Vaccine. 2016;34(2):187–9.

2. Freij J, Mindeker M, Kesely H, Dounagoou Moto D, Naisseg S, Zinstag J, et al. Survey of animal injury and their management for an estimate of human rabies deaths in N'Djamená. Chad Trop Med Int Health. 2013;18(12):1555–62.

3. Gogtay N, Nagpal A, Mallad A, Patel K, Simpson S, Belur A, et al. Demographics of animal bite victims & management practices in a tertiary care institute in Mumbai, Maharashtra, India. Indian J Med Res. 2014;139(3):459.

4. Taylor LH, Knopf L. Partners for rabies prevention surveillance of human rabies by national authorities-a global survey. Zoonoses Public Health. 2015;62(7):543–52.

5. Kulkarni P, Manalippa VG, Manjushri R. Clinico-epidemiological study of human rabies cases attending epidemic disease hospital Mysore city, Karnataka, India. Int J Community Med Public Health. 2017;4(8):2825.

6. Simão NR, Borba AM, da Silva ALF, Vieira EMM, Carvalhosa AA, Bandeca MC, et al. Animal bite injuries to the face: a case report. J Int Oral Health. 2013;5(4):68.

7. Kole AK, Roy R, Kole DC. Human rabies in India: a problem needing more attention. Sclelo Public Health. 2014;9(2):230.

8. Minhas A, Singh M, Sood A, Raj D, Bhardwaj AK. Epidemiology of animal bite reported at animal bite clinic during 2015-16 at a tertiary care Centre of Himachal Pradesh. Indian J Community Health. 2018;30(4):354–60.

9. Kassiri H, Kassiri A, Mavari S, Jashrehi A, Lotfi M. Prevalence rate and epidemiological determinants of animal bite in Ahvaz County, Khuzestan Province. Southwestern Iran J Acute Dis. 2014;13(1):51–5.

10. Havasian MR, Rooghani AL, Yasemil MR, Roinar T, Hosseini RA, Panahi JA. Epidemiology of animal bites in regions of ilam, Iran. Organization. 2015;83:360–8.

11. Dehghani R, Sharif A, Madani M, Kashani HH, Sharif MR. Factors influencing animal bites in Iran: a descriptive study. Osong Public Health Res Perspect. 2016;7(4):273–7.

12. Kassiri H, Kassiri A, Pourpodael-Fard M, Lotfi M. The prevalence of animal bite during 2004-2008 in Isfahan-Gharb county, Kermanshah province, Western Iran. Asian Pac J Trop Dis. 2014;4:S342–4.

13. Holzer KJ, Vaughn MG, Murugan V. Dog bite injuries in the USA: prevalence, correlates and recent trends. Int J Prev. 2019;25(3):187–90.

14. Hatam N, Esmaeilzadeh F, Mirahmidzadeh A, Keshavarz K, Rajabi A, Afsar Kazerooni P, et al. Cost-effectiveness of rabies post exposure prophylaxis in Iran. J Res Health Sci. 2013;14(2):122–7.

15. Babazadeh T, Nikbakht HA, Daire M, Yegane-Kasgari M, Ghaffari-Fam S, Banaye-Jedd M. Epidemiology of acute animal bite and the direct cost of rabies vaccination. J Acute Dis. 2016;6(5):488–92.

16. Esmaeilzadeh F, Rajabi A, Vahedi S, Shamsadiny M, Ghojogh MG, Hatam N. Epidemiology of animal bites and factors associated with delays in initiating post-exposure prophylaxis for rabies prevention among animal bite cases: a population-based study. J Prev Med Public Health. 2017;50(3):210.

17. Shamshirgan SM, Bazrak H, Ghaffari-Fam S, Kosh A, Sarbakhsh P, Ghasemzadeh P. Epidemiological characteristics and trends in the incidence of animal bites in Maku County, Islamic Republic of Iran, 2003-2012. E Medet Health J. 2017;23(7):507.

18. Khutory O, Abdi A, Fatahpour T, Towhidii F. The epidemiology of scorpion stings in tropical areas of Kermanshah province, Iran, during 2008 and 2009. J Venom Anim Toxins J. 2015;11(1):45.

19. Wikipedia. Kermanshah Province. Available at: https://en.wikipedia.org/wiki/Kermanshah_Province. Access date 7 March 2020.

20. Aziz H, Rhee P, Pandit V, Tang A, Gries L, Joseph B. The current concepts in management of animal (dog, cat, snake, scorpion) and human bite wounds. J Trauma Acute Care Surg. 2015;78(3):641–8.

21. Venkatesan M. An epidemiological study of animal bites and envenomings in a rural district of Tamilnadu,India. Online J Health Allied Sci. 2014;13(4):1–6.

22. Tran CH, Kligerman M, Andrecy LL, Ethert MD, Adrien P, Blanton JD, et al. Rabies vaccine initiation and adherence among animal-bite patients in Haiti, 2015. PLoS Neglect Trop Dis. 2018;12(11):e0006955.

23. Zhovrenbati B, Asadi P, Kasnaive VM, Tajik H, Fatemi MS. Epidemiologic study of animal bites in Rasht County, Guilan Province, Iran’s North, 2012. Iran J Emerg Med (UAE). 2014;1(1):1–5.

24. Charkazi A, Behnampour N, Naficy M, Esmaeili A, Shahnejad H, Heshmati H. Epidemiology of animal bite in Ar Qala city, northen of Iran. J Educ Health Promot. 2015;2:13.

25. Wangoda R, Angidza T, Kito S, Nyangoma E, Nakhubuku J. Animal bite injuries in the accident and emergency unit at Mulago Hospital in Kampala, Uganda. Pan Afr Med J. 2019;33(12):112.

26. Kumar S, Gupta A, Sachdeva A, Chaudhary A, chamota S. Epidemiological profile of animal bite patients attending emergency department at a tertiary care health facility in a northern hilly Indian city. Int J Community Med Public Health. 2016;3(7):3014.

27. Patel S, Toppo M, Lodra R. An epidemiological study of animal bite cases in a tertiary care center of Bhopal city: a cross-sectional study. Int J Med Sci Public Health. 2017;6(3):1.

28. Raihi M, Lattifi B, Bakhtryi M, Yavari P, Khezeli M, Hatami H, et al. Epidemiologic survey of animal bites and causes of delay in getting preventive treatment in Tabbars during 2005-2010. Toloo-e-Behdasht. 2012;19(4):20–31.

29. Guhanad MS, Roshanieci G, Rostampour F, Fallahi A. An epidemiologic study of animal bites in Ilam Province. Iran Arch Iran Med. 2012;15(6):355–60.

30. Shah V, Bala D, Thakker J, Dalal A, Shah U, Chauhan S, et al. Epidemiological determinants of animal bite cases attending the anti-rabies clinic at V5 general hospital, Ahmedabad. Indian J Community Med Public Health. 2012;37(1):166–8.

31. Salama Lo C, Nacima A, Cuamba L, Guiral L, Amiel O, Babat A, 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 Neglect Trop D. 2017;11(7):e0005787.

32. Thomas N, Brook I. Animal bite-associated infections: microbiology and treatment. Expert Rev Anti-Infect Ther. 2011;9(2):215–26.

33. Yan S, Chen Y, Ye W, Chen F, Li L. Characteristics and factors associated with post-exposure prophylaxis (PEP) treatment of dog and cat bites among left-behind children: a cross-sectional study in two cities of China. BMJ Open. 2019;9(5):e024764.

34. Marathe N, Kumar S. Epidemiological trends, knowledge and practices of animal bite in children attending outpatient department of Rewa city—A hospital based survey. J Evol Med Dent Sci. 2018(10):667–71.

35. Eke C, Omotowol O, Ukoja O, Ibe B. Human rabies: still a neglected preventable disease in Nigeria. Niger J Clin Prat. 2015;18(2):268–72.

36. Carrara P, Parola P, Bouqui S, Gautret P. Imported human rabies cases worldwide, 1990-2012. Plos Neglect Trop D. 2013;7(6):e2209.

37. Tiembre I, Benie J, Attoh-Tohre H, Zengbe-Ascay P, Tetchi S, Kpebo D, et al. Discontinuation of postexposure prophylaxis at the anti-rabies centers of Abidjan, Cote d’ivoire. Bull Soc Pathol Exot. 2013;106(4):667–71.

38. Shelke P, Rachh PR. Equine Rabies Immunoglobulin: A Review. J drug deliv Sci Technol. 2019;9(4-s):730–8.
40. Vučinić M, Vučićević M. Children are victims of dog bites due to irresponsible dog ownership, parenthood, and managers of school institutions in Serbia. J Vet Behav. 2019;30:61–8.

41. 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.

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