

## Original Article

# An increasing public health problem: Suspected rabies exposures

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### Abstract

**Introduction:** The increasing trend of rabies suspected exposures is a serious public health problem that is challenging the health systems of developing countries both in terms of labor and economics. The purpose of our study is to determine the current state of rabies suspected exposure cases.

**Methodology:** This descriptive and cross-sectional study was conducted by retrospectively examining the applications made due to suspected exposures to a state hospital's emergency service in Turkey. Descriptive and analytical statistics were used in data analysis and  $p \leq 0.05$  was considered as statistically significant.

**Results:** Between 2015 and 2019, 3,378 hospital admissions due to suspected exposures were detected ( $n = 3,378$ ). The number of admissions, which was 558 in 2015, increased every year and reached 829 in 2019 ( $p < 0.001$ ). Also admissions after contact with cats have increased over the years and have passed contact with dogs in 2019 ( $p < 0.001$ ). Post-exposure prophylaxis was applied to all cases, but 0.8% ( $n = 26$ ) of them were found to be inappropriate according to guidelines. It was observed that 38.3% of overall cases examined were individuals aged 19 and under. It was also observed that 69.1% ( $n = 2,326$ ) of the suspected exposures were caused by owned animals ( $p < 0.001$ ).

**Conclusions:** The case rates seen in children indicate the need for special studies for children. Applications for suspected exposures due to contact with cats were found to be a growing problem. Therefore, it was concluded that the patterns of rabies suspected exposure cases in Turkey and similar developing countries should be monitored regularly and measures should be taken according to local needs. Besides, stray animals in cities must be minimized and all animals living in cities owned or stray, must be monitored in terms of vaccination.

**Key words:** Rabies; rabies suspected exposures, developing countries; Turkey.

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### Introduction

Rabies has been described as one of the oldest diseases in history. It has been reported that the first information about rabies disease was found in the inscriptions written about 4,000 years ago, from the time of the ancient Mesopotamian civilizations. Rabies is a zoonotic disease that causes viral encephalomyelitis in mammals and humans. Its cause is a RNA virus belonging to the genus *Lyssavirus*, within the family of *Rhabdoviridae*. It is known that all warm-blooded animals can be infected by rabies virus although their susceptibility varies and that there is a difference between species in terms of the risk of transmitting the disease. For example, contacts of animals such as foxes and wolves constitute the highest risk group, while dog contact is defined as medium risk for rabies disease transmission [1]. Of course, dogs should be looked from a different perspective because they appear to be the most important factor of contact with "suspected rabies exposures" (hereinafter referred to as "suspected

exposures") as they have been living with humans since ancient times. The World Health Organization (WHO) estimates that every year 59,000 people die worldwide due to dog-transmitted rabies. WHO states that rabies has been eliminated from Western Europe, Canada, the United States (USA), Japan and some Latin American countries, but it still remains an important public health problem in the Middle East and some Latin American countries, and particularly in Africa and Asian countries [2]. WHO initiated a global action in partnership with other organizations to eliminate human deaths from dog-mediated rabies by 2030 [3].

Rabies is a vaccine-preventable disease and the first vaccination was developed more than one hundred years ago [4]. However, it causes thousands of human, mainly children deaths every year. Although such generalizations refer to "worldwide", rabies became a disease affecting poor communities in low and middle-income countries. High-income countries eliminated rabies transmission from pets thanks to massive

vaccination. However, as a component of inaccessibility to health services, thousands of human deaths are reported every year in low-income countries because of not accessing or late access to rabies vaccine. From that perspective, rabies disease can be considered as a social equity issue [5]. The purpose of our study is to determine the current state of rabies suspected exposure cases.

#### *Current Status and Fight Against Rabies in Turkey*

Approximately 250,000 suspected exposures are reported in Turkey every year and 1-2 case of rabies in average are detected. Therefore, Turkey is among the countries where rabies is still seen as endemic. It is affirmed that within the 20 years-period from 1997 to 2017, approximately 90,2% of animal rabies cases were in domestic animals and dogs are reported to be in the first rank with 43,6%, followed by cattle with 36,6%. Only 3,9% of the cases reported within that period is in cats.

According to the current Turkish legislation, it is mandatory for pet owners to get their dogs older than three months and cats older than six months registered. Veterinarians apply microchips to owned dogs and cats and provide them with a certified id card upon the request of their owners. Those animals get registered to the database of the Ministry of Food, Agriculture and Livestock. Municipalities have the obligation of recording the number and other related information of the stray animals living throughout their area of responsibility and keeping those records up-to-date. According to the same legislation, all owned and stray animals must be vaccinated against rabies once a year and vaccination records must be kept. All details about vaccination are regulated by laws.

In Turkey, domestic animals such as cats, dogs, sheep, goats, cattle, donkeys and horses and wild animals such as foxes, wolves, jackals, martens, weasels, skunks, bears and pigs are considered as species with a high rabies exposure risk. On the other hand, today's data indicate that there was no rabies transmission to human by bites of animals such as mice, guinea pigs, hamsters, squirrels and rabbits or from human to human. For example, no rabies transmission to human by bat kinds was reported in Turkey until today. Therefore, rabies prophylaxis is not recommended for such contacts on the condition to check the updated data [1, 6].

The Rabies Field Guideline published in 2014 in Turkey was recommending 2 doses of vaccine for suspected exposure cases who previously got a full-dose and four or five-dose schema in case of

vaccination for the first time. The Rabies Prophylaxis Guideline published in 2019 recommends the same for cases who previously got a full-dose but only a four-dose schema in case of vaccination for the first time. It is recommended for cat and dog contacts to stop the vaccination if the animal can be observed and stays healthy for a period of 10 days [1,6].

## **Methodology**

### *Study Design*

This descriptive and cross-sectional study was conducted by retrospectively examining the suspected exposure cases that rabies prophylaxis was applied in a state hospital's emergency service situated in Kırklareli City's Lüleburgaz District. The hospital provides health services also to other neighborhoods around. Lüleburgaz is one of the largest districts in the region of Thrace, in the northwest of Turkey. The socioeconomic development level of the district is above Turkey's average. Lüleburgaz is on a flat land and there are no large areas where wild animals live. The wild animals that are most frequently seen in the District's territory are foxes, martens, weasels and feral pigs.

### *Target Population and Sampling*

The target population of this study consists of 3,378 suspected cases admitted to the hospital between 2015 and 2019 (N = 3,378). All cases that rabies prophylaxis was applied were included to the study and no sampling was done.

### *Data Collection*

According to the current legal regulations in Turkey, the health institution that receives a suspected exposure case manually fills out a "Rabies Suspected Exposure Examination Form". The result data of the forms are transmitted to Turkey's Ministry of Health in electronic environment. The data to use in our study were obtained by examining the Rabies Suspected Exposure Examination Forms available in the hospital's archives.

### *Statistical Analysis*

SPSS 22 (Statistical Program for Social Sciences) software was used in analyzing the survey data. Descriptive statistics are presented in form of numeric value, percentage, standard deviation and average. Data distribution was verified by using Kolmogorov-Smirnov and Shapiro Wilk tests. Chi-square, Mann Whitney and Kruskal Wallis tests were used in analyzing the data that were not normally distributed. Findings were evaluated at 95% confidence interval and

results with  $<0.05$  p value were admitted as statistically significant. Two, three, four and five-dose applications were classified as “vaccination conform to guidelines” and single-dose applications were classified as “vaccination non-conform to guidelines”. As to age groups, minors under 6 years-old were classified as “preschool-age children” and minors between six and fourteen years-old were classified as “primary school-age children”. Post exposure prophylaxis (PEP) applications recommended by the Turkish Ministry of Health’s Guideline for suspected contacts were considered as “necessary PEP” and the ones which were not recommended by the guideline were considered as “unnecessary PEP”.

### Ethical Consideration

Our study was conducted with the permission of Kırklareli Provincial Health Directorate Research Applications Examination and Evaluation Commission (dated March 10, 2020 and numbered 2020/19) and Kırklareli University Institute of Health Sciences Ethics Committee (dated May 4, 2020 and numbered 2020-16).

### Results

Between 2015 and 2019, 3,378 hospital admissions due to suspected exposures were detected (n = 3,378). Although 99.1% of total admissions (N = 3,348) was

due to dog or cat exposures, 0.3% (n = 10) of mice, 0.1% (n = 3) of horses, 0.1% (n = 3) of bats, a monkey and a seagull bite and also 0.4% (n = 12) of human bites were seen from records. It was determined that 37.9% (n = 1,281) of the patients were female and 62.1 (n = 2,097) were male ( $p < 0.001$ ). Distribution of suspected exposures’ some specifications by years are shown in Table 1.

The most common cause of hospital admissions due to suspected exposures in women was cats with 56.8% (n = 727), whereas in men it was dogs with 63.0% (n = 1,322) ( $p < 0.001$ ). Age of the patients ranged from 1 to 93 years old, and the mid age was  $31.2 \pm 21.6$ . The average age of women was  $30.3 \pm 21.5$  and the one of men was  $31.8 \pm 21.6$ . Distribution of hospital admissions due to suspected exposures by age groups can be seen in Figure 1.

It is seen that the rate of contact with cats as a reason of suspected exposure statistically significantly increased by years ( $p < 0.001$ ). The most frequent hospital admissions due to suspected exposures were in July with 11.4% (n = 386) and in August with 11.2% (n = 386), and infrequent with 5.3% (n = 178) in January and with 5.7% (n = 194) in February ( $p < 0.001$ ).

It has been seen that 46.6% (n=171) of the suspected exposures under the age of 6 were in summer, 6.0% (n = 22) were in winter months, while the rest of the group is 30.8% (n = 928) in summer, 18.8% (n =

**Table 1.** Distribution of suspected exposures’ some specifications by years.

Age Group	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	2019 n (%)	Total n (%)	P
<b>Women</b>							
≤ 6	31 (14.4)	26 (13.5)	30 (12.0)	41 (14.5)	53 (15.5)	181 (14.1)	0.434
7 – 14	39 (18.1)	41 (21.4)	39 (15.5)	39 (13.8)	68 (19.9)	226 (17.6)	
15 – 64	127 (59.1)	111 (57.8)	164 (65.3)	184 (65.2)	204 (59.8)	790 (61.7)	
≥ 65	18 (8.4)	14 (7.3)	18 (7.2)	18 (6.4)	16 (4.7)	84 (6.6)	
<b>Subtotal</b>	<b>215 (38.5)</b>	<b>192 (36.6)</b>	<b>251 (37.5)</b>	<b>282 (35.4)</b>	<b>341 (41.1)</b>	<b>1281 (37.9)</b>	
<b>Men</b>							
≤ 6	35 (10.2)	39 (11.7)	50 (12.0)	75 (14.6)	78 (16.0)	277 (13.2)	0.364
7 – 14	53 (15.5)	61 (18.3)	68 (16.3)	86 (16.7)	69 (14.1)	337 (16.1)	
15 – 64	230 (67.1)	208 (62.5)	260 (62.2)	307 (59.6)	301 (61.7)	1306 (62.3)	
≥ 65	25 (7.3)	25 (7.5)	40 (9.6)	47 (9.1)	40 (8.2)	177 (8.4)	
<b>Subtotal</b>	<b>343 (61.5)</b>	<b>333 (63.4)</b>	<b>418 (62.5)</b>	<b>515 (64.6)</b>	<b>488 (58.9)</b>	<b>2097 (62.1)</b>	
<b>Reason of exposure</b>							
Dog	351 (62.9)	313 (59.6)	372 (55.6)	429 (53.8)	400 (48.3)	1865 (55.2)	< 0.001
Cat	202 (36.2)	204 (38.9)	291 (43.5)	364 (45.7)	422 (50.9)	1483 (43.9)	
Other*	5 (0.9)	8 (1.5)	6 (0.9)	4 (0.5)	7 (0.8)	30 (0.9)	
<b>Admission from</b>							
Within the district	489 (14.5)	477 (14.1)	603 (17.9)	714 (21.1)	750 (22.2)	3033 (89.8)	0.403
Outside the district	69 (2.0)	48 (1.4)	65 (2.0)	83 (2.5)	79 (2.3)	345 (10.2)	
<b>Type of settlements</b>							
Urban	412 (73.8)	401 (76.4)	550 (82.2)	648 (81.3)	702 (84.7)	2713 (80.3)	< 0.001
Suburban	41 (7.3)	44 (8.4)	37 (5.5)	61 (7.7)	53 (6.4)	236 (7.0)	
Rural	105 (18.8)	80 (15.2)	82 (12.3)	88 (11.0)	74 (8.9)	429 (12.7)	
<b>Total</b>	<b>558</b>	<b>525</b>	<b>669</b>	<b>797</b>	<b>829</b>	<b>3378</b>	

\* 10 mice; 3 horses; 3 bats; a monkey and a seagull bite and also 12 human bites.

567) in winter ( $p < 0.001$ ). The most common cause of suspected exposures in preschool age children and primary school age children was injury by cats with 70.0% ( $n = 257$ ) and 51.1% ( $n=334$ ), respectively, while in other age groups was injury by dogs ( $p < 0.001$ ).

In the distribution of suspected exposures to the days of the week, it was observed that the highest number of admissions were on Fridays with 15.8% ( $n = 534$ ) and the minimum were on Wednesday with 13.2% ( $n = 445$ ) ( $p = 0.088$ ). It was also observed that 69.1% ( $n = 2,326$ ) of the suspected exposures were caused by owned animals ( $p < 0.001$ ).

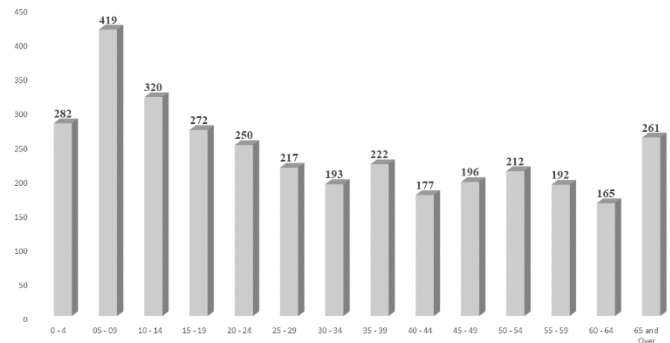
No statistically significant difference was found in terms of settlements where the exposure occurred in respect of gender ( $p=0.451$ ). However, while owned animal exposures in urban areas were 73.6% ( $n = 1,998$ ), it was found to be 47.1% ( $n = 202$ ) in semi-urban and 53.4% ( $n = 126$ ) in rural areas ( $p < 0.001$ ).

99.2% ( $n = 3,372$ ) of the cases has been only vaccinated and 0.8% ( $n = 6$ ) cases Human Rabies Immune Globulin (HRIG) treatment was applied together with the vaccine. While 99.2% ( $n = 3,352$ ) of PEP were found to be necessary prophylaxis, 0.8% ( $n = 26$ ) were found to be unnecessary prophylaxis. One dose of vaccine to 7.6% ( $n = 256$ ) of cases, two doses to 6.4% ( $n = 215$ ), three doses to 33.4% ( $n = 1,129$ ), four doses to 19.3% ( $n = 653$ ) and five doses to 33.3% ( $n = 1,125$ ) of cases were administered. No statistically significant difference was found between the individuals who were vaccinated in non-conformance with guidelines regarding their sociodemographic characteristics such as gender ( $U = 1342891.500$ ,  $z = -0.057$ ,  $p = 0.955$ ), residence ( $H(2) = 2.039$ ,  $p = 0.361$ ). None of the cases developed rabies disease.

## Discussion

Two different epidemiological characteristics of worldwide rabies suspected exposures were reported: infection only from wild animals like in the USA and infection mainly from uncontrolled domestic animals like in India. It is seen that rabies suspected exposures arise mainly from domestic animals also in Turkey. Therefore, the recommendations in the up-to-date guidelines in Turkey were developed by taking the country's data and the rabies post-exposure prophylaxis guidelines of WHO and other countries into consideration [1-6]. According to the Turkish Ministry of Health's guidelines, 99.2% of the cases examined in our study were qualified as "necessary prophylaxis" [1, 6]. It was seen that PEP was applied to 10 mice, 3 bats, 12 human and 1 seagull contact. However, both The

**Figure 1.** Distribution of hospital admissions due to suspected exposures by age groups



Rabies Field Guideline published in 2014 and The Rabies Prophylaxis Guideline published in 2019 do not recommend rabies prophylaxis for such contacts [1, 6]. It is nevertheless seen that wrong field practices continue despite the guidelines published after that suggestion. This situation forms the opinion that more information and awareness trainings should be organized on PEP for healthcare professionals, especially physicians holding decision maker positions in emergency departments.

Another compelling result is the number of vaccine doses. It was detected from the records that 8% of the cases were not vaccinated in conformance with the guidelines. No difference was found between the individuals who were examined from an incomplete vaccination perspective, regarding their sociodemographic characteristics. However, there are studies reporting differences based on individuals' sociodemographic characteristics [7]. Some of those who were not vaccinated in conformance with the guidelines may likely be vaccinated at other healthcare centers and appear as vaccinated in a single dose due to lack of registration. However, it can still be said that a significant number of people were vaccinated incompletely.

According to the current guidelines in Turkey, a "Rabies Information Form" is issued and the suspected exposure sufferer is informed by the physician. These forms are even issued in English, German, French, Russian and Arabic for foreigners living in Turkey or tourists. The fact that there is a high rate of incomplete vaccination despite all suggests that a particular importance should be given in creating more awareness in sufferers when the first dose of vaccine is applied.

In our study, it was found that more than one third of the cases examined were individuals aged 19 years and younger. It was reported that 33.7% of the cases examined in a different study in Turkey were

individuals aged 19 and under [8]. These results suggest that children should be more educated about possible rabies exposure. Children should be educated to stay away from wild or stray animals and not adopt wild animals as pets [9]. From another point of view, policies should be developed to protect children from suspected exposures. In addition, in our study, approximately two-thirds of the people suffering from suspected exposure were male and this result is consistent with other studies [10, 11]. Some studies concluded that men have less awareness of rabies than women [12, 13]. Therefore, it will be useful to organize awareness trainings on suspicious exposures for all family members, not just children [14].

It was observed in our target population that suspected exposure applications in summer are almost twice higher than the applications in winter. This result is consistent with other similar studies [15-17]. Although there are no findings in our study that can reveal the exact causes of this, some possibilities are foreseeable. For example, school-age children are on vacation in summer and animals that raise their offspring in summer can be more aggressive with the instinct to protect them. In addition, people spend more time outdoors in summer or they can be better protected against bites by wearing thicker clothes against the cold in winter. It is possible to increase these examples. It is thought that such local data should be collected regularly and the related training content should be adapted to local needs.

In our study, it was observed that four-fifths of suspected exposure applications came from people living in urban areas. This result is compatible with some other studies conducted in Turkey. For example, it was reported that 77.7% of suspected exposure applications examined in a study in Turkey came from individuals living in urban areas [18]. In addition, almost two-thirds of the causes of suspected exposures in our study were found to be owned animals and it was determined that the rates of suspected exposures with owned animals increased statistically from rural to urban. It is thought that this situation can be explained with two probabilities: individuals are either injured by animals they think they “own” or their owned animals injure other people in the environment. Both situations can be considered as an indication that animal owners do not have enough knowledge and experience about animals and that not enough adequate measures are taken to prevent animals from harming humans.

On the other hand, according to WHO recommendations, if the suspected animal has been vaccinated against rabies in the last year, it should be

observed for 10 days along with wound care and tetanus prophylaxis without rabies vaccination [19-21]. However, although two-thirds of applications are due to contact with owned animals, it is seen that PEP was applied to all sufferers in our study group. This suggests that owned animals that caused suspected exposures are either unvaccinated or their vaccination status is unknown. In two different studies conducted in Turkey, owned animals appear as the cause of 73.5% and 77.7% of total suspected exposures. Despite this, PEP was applied to all of them on the grounds that the vaccine status was unknown [7, 10]. These results indicate that there are some issues with monitoring the vaccination and/or vaccination status of owned animals.

Apart from restricting the ownership of certain breeds of animals and some types of dogs, there are still no legal regulations in Turkey that bind animal ownership to rules and require pre-ownership training on the care, training, vaccination of animals, etc. and it has become a social problem that these adopted animals or their “excess” offspring are sometimes left uncontrollably in nature or on the streets. Suspected exposures pose a burden on the health systems in addition to the physical and psychological trauma that they create in the sufferers. For example, a study conducted in the USA reported that dog bites were responsible for more than 300.000 emergency room visits with a total financial burden of more than \$100 million per year [22].

In order to eliminate the suspicion of rabies in domestic animal contacts in countries such as Turkey, it is understood that in addition to placing importance on regular records, it is also necessary to vaccinate cats and dogs that make up the vast majority of suspected exposures, in mass. WHO reports that mass vaccination of domestic animals, especially dogs is essential for the eradication of rabies [23]. There are also studies that report that such mass animal vaccinations are extremely cost-effective [24].

One of the most remarkable results of our study is the increase in cases of suspected exposures due to cat contact over the years. In fact, there are numerous studies that report that most of the rabies suspected exposures is due to dogs [25, 26]. However, a small number of cases who died from rabies after being scratched by cats were also reported [27]. Therefore, it was determined that the causes of increased suspected exposure due to cat contact cases should be investigated and a separate attention should be paid to cats in activities such as education and vaccination.

## Conclusions

In our study, it was found that some of the known problems about rabies suspected exposures continued and in addition, changing patterns were introduced. As it is understood from the literature, it is a problem in many countries that the applications performed in the emergency services are not in conformance with the guidelines. Therefore, it was concluded that the medical staff making decisions about PEP should be trained continuously and their practices should be monitored regularly. One of the most important results of our study is the detection of the suspected exposures due to contact with cats which increased and even passed contact with dogs. In some countries, suspected exposures due to contact with dogs are reported to be the most important problem, while in others, suspected exposures due to contact with wild animals come to the fore. However, our study has identified an increasing trend of suspected exposure due to contact with cats. Although our study focused on rabies suspected exposures, it is known that injuries caused by cats also pave the way for many other infectious diseases. Therefore, it was concluded that suspected exposures due to contact with cats should be paid additional attention. In order to reduce PEP practices against increased rabies, it is understood that it is necessary to immediately start tracking the vaccination status of cats and to program regular trainings for both cat owners and children who appear to have the most contact with cats. It was concluded that the patterns of rabies suspected exposure cases in Turkey and similar developing countries should be monitored regularly and measures should be taken based on local needs.

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