



A Notable Increase in Human Rabies Mortality After Ten Years in Iran in 2022: A Case Series Study

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Abstract

Rabies virus is responsible for 60 000 deaths annually worldwide, and over 95% of all human rabies deaths occur in developing countries. In Iran, the annual number of animal bites is 180 per 100 000 people, and rabies control programs focus more on post-exposure prophylaxis (PEP). In this study, the data on people whose death was caused by rabies were obtained from the WHO Collaborating Center (CC) for Reference and Research on Rabies (Pasteur Institute of Iran) from 2011 to 2022. Data analysis showed a remarkable increase in human rabies mortality rate after 10 years in Iran in 2022, with 14 cases. Then, the causes were investigated despite prevention measures.

The increase in human rabies cases in Iran indicates that the currently used control methods are insufficient. Controlling the population of stray dogs, sterilization, and vaccination coverage of 70% are the most essential and basic steps in preventing rabies.

Keywords: Rabies, Control, Vaccination, Human deaths, Iran

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Introduction

Rabies is a fatal zoonotic disease caused by lyssaviruses belonging to the family *Rhabdoviridae*. The rabies virus is responsible for 59 000 deaths annually worldwide, and over 95% of all human rabies deaths occur in developing countries.¹ There is significant variation in the worldwide epidemiology of rabies and the distribution of rabies virus reservoir species. At least 30 reservoir species have been identified, which mainly include terrestrial carnivores, blood-sucking bats, and insectivorous bats. However, the primary transmission route is through rabid dog bites, which account for 96% of human rabies cases.¹

In Iran as a part of the Middle East, rabies is one of the most critical public health problems and is usually prevalent among dogs, wolves, foxes, jackals, and cats. It has been reported that dogs and cats are responsible for 99% of the annual exposure reported in Iran.¹

There is no cure for the disease, and the patient dies after the onset of symptoms. However, pre-exposure and post-exposure prophylaxis (PEP) are the only ways to control this disease.²

In Iran, the annual number of animal bites is 180 cases per 100 000 people, and rabies control programs mainly focus on PEP. According to the reports of the Center for Communicable Diseases Control of Iran and The WHO Collaborating Center (CC) for Reference and Research on Rabies (Pasteur Institute of Iran), the annual use of PEP has increased in Iran. In 2021, more than 125 000

people received PEP, which is almost double compared to 2015. PEP for rabies is accessible and free of charge, and more than 700 round-the-clock centers are active for this purpose. Therefore, limited human deaths in the country are reported.³ Unfortunately, the rabies death rate is increasing despite excellent vaccination and post-exposure prophylaxis. This study investigated human rabies deaths in Iran from 2011 to 2022 and the reasons for its increase despite rabies control and prevention measures, especially in 2022.

Materials and Methods

All rabies-suspected human cases during 2011-2022 were reported by forensic pathologists to the WHO CC for Reference and Research on Rabies at the Pasteur Institute of Iran.

The fluorescent antibody test (FAT) is the gold standard method for rabies diagnosis. The information of victims whose death was confirmed by the FAT method was used in this study.

The data of these samples from 2011 to 2022 were used for this study. These data were translated into English and manually transferred into a Microsoft Excel spreadsheet.

Results

The data on human rabies cases were obtained from the WHO CC for Reference and Research on Rabies of Pasteur Institute of Iran. Based on these data, the rate of

human rabies was almost the same from 2011 to 2022 (over ten years). However, these cases significantly increased in 2021 and 2022 (Figure 1). The graph shows that the

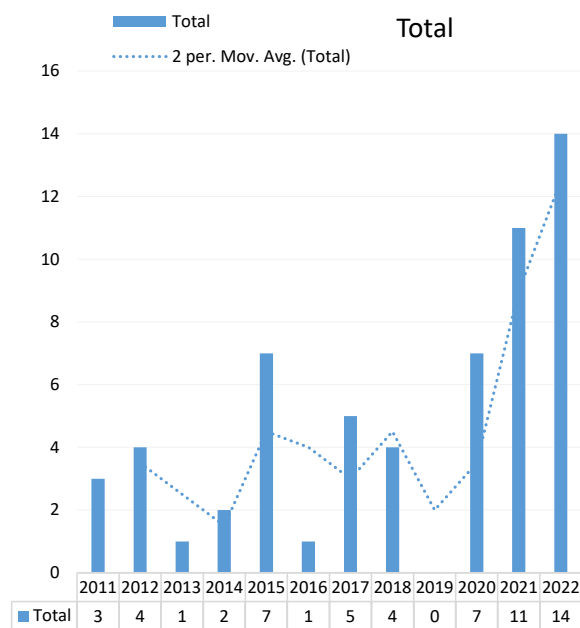


Figure 1. The Frequency of Human Rabies in 10 Years (2011-2022) (n = 59) Based on Reports of the WHO CC for Reference and Research on Rabies of Pasteur Institute of Iran

highest number of deaths due to rabies was reported in 2022, with 14 cases.

Demographic information of rabid patients obtained from the WHO CC for Reference and Research on Rabies in Pasteur Institute of Iran in 2021 and 2022 is shown in Table 1. According to the history of the patients, after being bitten by rabid animals, six patients received complete PEP, and six patients received partial PEP.

Discussion

During more than ten years, 59 human rabies cases were recorded, and most of the cases were reported in 2022, with 14 cases. However, this number is lower compared to many other Asian countries (Pakistan, Bangladesh, India, Myanmar, Philippines, Indonesia, Sri Lanka, Vietnam, and Thailand).⁴ In a study conducted in 2008, Janani et al found that 66.7% of human rabies cases were not vaccinated against rabies, and 76.5% did not receive anti-rabies serum.⁵ These findings show the importance of correctly implementing PEP and the need to increase awareness in the human population.

The current study showed that 80% (n=20) of human rabies cases were male (Table 1). In the study conducted by Janani et al, 90% of rabies cases occurred in men. Additionally, Rezaeinasab et al (2007) reported that 8 cases of rabies (80%, n = 10) were male.⁶ In a similar study

Table 1. Demographic Information of Patients Who Died due to Rabies in 2021 and 2022

No.	Gender	Year of Report	Age	Province	Species of Animal	Vaccination History	The number of Doses Received
1	Male	2021	55	Tehran	Stray dog	No	
2	Male	2021	28	Sistan and Balouchestan	Stray dog	Yes	3
3	Male	2021	15	Sistan and Balouchestan	Stray dog	Yes	3
4	Male	2021	5	Mazandaran	Stray dog	No	
5	Female	2021	79	Mazandaran	Stray dog	Yes	4
6	Male	2021	25-35	Sistan and Balouchestan	Stray dog	No	
7	Male	2021	47	Mazandaran	Domestic dog (pet)	Yes	2
8	Male	2021	28	Tehran	Guard dog	Yes	1
9	Male	2021	42	Tehran	Stray dog	No	
10	Male	2021	19	Sistan and Balouchestan	Stray dog	No	
11	Female	2021	2	Tehran	Domestic dog (pet)	No	
12	Male	2022	28	Tehran	Domestic dog (pet)	Yes	1
13	Male	2022	42	Tehran	Stray dog	Yes	1
14	Female	2022	2	Tehran	Domestic dog (pet)	No	
15	Male	2022	25	Ardebil	Domestic dog (pet)	Yes	3
16	Male	2022	5	Mazandaran	Domestic dog (pet)	Yes	1
17	Male	2022	23	Tehran	Stray dog	No	
18	Female	2022	2	Kerman	Wolf	Yes	4
19	Male	2022	51	Kerman	Wolf	Yes	4
20	Male	2022	59	Tehran	Domestic dog (pet)	Yes	1
21	Male	2022	10	Tehran	Stray dog	No	
22	Female	2022	48	Khuzestan	Stray dog	No	
23	Male	2022	19	Sistan and Balouchestan	Stray dog	No	
24	Male	2022	38	Gilan	Stray dog	No	
25	Male	2022	6	Golestan	Stray dog	No	

conducted in India, 71% of cases occurred in men⁷. The higher percentage of this disease in men may be due to the presence of more men in the environment for occupational and non-occupational activities and their boldness in contact with animals.¹

Many human rabies cases during recent years have been reported from Tehran, Sistan and Balouchestan, and Mazandaran provinces. Investigations showed that in Sistan and Balouchestan, all the victims were attacked by stray dogs (Table 1). Sistan and Balouchestan province is located near the border with Pakistan, in which a high number of human rabies are reported annually (5000 cases).⁸

According to this study, the average age of people with rabies was 28 years. Additionally, 36% of cases were less than 20 years old. Similarly, 72% of cases in Zimbabwe were under 19 years of age.⁹

In Iran, similar to other Asian, African, and Latin American countries, dogs are the main causes of human rabies (about two-thirds of cases), and only one-third of human rabies cases are caused by foxes, wolves, and jackals. As shown elsewhere, cats do not play a significant role.¹⁰ The data obtained in this study also align with these findings.

The results obtained in this study showed that 52% of human rabies cases did not receive the vaccine. Compared to these findings, a study conducted in India showed that 79.1% and 98.7% of suspected human rabies cases did not receive an anti-rabies vaccine and serum, respectively. Probably, this can be one of the reasons for the high number of human deaths in India compared to Iran.⁷ Although the occurrence of death after vaccination does not necessarily indicate the failure of vaccination, some reports state that the cause of death despite vaccination can be due to the lack of vaccination or its permanent severe complications such as encephalitis, encephalomyelitis, myeloradiculitis, and polyradiculitis. In a study conducted by Rasooli et al, incomplete or incorrect rabies prevention measures, improper or insufficient washing, lack of sufficient and appropriate immune response, vaccine cold chain failure, direct inoculation of the virus into nerve endings, quick suture of the wound, and non-compliance of vaccine strains with circulating rabies virus strains were mentioned as the causes of vaccination failure.³

According to the Infectious Diseases Management Center of the Ministry of Health, Treatment, and Medical Education report, illegal immigration from some neighboring countries after the outbreak of war can be another reason for this problem.

Another factor in the increase of rabies cases in the country and the human death rate is the increase in the population of stray dogs which has led to increased contact with stray dogs due to rough sleeping or feeding stray dogs. Studies have shown that owning a pet such as a dog is very common among homeless people,¹¹ which can increase the risk of being bitten and the occurrence of rabies.

Dogs are the main reservoirs of rabies in developing countries in Africa, Asia, and the Middle East, and account for 99% of human rabies deaths. Canine rabies is still endemic. Therefore, vaccinating dogs and providing PEP to humans until dog rabies is eliminated can significantly help eliminate dog-transmitted rabies as a public health problem.¹²

However, society's awareness of this disease causes a relative increase in the number of dog bites. Besides, one of the behavioral changes needed to control rabies is for owners to accept responsibility for their dogs and their reproduction. It includes protecting the dog from rabies via vaccination and sterilization. Promoting responsible dog ownership is only possible through adequate legislation, public awareness, education, and recognition of cultural and economic conditions.¹²

The massive increase in urban solid waste production and inefficient waste collection and management due to the lack of resources and planning have led to a significant increase in the volume of garbage in the streets, which has caused a rise in the roaming dog population around the cities. The availability of food, shelter, and freedom of movement for stray dogs caused by the negligence, irresponsibility, and ignorance of people has led to the survival of dogs, posing a great danger to people and society.¹³

Therefore, the first step is to identify and vaccinate rabies reservoirs to prevent the excessive occurrence of animal bites and reduce the economic burden on different communities. The second step is to use rapid molecular methods to diagnose rabies, inform people at risk, and increase physicians' awareness.¹⁴ Due to the significant annual expenditure on the provision of PEP, human rabies mortality rate in Iran is favorable compared to many Asian and African countries. The low number of human rabies cases shows that post-exposure prophylaxis program is effective in preventing rabies in the country. In Iran, no severe national effort has been made to control rabies in animals, especially dogs, and rabies control programs are implemented only periodically and regionally.¹⁵

Conclusion

The increase in human rabies cases in recent years in Iran indicates that the currently used control methods are insufficient. Controlling the population of stray dogs, sterilization, and vaccination coverage of 70% are the most essential and fundamental steps in preventing the increase of rabies. On the other hand, informing people and families about animal bites, keeping animals, and controlling homeless people can help physicians and the government prevent these events and reduce the economic burden.

Authors' Contribution

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Project administration: Rouzbeh Bashar.

Supervision: Rouzbeh Bashar.

Writing—original draft: Nazanin Shabansalmani.

Writing—review & editing: Nazanin Shabansalmani.

Competing Interests

The authors declare that there is no conflict of interests.

Ethical Approval

The study was approved by the Ethics Committee of the Pasteur Institute of Iran (IR.PII.REC.1398.002).

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