

Human Rabies Status in Yemen During (2019-2022)

Dr.Muneera Shaher

Head Of Public health and community medicine department at 21 September university of medical and applied sciences

وضع داء الكلب في اليمن خلال الفترة (٢٠١٩-٢٠٢٢)

د. منيرة شاهر

Abstract: Introduction: Rabies is a common, serious zoonotic viral infectious disease. The number of people at risk of Rabies is more than 3 billion in over 150 countries and territories. It causes about 50000-60000 human deaths annually worldwide. The majority of the deaths were in Asia and Africa. Yemen is a country in which canine rabies is endemic. Annually, up to 14,000 people are exposed to animal bites in Yemen. Mortality cases were between 17 to 69 per year as recorded. **Objectives:** Estimate the number of human rabies cases, the socio-demographic characteristics of individuals affected, case fatality rate in Yemen during the period from 2019 to 2022. **Methodology:** A retrospective registry-based cross-sectional descriptive study conducted in Yemen during the period from 2019 to 2022. **Results:** The results show that there were an estimated 61294 and 174 cases and mortality, respectively. The number of males is about two times and more than the number of females, with 43619 (71.16%) and 17675 (28.83%) respectively. In the age group [More than 5 years], the number of cases was the highest; 54415 (88.77%) cases, followed by the age group (Less than years); 6879 (11.22%) cases. **Conclusion:** Rabies is endemic in Yemen and remains a significant public health hazard with a very high annual rabies cases and mortality. Male children above 5 years were most often involved as victims in attacks by rabies-positive animals.

Keywords: Human rabies, Case fatality rate, Animal bites, Yemen.

المخلص: المقدمة: يُعد داء الكلب من الأمراض الفيروسية الحيوانية المنشأ الخطيرة والشائعة، ويُشكل تهديدًا صحيًا عالميًا. تشير التقديرات إلى أن أكثر من ٣ مليارات شخص في أكثر من ١٥٠ دولة وإقليم معرضون لخطر الإصابة بهذا المرض. يتسبب داء الكلب في حوالي ٥٠,٠٠٠ إلى ٦٠,٠٠٠ حالة وفاة بشرية سنويًا على مستوى العالم، وتتركز الغالبية العظمى من هذه الوفيات في قارتي آسيا وأفريقيا. تُعد اليمن من الدول التي يتوطن فيها داء الكلب الكلب، حيث يُسجل سنويًا ما يصل إلى ١٤,٠٠٠ حالة تعرض لعضّات الحيوانات. وقد تراوح عدد الوفيات المسجلة بين ١٧ إلى ٦٩ حالة سنويًا. **الأهداف:** تهدف هذه الدراسة إلى تقدير عدد حالات داء الكلب البشري، وتحليل الخصائص الاجتماعية والديموغرافية للأفراد المصابين، بالإضافة إلى حساب معدل الوفيات الناتجة عن المرض في اليمن خلال الفترة من عام ٢٠١٩ إلى عام ٢٠٢٢. **المنهجية:** تم تنفيذ دراسة وصفية مقطعية استعادية قائمة على السجلات في الجمهورية اليمنية، وذلك خلال الفترة الممتدة من عام ٢٠١٩ إلى عام ٢٠٢٢. **النتائج:** أظهرت البيانات المسجلة وجود ما يُقدَّر بـ ٦١,٢٩٤ حالة إصابة بشرية بداء الكلب، و١٧٤ حالة وفاة خلال فترة الدراسة. بلغ عدد الذكور المصابين ٤٣,٦١٩ حالة (٧١,١٦٪)، وهو ما يزيد عن ضعف عدد الإناث المصابات البالغ ١٧,٦٧٥ حالة (٢٨,٨٣٪). كانت الفئة العمرية التي تزيد أعمار أفرادها عن خمس سنوات الأكثر تأثرًا، حيث سُجّلت ٥٤,٤١٥ حالة (٨٨,٧٧٪)، تلتها الفئة العمرية الأقل من خمس سنوات بعدد ٦,٨٧٩ حالة (١١,٢٢٪). **الاستنتاج:** يُعد داء الكلب مرضًا متوطنًا في اليمن، ولا يزال يشكل تحديًا كبيرًا للصحة العامة، مع تسجيل معدلات مرتفعة من الإصابات والوفيات سنويًا. الأطفال الذكور الذين تزيد أعمارهم عن خمس سنوات هم الفئة الأكثر تعرضًا لهجمات الحيوانات المصابة بداء الكلب، مما يستدعي تعزيز برامج الوقاية والتوعية المجتمعية.

الكلمات المفتاحية: داء الكلب البشري، عضّات الحيوانات، معدل الوفيات، اليمن.

Introduction

Rabies is a common, serious zoonotic infectious disease. It is a viral infection caused by a neurotropic negative-sense, non-segmented, single-stranded RNA virus of the Rhabdoviridae family and the Lyssavirus genus. The virus is present in the saliva of the infected animal, which was a warm-blooded mammal, mainly a dog, and is transferred to humans by biting. In fact, dogs cause 99% of human deaths from rabies ^[1, 2]. Rabies infection, whenever it enters the central nervous system of the host, causes a fatal progressive encephalomyelitis in 100% of cases ^[1].

Rabies has been controlled in many parts of the world and is considered rabies-free. The number of people at risk of Rabies is more than 3 billion in over 150 countries and territories. It causes about 50000-60000 human deaths annually worldwide. The majority of the deaths were in Asia and Africa.

The spread of canine rabies is not under control and very far from being eliminated. The vast majority of cases were under the age of 15 years old ^[3-6]. Rabies is endemic in animals in the Arabian Peninsula, except the United Arab Emirates, Qatar, and Kuwait, which are considered rabies-free. Certain countries in the area have been reporting increasing numbers of cases of wildlife rabies, including Oman, Saudi Arabia, and Yemen. Although Saudi Arabia is the largest country in the Peninsula, little has been published about the rabies situation in the country. Animal rabies in Oman is characterized by a red fox sylvatic cycle; other cases have been reported in camels, cattle, goats, and sheep. In

Yemen, the majority of cases were reported in stray dogs ^[7].

This study aims to estimate and describe the prevalence of rabies in Yemen

Methods

This study employed a retrospective, registry-based, cross-sectional descriptive design conducted in Yemen between 2019 and 2022. The study population included all cases documented by the National Rabies Control Program (NRCP), affiliated with the Ministry of Public Health and Population. A comprehensive sampling approach was adopted to include all registered cases during the study period.

The study was conducted within the operational scope of the NRCP, and data were extracted from its annual reports submitted to the Electronic Integrated Disease Early Warning System (EIDEWS). All collected data were reviewed for completeness and accuracy and analyzed by a qualified SPSS specialist. Results were presented in structured tables aligned with the study objectives.

Key variables assessed included the residence, gender, and age of affected individuals. Ethical approval was obtained through formal permission letters issued by the Department of Community Medicine at 21 September University and directed to the NRCP.

As a registry-based study, several limitations were encountered. These included the absence of similar recent studies in Yemen, the limited availability of comparable research in past years, and unequal age group intervals in NRCP reports. Additionally, certain variables such as occupation, bite location, and educational level were not recorded.

Reporting inconsistencies were noted across governorates, with some failing to submit data on a regular basis or at all. The study also faced financial constraints and reflected a broader issue of community-level neglect toward this endemic disease.

Results

Out of 61,294 reported cases, the majority (88.77%) occurred in children aged ≤ 5 years, who also accounted for 53.44% of total deaths. In contrast, individuals older than 5 years represented only 11.22% of cases but contributed 46.55% of mortalities. These findings suggest a disproportionately high exposure among young children, while older individuals may experience more severe outcomes or delayed treatment.

Analysis of gender distribution revealed a marked predominance among males, who accounted for 71.16% of reported human rabies cases, compared to 28.83% among females. This disparity may reflect differences in exposure risk, occupational patterns, or behavioral factors influencing contact with rabid animals.

A total of 61,294 cases and 175 deaths were recorded across 15 governorates, with an overall case fatality rate of 0.28%. Amanat Al-Asima had the highest burden, accounting for 26.6% of cases and 54% of deaths. In contrast, governorates such as Sa'dah, Raymah, Mareb, Al-Bayda, and Al-Dhale reported no deaths despite confirmed cases. Sana'a showed a notably high fatality rate (2.78%) despite low case numbers, suggesting possible delays in diagnosis or limited access to care. Variations in fatality rates across regions may reflect differences in healthcare infrastructure, reporting accuracy, and population

characteristics. The distribution of cases across governorates shows marked regional variation. Amanat Al-Asima reported the highest number of cases (16,312), followed by Ibb (13,561) and Dhamar (13,489), indicating concentrated burden in central urban areas. Moderate case counts were observed in Amanat Al-Babira (6,640) and Hajjah (4,327), while peripheral regions such as Marib (8), Rayma (138), and Al-Dhale (146) recorded the lowest figures. These disparities may reflect differences in population density, reporting capacity, or access to healthcare across governorates.

Mortality data revealed significant regional disparities. Amanat Al-Asima accounted for the highest number of deaths (94), followed by Dhamar (31) and Ibb (18), indicating a concentrated fatality burden in central governorates. In contrast, several regions, including Al-Jawf, Al-Dhale, Al-Mahweet, Mareb, Rayma, and Sa'dah, reported zero deaths despite confirmed cases. These differences may reflect variations in healthcare access, reporting practices, or population vulnerability across governorates.

Between 2019 and 2022, reported human rabies cases showed notable year-to-year fluctuations. The highest number of cases was recorded in 2019 (17,197), followed by a decline in 2020 (14,492) and a slight increase in 2021 (15,205). In 2022, cases dropped again to 14,400. These trends may reflect changes in surveillance, vaccination coverage, public awareness, or reporting practices over time.

The proportion of human rabies cases to mortality reveals a stark disparity, with mortality accounting for only 0.28% of total reported cases. The overwhelming majority (99.72%) represent non-fatal outcomes. This suggests either effective post-exposure management or potential underreporting of

Human Rabies Status in Yemen During (2019-2022)

Dr.Muneera Shaher

rabies-related deaths, warranting further investigation into surveillance accuracy and treatment accessibility.

Table 4.1 Distribution of Human Rabies Cases and Mortality According to Age Groups

<i>Age</i>	<i>Case</i>		<i>Mortality</i>	
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>
< 5 y	6879	11.22	81	46.55
≥ 5 y	54415	88.77	93	53.44
Total	61294	99.89	174	99.92

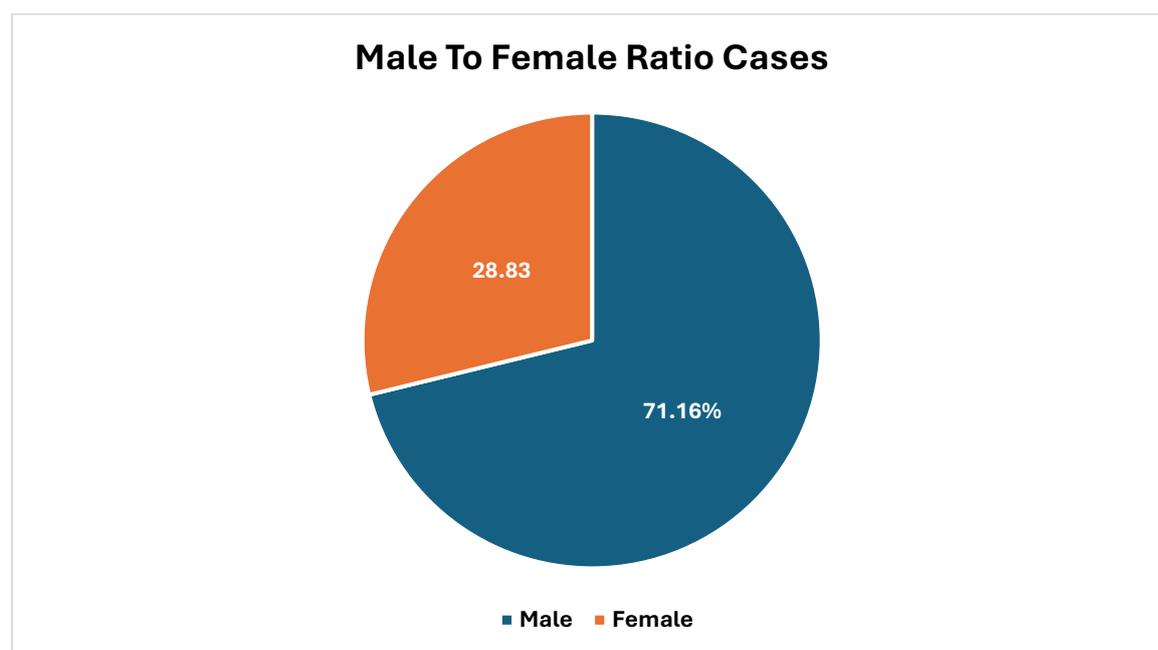


Fig 4.1 Distribution of Human Rabies Cases According to Gender

Human Rabies Status in Yemen During (2019-2022)

Dr.Muneera Shaher

Table 4.2 Distribution of Human Rabies Cases, Mortality, and Case Fatality Rate According to Governorates

Governate	Case		Mortality		Case fatality rate 100
	N	%	N	%	
<i>Amanat Al-Asima</i>	16312	26.6	94	54	0.57
<i>Sana'a</i>	895	1.46	7	4	0.78
<i>Taiz</i>	1.27	796	3	1.72	0.37
<i>Ibb</i>	13561	22.1	18	10.34	0.13
<i>Sa'dah</i>	622	1.01	0	0	0
<i>Rayma</i>	138	0.22	0	0	0
<i>Mareb</i>	8	0.01	0	0	0
<i>Al-Hudaidah</i>	922	1.5	3	1.72	0.32
<i>Dhamar</i>	13489	22	31	17.81	0.22
<i>Al-Mahweet</i>	1472	2.4	4	2.29	0.27
<i>Amran</i>	4327	7.05	5	2.87	0.11
<i>Hajjah</i>	1782	2.9	1	0.57	0.05
<i>Al-Baidha</i>	6640	10.83	8	4.6	0.12
<i>Al-Dhale</i>	146	0.24	0	0	0
<i>Al-Jawf</i>	184	0.3	0	0	0
Total	61294	99.89	174	99.92	0.28

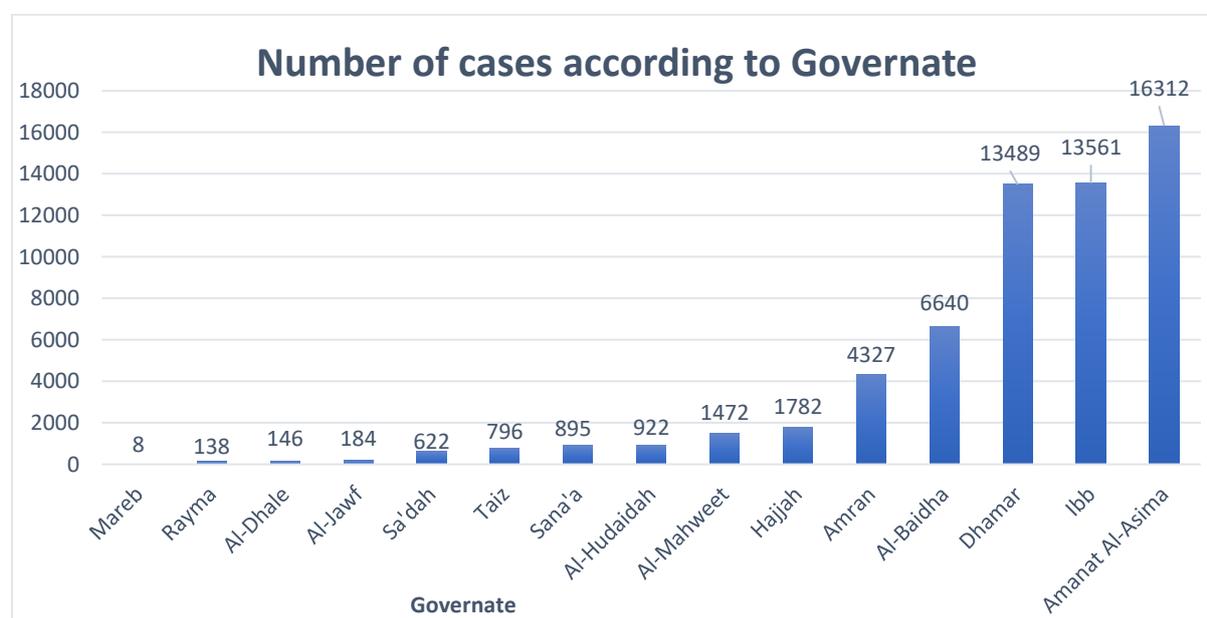


Fig 4.2 Distribution of Human Rabies Cases According to Governorates

Human Rabies Status in Yemen During (2019-2022)

Dr.Muneera Shaher

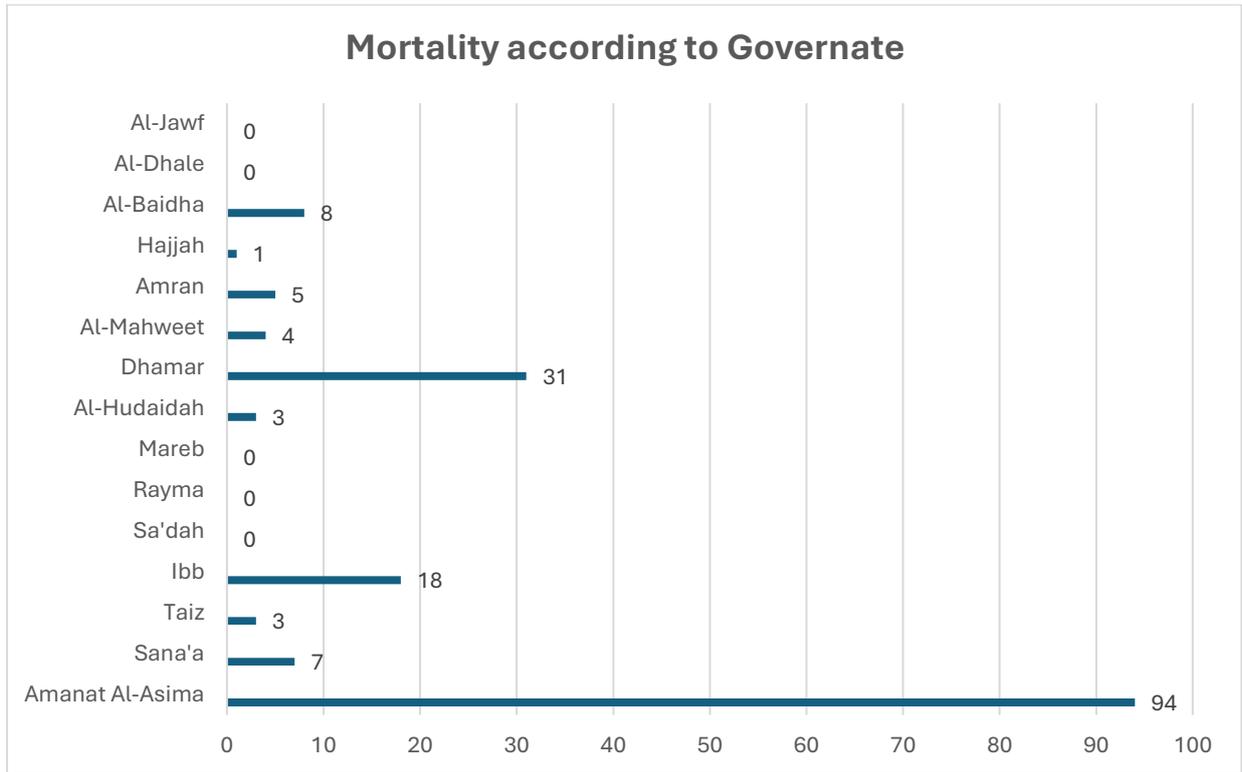


Fig 4.3 Distribution of Mortality According to Governorates

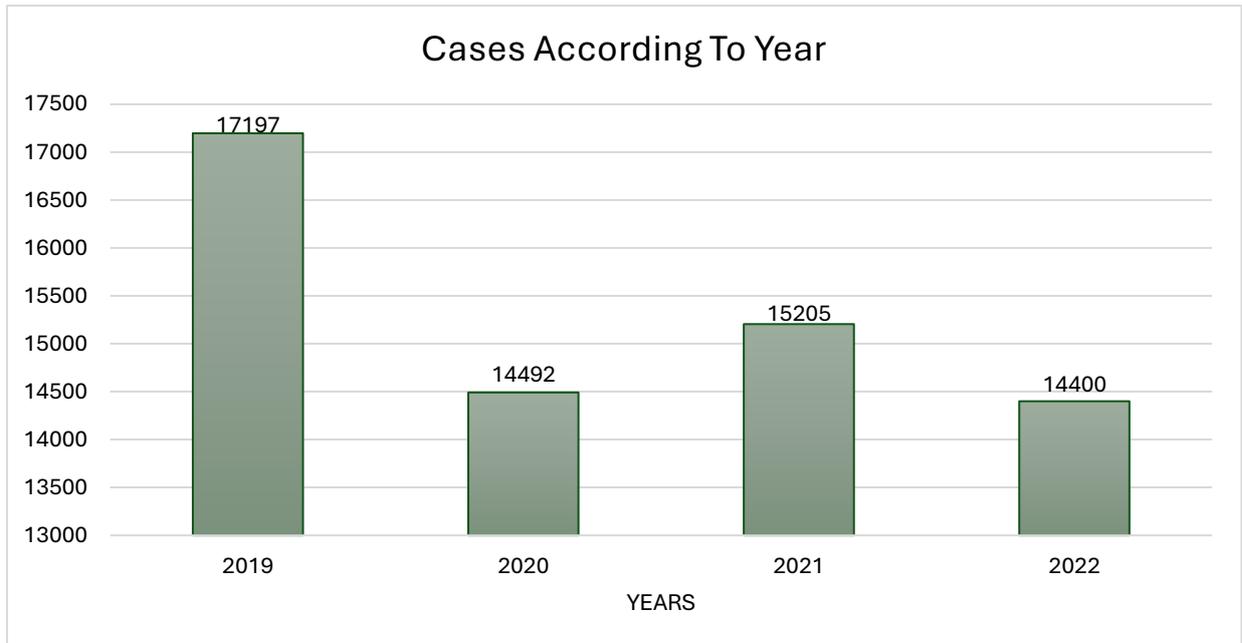


Fig 4.4 Distribution of Human Rabies Cases and Mortality in Each Year

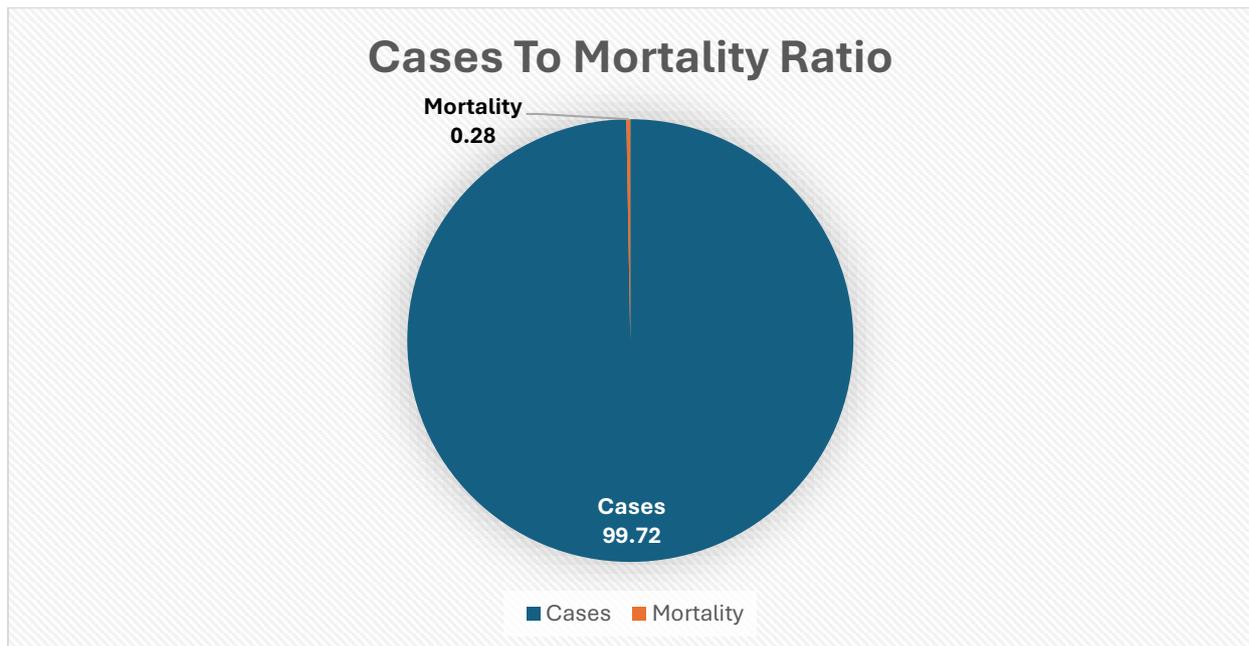


Fig 4.5 Percentage of Mortality to Cases Of Human Rabies Cases

Discussion

The number of people at risk of rabies is more than 3 billion in over 150 countries and territories. It causes about 50000-60000 human deaths annually worldwide ^[3-6].

The aims of this study were mainly to estimate the number of human rabies cases and mortality cases in Yemen during the period (2019-2022).

The results of our study were based on NRCP reports to EIDEWS (Electronic Integrated Disease Early Warning System) annual reports from 2019 to 2022, which revealed a significant number of rabies cases, particularly in rural areas, where many cases may have gone untested and unreported. Thus, the reported cases in this study provide only an index of the disease's magnitude and may be an underestimation of the problem's extent ^[8].

The results show that there were an estimated 61294 post-animal bite cases during the four years of the study, from the period

2019-2022. This number is considered very high when compared to another similar study in the same country during the ten years from 2011 to 2017 ^[4].

Another retrograde study was conducted in the nearby country Oman during the period of (1991-2013) and the estimated number of post-animal bites in the study period was 2278 cases, which is considered very low in compared to the studies in Yemen either in the 90s or the last two decades this might due to unreported minor scratches since their cases are by cats, the enormous actions for controlling the stray dogs and encouraging the vaccination for domestic animals in Oman country ^[9].

In this study, the male female ratio is in the favor of males, which was two times more than the number of females with 43619 (71.16%) and 17675 (28.83%) respectively, which was similar to many studies like in Oman (70.1% in males and 29.9% in females) ^[9], and Iran (79.16% were males and 20.84% were females) ^[10], and this might be due to the

similarity in social habits regarding females working outdoors while other hand another study in Puerto Rico estimated that men more than women when it comes to male and female ratio [11].

When it comes to age, our study gives very interesting results regarding the age of victims of animal bites. In the age group ≥ 5 years, the number of cases was the highest; 54415 (88.77%) cases, then the age group less than 5 years; 6879 (11.22%) cases. This is similar to the previous study in Yemen during (2011-2017) [7], where it was found that the age group from 0 to 4 years had 15% but, on the other hand, the other studies in Oman [9], Zimbabwe [12], and Tanzania [13]. In which the majority of cases were among children, and this interesting fact might be due to the very narrow categorization for age in our study, two categories only: < 5 years and ≥ 5 years. This result may be because children and young people are often involved in outdoor activities, which can spark their curiosity and limited knowledge of dog behavior, as well as their inability to protect themselves. These findings are like the studies in Zimbabwe [12], Nigeria [14], and Tanzania [13].

The results show that there were an estimated 61294 cases and 174 cases and mortality, respectively. This means that the case mortality rate is 0.28% which is slightly less than the case mortality rate of 0.38% in [4]. There was another study in Yemen during eight years, 2011–2018, a total of 89,590 possible exposure cases in a suspected rabid animal bite were reported, of them (29%) 25,574 were exposed to a positively confirmed rabid animal and have Post Exposure Prophylaxis (PEP), from those possible exposure cases (0.4%) 347 have human rabies and died [15].

Conclusion and Recommendation

According to NRCP reports submitted to EIDEWS from 2019 to 2022, an estimated 61,294 post-animal bite cases were recorded in Yemen. Amanat Al-Asimah accounted for one-quarter of cases, followed by Ibb, Dhamar, Al-Baidha, and Amran, while Rayma, Mareb, Al-Dhale, and Al-Jawf reported the fewest. Mortality was highest in Amanat Al-Asimah, with zero deaths in several governorates. Males represented nearly three-quarters of cases, and most patients were older than five years.

The national case fatality rate was 0.28%, which is low locally but high compared to international standards, as many countries have declared themselves rabies-free.

The study calls for more rabies research in Yemen, stronger public awareness through education and media, reliable vaccine and HRIG supply, improved reporting and diagnostics, inclusion of detailed case data, and measures to reduce stray dogs.

References

1. WHO, *WHO Expert Consultation on Rabies: WHO TRS N°1012*. World Health Organization, 2018. **85**: p. 309–320.
2. Singh, R., et al., *Rabies—epidemiology, pathogenesis, public health concerns and advances in diagnosis and control: a comprehensive review*. Veterinary Quarterly, 2017. **37**(1): p. 212–251.
3. Wunner, W.H. and D.J. Briggs, *Rabies in the 21st century*. PLoS neglected tropical diseases, 2010. **4**(3): p. e591.

Human Rabies Status in Yemen During (2019-2022)

Dr.Muneera Shaher

4. Abdulmoghni, R.T., et al., *Incidence, trend, and mortality of human exposure to rabies in Yemen, 2011-2017: observational study*. JMIR Public Health and Surveillance, 2021. **7**(6): p. e27623.
5. Seimenis, A., *The rabies situation in the Middle East*. Developments in biologicals, 2008. **131**: p. 43–53.
6. Knobel, D.L., et al., *Re-evaluating the burden of rabies in Africa and Asia*. Bulletin of the World health Organization, 2005. **83**: p. 360–368.
7. Al-Shamahy, H.A., A. Sunhope, and K.A. Al-Moyed, *Prevalence of rabies in various species in Yemen and risk factors contributing to the spread of the disease*. Sultan Qaboos University Medical Journal, 2013. **13**(3): p. 404.
8. Nasher, S., et al., *Electronic Integrated Disease Early Warning System Surveillance System Evaluation, Sana'a Capital, Yemen, 2021*. Iproceedings, 2022. **8**(1): p. e36554.
9. Al Abaidani, I., et al., *Epidemiology of rabies in Oman: a retrospective study (1991–2013)*. EMHJ, 1995. **21**(8).
10. Rezaeinasab, M. and M. Rad, *Analytical survey of human rabies and animal bite prevalence during one decade in the province of Kerman, Iran*. Critical Care, 2008. **12**(Suppl 2): p. P1.
11. GM, Q.C., C. Perez-Cardona, and A.O. FI, *Descriptive study of animal attacks and bites in the municipality of San Juan, Puerto Rico, 1996-1998*. Puerto Rico health sciences journal, 2000. **19**(1): p. 39–47.
12. Pfukenyi, D., et al., *A retrospective study of rabies in humans in Zimbabwe, between 1992 and 2003*. Acta tropica, 2007. **102**(3): p. 190–196.
13. Cleaveland, S., et al., *Estimating human rabies mortality in the United Republic of Tanzania from dog bite injuries*. Bulletin of the World health Organization, 2002. **80**(4): p. 304–310.
14. Eke, C., et al., *Human rabies: still a neglected preventable disease in Nigeria*. Nigerian journal of clinical practice, 2015. **18**(2): p. 268–272.
15. Abdulmoghni, R., K. Almoayed, and M. Al Amad, *Patterns and distribution of human exposed to rabies in Yemen, 2011–2018*. International Journal of Infectious Diseases, 2020. **101**: p. 262.