

Retrospective Investigation of Crimean-Congo Hemorrhagic Fever (CCHF) in Thi-Qar Province from Year 2022 to 2023

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Abstract

Crimean-Congo haemorrhagic fever (CCHF) is a tick-borne disease that poses a significant threat to public health in Iraq. This study aimed to investigate the epidemiology of CCHF in humans, focusing on occupational exposure, mortality rates, and temporal distribution. The retrospective analysis identified 290 confirmed cases reported between 2022 and 2023, with a total incidence case estimate of 13.5 per 100,000 individuals. The highest proportion was found among housewives (36%), followed by animal ' owners (21%) and animal ' sellers (16%). The mortality rate was estimated to be 2.1 per 100,000 individuals, with a case fatality rate of 15.5%. The temporal analysis revealed a peak incidence in June 2022 (1.86 per 100,000 individuals) and May 2023 (1.53 per 100,000 individuals), highlighting the seasonal patterns in disease transmission. The suggested control program should include the application of acaricides to reduce tick infestations, enforcing regulations to prevent illegal animal slaughtering, and public awareness campaigns to improve knowledge about the disease.

Keywords: CCHF outbreak, Thi-Qar province, case-fatality rate, annual incidence, occupational exposure.

Introduction

Crimean-Congo hemorrhagic fever (CCHF) is a severe and often fatal viral zoonotic disease that constitutes a significant public health important. It is caused by the Crimean-Congo hemorrhagic fever virus (CCHFV), a Nairoviridae family member, characterized as a negative-sense, single-stranded RNA virus. The viral genome consists of three distinct segments—large (L), medium (M), and small (S)—encoding essential proteins for viral replication and pathogenicity. The virus is primarily transmitted through the bite of infected ticks, particularly from the genera of *Hyalomma* and *Ixodes*, which act as vectors and reservoirs, perpetuating its circulation within animal populations (1). Humans typically acquire the infection through tick bites or direct contact with infected animal tissues, especially when handling carcasses without effective protective measures. Following an incubation period of 5 to 13 days, infected individuals often present with non-specific symptoms, including fever, myalgia, back pain, abdominal discomfort, vomiting, and diarrhea (2). In severe cases, hemorrhagic complications such as petechiae, ecchymosis, and subcutaneous bleeding may occur, causing progression to multiorgan failure, including hepatic and renal dysfunction. Without timely medical intervention, the disease may result in mortality, with case fatality rates reported to be between 10% and 40% (3). The lack of a licensed vaccine exacerbates the challenge of controlling CCHF outbreaks, although antiviral therapy with ribavirin has shown promise to mitigate the disease's severity (4).

CCHF is endemic in various parts of the world, including the Middle East, Asia, Africa, and southeast Europe, with sporadic outbreaks linked to ecological and occupational factors (5,6). The global seroprevalence of CCHFV is 11.6% among humans and 0.4% in animal populations, with higher rates reported in regions with significant tick infestations and human-animal interactions (7). The disease prevailed mainly in Arab countries, where cattle and camel populations exhibit seroprevalence rates of 29% and 21%, respectively (8). Risk factors such as hot climate, uncontrolled livestock movement, and low awareness of CCHF among at-risk populations have been identified as key drivers of disease transmission (9). In Iraq, CCHF has been endemic since its initial identification in sporadic cases between 1979 and 1998 (10). Subsequent surveillance programs also documented a few cases, including six confirmed cases between 1998 and 2009 and 11 cases between 2009 and 2010, with a case fatality rate of 36% (11). A notable resurgence occurred in 2018, with 144 cases reported, primarily in central Iraq, and the trend continued with over 200 cases recorded between 2021 and 2022 (12,13). The increase in human' ' infections is attributed due to an increase in exposure to the virus over religious festivals such as Ramadan and Eid al-Adha, where the slaughtering of small ruminants is common practice. Despite the considerable burden of CCHF in Iraq, particularly in its southern regions, the epidemiological data is still limited. Hence, this study was designed to address the knowledge gap by estimating the incidence and fatality rates of CCHF, evaluating occupational

exposure risks, and analyzing the temporal distribution of cases in Thi-Qar province.

Area of Study

The study was conducted in Thi-Qar province, in southeast of southeast Iraq. Thi-Qar shares border with Basrah to the south and Missan, Muthanna, Qadisiya, and Wassit to the north and is geographically located approximately 370

Hospital Data Records

This study utilized retrospective hospital records from the Epidemiology Department of the Veterinary Hospital of Thi-Qar. The Veterinary Hospital partners with the health department in monitoring disease outbreaks and sharing critical epidemiological data. All data collection and analysis 'adhered to ethical guidelines, ensuring patient information confidentiality and anonymity. However, the dataset comprised the epidemiological information on patients diagnosed with CCHF during outbreaks recorded from 2022 to 2023. The variables extracted from the 'patient's records included demographic characteristics: patient age, sex,

Data Analysis

The analysis focused on the incidence of CCHF cases during the study period (2022 and 2023), including assessments of mortality and case-fatality rates. Data were stratified by key categorical variables, including demographic characteristics and risk factors, and presented in tabular form

Results

Incidence and Sociodemographic Factors

A total of 290 confirmed cases of Crimean-Congo haemorrhagic fever (CCHF) were reported between 2022 and

Materials and Methods

kilometers from the capital, Baghdad. The region features a tropical climate, with average summer temperatures peaking at 40°C, and receives minimum winter precipitation, averaging 100 mm annually (14). According to the last national census conducted in 2017, the population of Thi-Qar was estimated at 2,152,155 (15).

occupation, and residential address; Epidemiological risk factors: ownership of domestic animals, evidence of tick infestation, engagement in livestock slaughtering practices, and history of direct or indirect contact with confirmed CCHF cases; Temporal data: dates of disease onset, hospital admission, and diagnosis, categorized by month and year; Spatial data: geographic coordinates (latitude and longitude) of patients' residences. The collected data were transcribed into a Microsoft Excel spreadsheet to ensure uniformity and accuracy, enabling comprehensive analysis of disease patterns and identification of risk factors.

with frequencies, percentages, and 95% confidence intervals (CIs). Temporal trends in disease outbreaks were analyzed to identify monthly distribution patterns, with results visualized through a radar chart. Geographic data were incorporated to evaluate the spatial distribution of cases. The statistical analysis was conducted using SPSS software (version 22).

2023, corresponding to an overall incidence rate of 13.5 per 100,000 individuals. In 2022, 161 cases were recorded, with an estimated incidence rate of 7.5 per 100,000 individuals. In 2023, 129 cases were reported, corresponding to an incidence rate of 6.0 per 100,000

individuals. The demographic analysis revealed that approximately 50% of the affected individuals were male, while females accounted for 36% of the cases (Table 1). Among occupational groups, housewives exhibited the highest infection

rate (36%), followed by animal owners (21%) and animal sellers (16%). The mortality rate, associated with CCHF during the study period, was calculated at 2.1 per 100,000 individuals, while the case fatality rate was estimated at 15.5%.

Table 1: Sociodemographic factors of the patients with CCHF for a two-years period of infection.

Category	Reported cases in 2022 (N=161)		Reported cases in 2023 (129)	
	N	Percentage (95%CI)	N	Percentage (95%CI)
Age-group				
≤ 20	34	21.12 (15.1,28.2)	28	21.71 (14.9, 29.8)
21-30	30	18.63 (12.9, 25.5)	26	20.16 (13.6, 28.1)
31-40	29	18.63 (12.4, 24.8)	28	21.71 (14.9, 29.8)
41-50	37	22.89 (16.7, 30.3)	21	16.28 (10.4, 23.8)
>50	31	19.25 (13.5, 26.2)	26	20.16 (13.6, 28.1)
Gender				
Female	71	44.10 (36.3,52.1)	51	39.53 (31.0, 48.5)
Male	90	55.90 (47.9,63.7)	78	60.47 (51.5, 69.0)
Occupation				
Animal owner/seller	34	21.12 (15.1,28.2)	21	16.28 (10.4, 23.8)
Butcher	17	10.56 (6.3,16.4)	14	10.85 (6.1, 17.5)
Child	1	0.62 (0.0,3.4)	0	0.00 (0.0, 2.8)
Public servant	10	6.21 (3.0,11.1)	5	3.88 (1.3, 8.8)
Housewife	58	36.02 (28.6,44.0)	46	36.66 (27.4, 44.6)
Students	15	9.32 (5.3,14.9)	7	5.43 (2.2, 10.9)
Others	26	16.15 (10.8,22.8)	36	27.91 (20.4, 36.5)
Patient condition				
Died	34	21.12 (15.1,28.2)	11	8.53 (4.3, 14.7)
Survived	127	78.88 (71.8,84.9)	118	91.47 (85.3, 95.7)

Risk Factors and Spatial-temporal Analysis

According to the investigation, the majority (65%) of the patients pronounced that their domestic animals were infested with ticks (Table 2). Over half of the patients reported practicing livestock slaughtering at home. Only a small proportion (3%) acknowledged that they were consistently in contact with other infected individuals, suggesting that animal exposure and tick infestation were the predominant risk factors for disease transmission. Geographically, the highest

number of reported cases originated from Nassiriyah district, with 129 cases, followed by Al-Shatra and Al-Rifai districts (Table 3).

Temporal analysis of the outbreak revealed a sharp increase in incidence rates in 2022, from April to June, with rates rising from 0.88% to 1.86% per 100,000 individuals (Figure 1). Following this peak, the incidence progressively declined from July to December. The outbreak resurfaced with sporadic cases early in the beginning of 2023. Incidence cases began to rise in April (0.37% per 100,000 individuals),

reaching a peak in May at 1.53% per 100,000 individuals. The subsequent months showed fluctuations in incidence, specifically in June and July. A gradual decline in cases was observed from August, with the outbreak subsiding by the

year's end. A geographic map was generated using ArcGIS to illustrate the spatial distribution of cases (Figure 2). This map highlights the high number of cases within the districts of Thi-Qar province.

Table 2: Risk factors included tick infestation, home-slaughtered animals, and contact-infected cases.

Answer (yes/no)	Ticks presented on animals or in barns	Animals slaughtered at houses	Contact with similar cases infected by CCHF
Yes	191 (65.86%)	157 (54.14%)	9 (3.10%)
No	99 (34.14%)	133 (45.86%)	281 (96.90%)

Table 3: Estimating the incidence cases of CCHF per 10000 in the five districts of Thi-Qar.

Districts	Number of cases in 2022	Incidence in 2022	Number of cases in 2023	Incidence in 2023	Population size of districts
Nassiriyah	70	0.88	59	0.74	793472
Suq Al-Shoyokh	19	0.57	20	0.61	329909
Al-Chibayish	2	0.19	5	0.48	105147
AL-Shatra	39	0.82	19	0.40	475145
Al-Rifai	31	0.69	26	2.88	448482

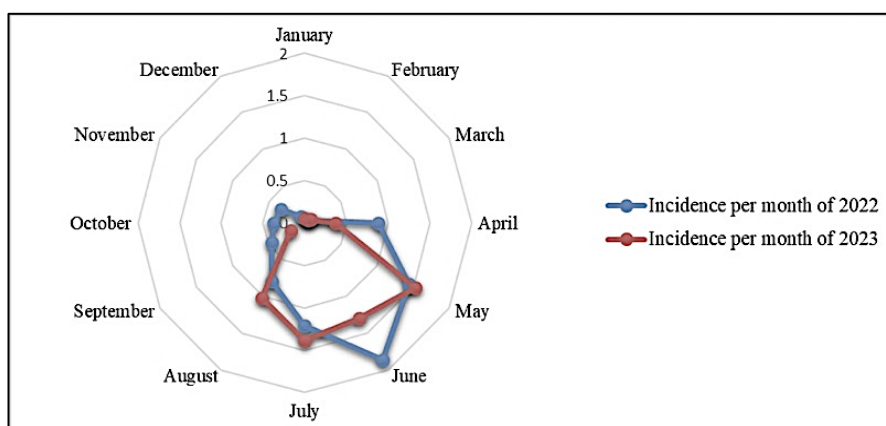


Figure 1: Incidence cases per month recorded between 2022 to 2023.

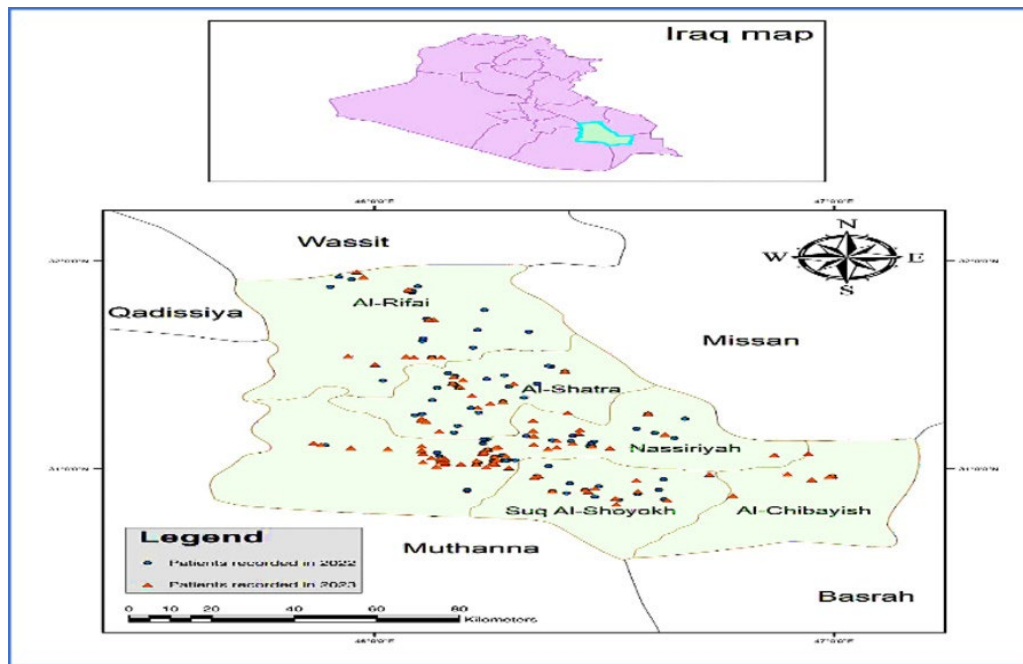


Figure 2: Thi-Qar map where cases of CCHF were reported in five districts (Created by ArcGIS version 10.3).

Discussion

Crimean-Congo hemorrhagic fever (CCHF) remains a critical public health challenge in Iraq, especially in the Thi-Qar province, as delineated by this study. The temporal dynamics of CCHF outbreaks in the region appear to be shaped by a complex interplay of environmental, socio-economic, and behavioral factors, which contribute to the persistence and expansion of the disease. As noted in our findings, the province exhibits a continued pattern of CCHF outbreaks, mainly due to the environmental resilience of the virus, which is facilitated by active tick populations and unregulated livestock movements. The ability of the virus to endure high ambient temperatures, combined with inadequate public health responses, has exacerbated the spread of the disease. The lack of a coordinated response to mitigate CCHF risks in human populations highlights the need for a more robust preparedness and surveillance

framework. Despite the 2022 outbreak, there was a failure to implement preventive measures or health education campaigns to reduce further risk of infections. The disease may be infiltrated into Iraq through unregulated animal trade, particularly from the endemic other neighboring countries, including Turkey and Iran (16).

A total of (290) cases were reported in this investigation (incidence cases 13.5 / 100,000 people). The incidence of CCHF varies in different parts of the world. For instance, in 2014, 25 cases were reported in Turkey (17), 14 cases were reported in Uganda between 2018 and 2019 (18), and 118 cases were reported in Afghanistan between 2021 and 2023 (19). The differences in disease occurrence reflect the variation in control programs implemented by public health authorities in different countries, as well as the differences in the environmental conditions. In Iraq, the study by Al-Ramahi and Taresh (20) found that

climatic factors including high temperatures and prolonged droughts, in addition to increased tick populations, lead to the emerging disease. The lack of active surveillance systems and vector control measures s to an exacerbated risk of outbreaks in the region.

In our study, housewives (36%) were the most significantly affected demographic group. This finding highlights the occupational and domestic risks posed by close interaction with livestock, particularly in rural and sub-urban regions. Housewives often engage in domestic responsibilities such as animal husbandry, milking, and meat preparation, which may increase exposure to the CCHF virus. These findings are consistent with a study conducted in Herat province, Afghanistan, where housewives represented 36.5% of confirmed cases (21). Similarly, in the current study, 21% of the cases were reported among animal owners and 16% among butchers. In this context, animal handlers, farmers, and abattoir workers are at high risk of infection due to frequent and prolonged contact with potentially infected animals and raw meat. A meta-analysis by Lwasa *et al.* (2020) (22) reported that workers and veterinarians in the abattoirs are four times more likely to be infected with CCHF, while those engaged in farming or animal handling can have a twofold increase in risk. This highlights the importance of targeting high-risk occupational groups for education and intervention. Additionally, a study from Oman indicated that 28% of CCHF patients were involved in slaughtering animals, 25% were livestock traders, and 9% were butchers (23). These findings underscore the need for public health interventions focused on preventive

education, particularly regarding using personal protective equipment (PPE), such as gloves, long-sleeved clothing, and boots, to reduce the risk of exposure.

The case fatality rate for CCHF in this study was estimated at 15.5%, which is relatively consistent with global reports. For example, the case fatality rate of CCHF in Bulgaria and Afghanistan was reported at 26% and 21.6%, respectively (24,25). The virulence of the Crimean-Congo haemorrhagic fever virus (CCHFV) is believed to be related to its genomic characteristics, which facilitate its acute pathogenic effects on infected individuals. Following infection, the virus triggers a cascade of immune responses, including suppression of interferon production, apoptosis of immune and liver cells, endothelial damage, and the activation of disseminated intravascular coagulation (DIC), which underlies the haemorrhagic manifestations of the disease (26,27). The severity of these clinical features often correlates with the overall fatality rate, highlighting the need for early diagnosis and effective clinical management. There has been no licensed vaccine for CCHF, although several vaccine candidates have undergone preclinical and clinical trials. These include DNA-based vaccines, mRNA vaccines, and other innovative immunization strategies to enhance innate and adaptive immune responses to the virus (28). Developing a successful vaccine could significantly reduce the incidence and severity of CCHF in human populations.

The seasonal trends of the CCHF outbreaks are another important factor to consider. As noted in our study, a marked increase in cases was observed during the summer months, particularly between

April and June. In 2022, the incidence rate surged from 0.88% to 1.86% per 100,000 individuals, while in 2023, the rate increased from 0.37% to 1.53% per 100,000 individuals. This seasonal pattern aligns with findings from Iran and Uganda, where elevated temperatures were associated with increased tick activity and CCHF transmission (29,30). The life cycle of the tick vectors, tough ticks, plays a central role in seasonal transmission. These ticks can maintain CCHFV circulation through both transstadial and transovarial transmission. Therefore, the virus can persist in livestock during seasonal periods (31). Given these findings, an integrated vector management (IVM) approach is critical to controlling CCHF in endemic regions. Insecticide-treated livestock, using acaricides, and measures to control tick populations in barns and farmyards are effective strategies for reducing the risk of infection (32). Personal protective measures, such as wearing gloves, long-sleeved clothing, boots, and insect repellents, should be promoted to high-risk groups, including animal handlers, butchers, and farmers. Furthermore, controlling tick infestations in areas where humans and livestock interact—such as farms, slaughterhouses, and markets—is essential in preventing the spread of the virus.

Finally, the improvement of public awareness through educational programs is a vital element. Communities should be informed about the risks of CCHF, the importance of early diagnosis, and preventive measures 'necessary to limit exposure mainly from animals' animal sources. Collaboration between veterinary and public health authorities is also crucial in assessing the epidemiological

predisposed factors that may contribute to the disease outbreak.

Conclusions

Crimean-Congo hemorrhagic fever spreads widely in Thi-Qar province, with high incidence cases reported from 2022 to 2023. The disease is probably transmitted to humans by tick bites and/or direct contact with animal meat products. The reported cases were increased sharply during the hot season. Intervention protocols to control disease transmission are required through the use of acaricides to eliminate tick infestations, improve public awareness about the disease, and implement policies to regulate slaughtering livestock at licensed abattoirs.

Conflict of interests

The authors declare that there is no conflict of interest.

Ethical Clearance

Approval was granted from the scientific committee of the College of Veterinary Medicine, University of Basrah (UB.VET.2024.473) on October 1, 2023.

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دراسة استرجاعية وتحقيقية لحمى القرم-الكونغو النزفية (CCHF) في محافظة ذي قار من سنة 2022 إلى 2023

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الخلاصة

حمى القرم والكونغو النزفية (CCHF) هي مرض ينقل بواسطة القراد ويشكل تهديداً كبيراً على الصحة العامة في العراق. هدفت هذه الدراسة إلى الاستقصاء عن وبائية حمى النزفية في البشر، مع التركيز على جانب التعرض المهني، ومعدلات الوفيات والتوزيع الزمني للمرض. التحليل الرجعي كشف عن 290 حالة مؤكدة ومسجلة بين عامي 2022 و2023، مع نسبة حدوث الإصابة 13.5 لكل 100,000 فرد. كانت النسبة الإصابة هي الأعلى بين ربات البيوت (36%)، بعد ذلك مالكي الحيوانات بنسبة (21%) وباعة الحيوانات بنسبة (16%). تم تقييم معدل الوفيات بـ 2.1 لكل 100,000 فرد، ومعدل الإماتة بنسبة 15.5%. أظهر التحليل الزمني إلى حدوث ذروة المرض في حزيران سنة 2022 (1.86 لكل 100,000 فرد) وفي أيار سنة 2023 (1.53 لكل 100,000 فرد)، مما يسلط الضوء على الأنماط الموسمية في انتقال المرض. استنتجت الدراسة أن حمى CCHF هو مرض مستوطن في محافظة ذي قار، وبرامج السيطرة مطلوب بشكل عاجل لتقليل حدوث اصابات جديدة. تشمل التدابير المقترحة للسيطرة استخدام المبيدات الحشرية لتقليل الاصابة بالقراد، وتطبيق القوانين لمنع الذبح العشوائي للحيوانات، مع القيام بحملات توعية لرفع مستوى المعرفة لدى السكان حول هذا المرض.

الكلمات المفتاحية: حمى القرم والكونغو النزفية، الإصابة في محافظة ذي قار، نسبة الاماتة، التعرض المهني.