American Journal of Biomedicine and Pharmacy
https://biojournals.us/index.php/AJBP
ISSN: 2997-7177

Epidemiological Study of Crimean–Congo Hemorrhagic Fever in Thi Qar Province from 2021 to 2023

Mohammed Mohsin Aziz
Department of Histology and Anatomy, College of Veterinary Medicine, Shatrah University, Al-Shatrah, Thi-Qar, Iraq

Received: 2024, 15, Dec
Accepted: 2025, 21, Jan
Published: 2025, 28, Feb

Annotation: Background: Crimean-Congo haemorrhagic fever (CCHF) has been sporadically reported in Iraq. However, a lack of preventive veterinary measures during the three years of the COVID-19 pandemic (2021, 2022, 2023) resulted in the largest CCHF outbreak in the country since 1979.

Study Objective: The study aimed to describe the epidemiological characteristics of CCHF cases in Thi-Qar province during 2021, 2022, and 2023, focusing on age, sex, residence, and history of contact with animals.

Materials and Methods: Data for this study were sourced from the Thi-Qar Veterinary Hospital's educational records. The research focused on laboratory-confirmed CCHF cases reported during three periods: July 7 to December 16, 2021; March 29 to December 11, 2022; and January 2 to December 4, 2023. Frequencies and percentages were used to describe demographic and epidemiological patterns. The epidemic curve was analyzed to illustrate the timing and duration of the outbreak.

Results: A total of 315 cases of CCHF were confirmed by the Iraq Central Public Health Laboratory using polymerase chain reaction (PCR) testing between July 7, 2021, and December 4, 2023. The first confirmed case was reported on July 3, 2021, with cases continuing through December 2023.

Most cases were males (n=180, 57.14%) and resided in Nasiriyah Center (n=85, 27%). The first case emerged in the 28th week of 2021. Case numbers peaked in the 20th week of 2022, with 64 cases reported, before gradually declining to only two cases by the 53rd week of 2023. The overall case fatality rate for the period was 17.7%.

Conclusion and Recommendations: The 2022 outbreak was the largest CCHF outbreak in Iraq since the disease was first documented over 40 years ago. Further identification of CCHF strains in Iraq is essential. Additionally, a national survey of CCHF vectors, along with studies exploring the knowledge, attitudes, and practices of high-risk groups, is strongly recommended to better understand and mitigate future outbreaks.

Keywords: Crimean-Congo Hemorrhagic Fever, Epidemiology, Outbreak Dynamics, Thi-Qar Province, Iraq, COVID-19 Pandemic, Occupational Risk, Public Health Surveillance, Tick-borne Disease, Veterinary Measures.

Introduction

Crimean-Congo haemorrhagic fever (CCHF) is an acute illness caused by an arbovirus transmitted to humans through ticks. The disease was first identified in 1944 on the Crimean Peninsula, with its viral origin confirmed a year later in 1945. A similar or serologically identical virus has been linked to sporadic cases of hemorrhagic fever in regions such as the Asian part of the former USSR, Bulgaria, and the former Yugoslavia. Additionally, virus isolates from the Democratic Republic of the Congo (formerly Zaire) and other parts of Western and Central Africa have been shown to be serologically identical to the CCHF virus.

Etiology

The Crimean-Congo haemorrhagic fever (CCHF) virus belongs to the family **Bunyaviridae**, within the genus **Nairovirus**, which is related to the Nairobi sheep disease virus. The virus has at least three identified subtypes. Bunyaviruses are either spherical or pleomorphic in shape, measuring between 80 and 120 nanometers, and are enveloped particles. Their genome consists of triple-segmented, single-stranded RNA, which is either negative-sense or ambisense, and ranges from 11 to 19 kilobases in size. The virus replicates in the cytoplasm of host cells and gains its envelope through a process called budding into the Golgi apparatus. Most of these viruses, including CCHF, are transmitted to vertebrates by arthropods, classifying them as arboviruses.

Occurrence

CCHF has been reported in 38 countries worldwide. In the past decade, outbreaks have been documented in Bulgaria, Albania, Serbia, Greece, Russia, Turkey, the United Arab Emirates, Oman, Iraq, Kuwait, Iran, Afghanistan, Pakistan, China, Mauritania, Burkina Faso, Senegal, the Democratic Republic of the Congo, Australia (Tasmania), Sierra Leone, and South Africa. In the former USSR, cases are seasonally restricted.

In regions where CCHF is endemic, infections occur in humans and domestic animals, with cattle being more frequently infected than sheep or goats. Birds that live on the ground are also susceptible to infection. Other animals such as hedgehogs, horses, and rodents serve as reservoirs for the virus. The CCHF virus has been isolated from more than 30 tick species, predominantly from **Hyalomma** ticks, but also from **Ixodes** species. Studies have demonstrated that the virus can be transmitted through both transovarial (from adult tick to eggs) and transstadial (from one life stage of the tick to another) mechanisms. Despite this, the cycle between ticks and vertebrates is crucial for maintaining the virus in the environment.

Transmission

Human infection with the Crimean-Congo haemorrhagic fever (CCHF) virus occurs through contact with ticks or infected livestock. For example, if a tick feeding on a cow is brushed off by hand, the virus can be transmitted. Activities such as slaughtering animals, castrating, branding, assisting with animal births, and working in rendering plants in rural areas significantly increase the risk of exposure.

Pathogenesis

Once infected, humans develop viraemia, where the virus multiplies in the endothelial lining of blood vessels. This triggers a proinflammatory response characterized by the release of cytokines like tumor necrosis factor (TNF)-α and interleukin (IL)-6 into the bloodstream. These cytokines worsen endothelial damage, leading to endothelial toxicosis. Additionally, the aggregation and degranulation of platelets on damaged blood vessel walls activate the intrinsic coagulation cascade. This cascade can result in disseminated intravascular coagulation (DIC) and ultimately lead to multiorgan failure.

Clinical Signs

The incubation period after a tick bite typically ranges from 1 to 3 days. However, it can extend to 5 or 6 days, and in some cases, up to 9 days following nosocomial exposure or contact with blood, tissues, or excreta from viremic animals. The disease begins abruptly with the onset of fever. Other early symptoms include redness and swelling of the skin on the face and neck, congestion, and edema of the conjunctiva and mucous membranes. Depression is also commonly reported.

By the fourth or fifth day, 75% of patients develop hemorrhagic diathesis. This condition manifests as petechial bleeding on the skin, mucosal bleeding, hematemesis, melena, and urogenital bleeding. The case fatality rate varies between 30% and 50%, depending on the virus strain and its severity. Patients who do not develop hemorrhagic diathesis generally have a lower risk of death. In severe cases, patients typically die from hemorrhagic shock or secondary infections.

Materials and Methods

Study Area and Population

This study was conducted in Thi-Qar province, Iraq, covering its central and peripheral districts, including Nasiriyah, Shatra, Souq Al-Shuyoukh, Sayed Dakhil, and Al-Rifai. The population targeted included individuals with suspected or confirmed cases of Crimean-Congo Hemorrhagic Fever (CCHF) reported between July 2021 and December 2023. The study utilized data from

Thi-Qar Veterinary Hospital's educational records, central health laboratory reports, and field surveys.

Study Design

The research employed a **retrospective observational study design** to analyze laboratory-confirmed CCHF cases over three years. Demographic, clinical, and epidemiological data were systematically collected and analyzed to assess patterns of disease transmission, seasonal distribution, and occupational risks.

Data Collection

1. **Case Definition**:

- Suspected CCHF cases were defined based on clinical criteria, including fever, hemorrhagic manifestations, and recent exposure to ticks or infected animals.
- Confirmed cases were identified through **reverse transcription polymerase chain reaction (RT-PCR)** testing performed at the Iraq Central Public Health Laboratory.

2. **Timeframe**:

- Data were collected for three periods:
- ✓ July 7 to December 16, 2021.
- ✓ March 29 to December 11, 2022.
- ✓ January 2 to December 4, 2023.

3. **Data Sources**:

- Veterinary hospital records for suspected and confirmed cases.
- Laboratory reports for RT-PCR-confirmed diagnoses.
- Field data on animal and tick populations, collected during vector control campaigns.

Variables Assessed

1. **Demographic Information**:

- ✓ Age, sex, and geographic location of confirmed cases.

2. **Exposure History**:

- ✓ Occupation and history of contact with animals or ticks.
- ✓ Environmental conditions and practices such as unregulated slaughtering.

3. **Temporal Distribution**:

- ✓ Monthly and seasonal variations in case numbers were analyzed.

4. **Clinical Outcomes**:

- ✓ Recovery and mortality rates for different demographic groups.

Data Analysis

1. **Descriptive Analysis**:

- ✓ Frequencies and percentages were used to summarize demographic data.
- ✓ Recovery and mortality rates were calculated for age, sex, and occupation groups.

2. **Epidemic Curve Analysis**:

- ✓ Weekly and monthly case counts were plotted to visualize outbreak timing and intensity.

3. **Geospatial Analysis**:

✓ Cases were mapped by district to identify geographic hotspots.

4. **Statistical Testing**:

✓ Chi-square tests and logistic regression analyses were conducted to evaluate associations between exposure factors and clinical outcomes.

Ethical Considerations

➢ Patient confidentiality was maintained throughout the study by anonymizing personal data.

➢ Ethical approval was obtained from the local health and veterinary authorities in Thi-Qar province.

Results and Discussion

Table 1. Distribution of laboratory-confirmed cases of Crimean-Congo haemorrhagic fever that occurred during the 2021,2022,2023 in Thi-Qar provience according to gender

Comforted Cases	Confirmed cases in 2021		Confirmed cases in 2022		Confirmed cases in 2023		Total confirmed case (percent %)	
	Deaths	**Recovery**	**Deaths**	**Recovery**	**Deaths**	**Recovery**	**Deaths**	**Recovery**
Male (180-57%)	**1 (16%)**	**5 (83%)**	**22(24%)**	**68 (75.5%)**	**9(10.7%)**	**75(89.3)**	**32(17.7%)**	**148(82.2%)**
Female (135-43%)	**2 (28%)**	**5(71%)**	**16 (22%)**	**55(77%)**	**6(10.5%)**	**51(91%)**	**24(17.7%)**	**111(82.2%)**
Total 315	**3(23%)**	**10(77%)**	**38(23.6%)**	**123(76.4%)**	**15(10.6%)**	**126(89.3%)**	**56(17.7)**	**259 (82.2%)**

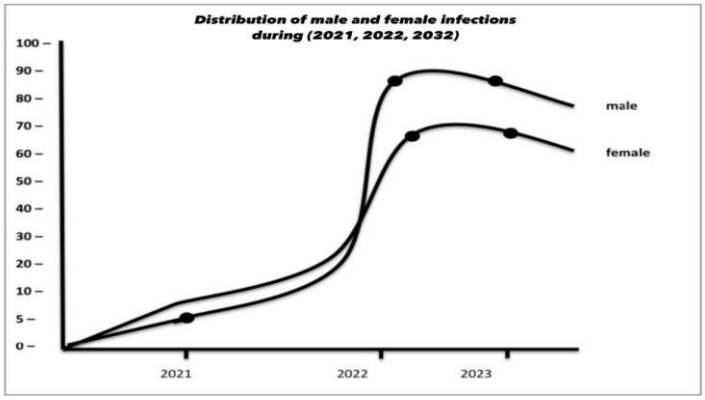

Figure 1. distribution of male and female infections during (2021,2022,2023)

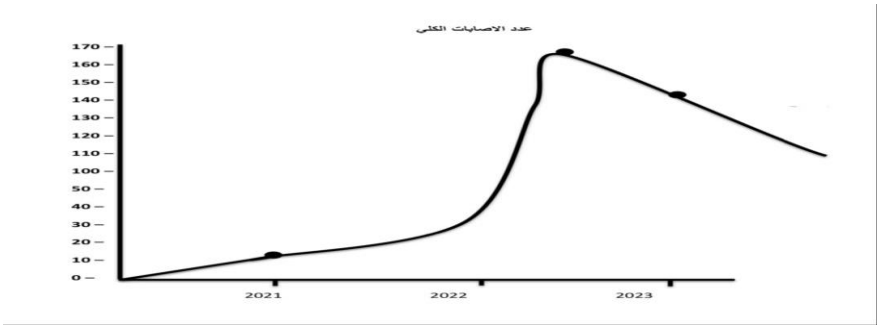

Figure 2. Total number of infected cases during(2021,2022,2023)

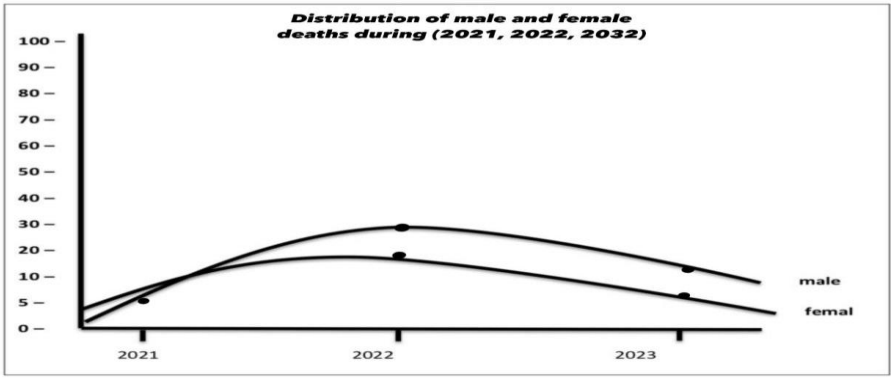

Figure 3. distribution of male and female deaths during (2021,2022,2023)

Based on the table 1, most of the cases were male, with the total number of males reaching (n=180, 57%) of the total number of infections. These cases recovered (n=148, 82%), and the number of deaths among them was (n=32, 17.8%) While in females, (n=135, 43%) of the total number of cases w, and most of these cases recovered, as the number of recoveries reached (n=111, 82%) and the number of female deaths reached (n=24, 17%)

We guess that the explanation for the results of female children is some of the reasons that make them more susceptible to infection is that they are exposed to dealing with affect -ed animals, as they work in professions that require direct dealing with infected animals . [16] Therefore, making data in the classifieds, such as the remaining minorities, makes it possible for more infections than females, and what makes the matter worse is that There is a difference in health and preventive exercise between males and females, as females are more concerned with cleanliness and less likely to deal with environments infested with dis- ease Finally, their concern in Iraq specifically is the random slaughter inside the cities. [17]

Table 2. Distribution of laboratory-confirmed cases of Crimean-Congo haemorrhagic fever that occurred during the 2021,2022,2023 in provience according to age

Comforted Cases	Confirmed cases in 2021		Confirmed cases in 2022		Confirmed cases in 2023		Total confirmed case(percent%)	
	Deaths	Recovery	Deaths	Recovery	Deaths	Recovery	Deaths	Recovery
<1–10 4 (1.27%)				2		2		4(100%)
11-20 (64-20.32%)	2 (28.5)	3 (42.8)	4 (13%)	27(87%)	3(10.71%)	25 (89.29%)	9(14%)	55(86%)
21-30 (67-21.27%)		3	11(33.3%)	22(66.7%)	5 (16.1%)	26 (83.9%)	16(24%)	51(76%)
31-40 (61-19.37%)		3	7(25%)	21(75%)	1(3.3%)	29 (96.7%)	8(13%)	53(87%)
41-50 (57-18.10%)			11 (29.73%)	26(70.27%)	1(5%)	19(95%)	12(21%)	45(79%)
51-60 (34-10.79%)	1 (50%)	1 (50%)	1(6.25%)	15(93.75)	4(25%)	12(75%)	6(17.6%)	28(82.4%)
61-70 (20-6.35%)			3(30%)	7(70%)		10(100%)	3(15%)	17(85%)
71-80(7-2.22%)			1(25%)	3(75%)	1(33.3%)	2(66.7%)	2(28.6%)	5(71.4%)
Total 315	3(23%)	10(77%)	38(23.6%)	123(77.4%)	15(10.6%)	126 (89.3%)	56(17.7%)	259(82.2%)

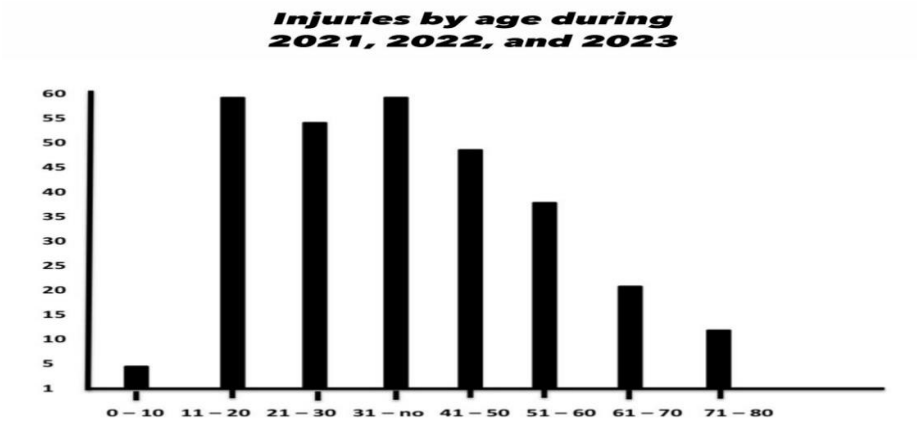

Figure 4. Distribution of laboratory-confirmed cases that occurred during the 2021,2022,2023 according to age

After reviewing the information from the veterinary hospital, we found that the peak incidence of infections ranges between 11 - 60 years, with the average age being 25 years

The age group with the most confirmed infections is 21-30 years (n=67.21%) out of a total number of 315 infections, recovered (n=51.16%), and deaths reached (n=6.23%)

It is the highest category of infection with the disease. The people most at risk of infection are those who work in the field of livestock, and since the ages of 1-60 are the most active, especially since most of them work in jobs that bring them into contact with animals[18], such as trainers, Livestock dealers, butchers, or even housewives, this places them in the field of infection, especially this age group. (21-30) is the most active young group . Followed by ages 11-20 years (n=64, 20%) of the total number, the number of recoveries (n=55, 17%), and deaths reached (n=9, 14) Then, for ages 31-40, the number of infections is 19% of the total number of recoveries recoveries (n=53, 87%) The number of deaths among them was (n=8, 13%), Followed by category 41-50, numbering 57 cases out of the total number of recoveries (n=45, 79%)Their deaths amounted to (n=12,21%) Then the age group from 61-70 (n=20, 6%) of the total number of infections, The number of recoveries (n=17, 85%) And deaths (n=3, 15%) of these infections [19] . We also noticed that group 8(71-80y.) and group 1(1-10 y.) are the least affected in the table . Where the category was (71-80), the number of infections reached 7, of whom recovered (n=5, 71%) Deaths were (n=2 , 28%) . As for category (1-10), 4 cases of infection were recorded, and no deaths were recorded.

Table 3. Distribution of laboratory-confirmed cases of Crimean-Congo haemorrhagic fever that occurred during the 2021,2022,2023 in Thi-Qar provience according to outbreak time

Comforted Cases / Months	Confirmed cases in 2021		Confirmed cases in 2022		Confirmed cases in 2023		Total confirmed case (percent %)	
	Deaths	Recovery	Deaths	Recovery	Deaths	Recovery	Deaths	Recovery
Jan. (1-0.3%)					1		1	
Feb. (1-0.3%)						1		1
Mar. (3-0.9%)				1	2		2(67%)	1(33%)
Apr.(31-9.8%)			4(17.4)	19(82.6)		8	4(13%)	27(87%)
May.(64-20%)			8(25.9%)	23(74.2%)	3(10%)	30(90%)	11(17%)	53(83%)
Jun.(64-20%)			9(25%)	27(75%)	4(14.3%)	24(85.7%)	13(20%)	51(80%)
Jul.(58-18%)	2(100 %)		6(23%)	20(77%)	2(6.6%)	28(93.3%)	10(17%)	48(83%)
Aug.(39-12%)			3(17.6%)	14(82.4%)		22	3(4%)	36(92%)
Sept.(21-6%)	1(25%)	4(75%)	4(40%)	6(60%)	1(16.7%)	5(83.3%)	6(29%)	15(71%)
Oct.(16-5%)		2	2(28.6%)	5(71.4%)	1(14.3%)	6(85.7%)	3(19%)	13(81%)
Nov.(12-3%)		3	2(25%)	6(75%)	1		3(25%)	9(75%)
Dec.(5-1%)		1		2		2		5
Total	3(23%)	10(77%)	38(23.6%)	123(77.4%)	15(10.6%)	126(89.3%)	56(17.7%)	259(82.2%)

numbers and percentages indicate that the most affected groups are (21-30)(31-40)(41-50)(51-60), respectively, It recorded the highest recovery rate in it category (71-80) and it also recorded the highest infection rate, 28%. Therefore, it is the most dange -rous group exposed to death when infected with the disease[20] .Then followed by 21-30 At 23%, it has the second highest mortality rate among deaths, and this puts it in second place [21] .

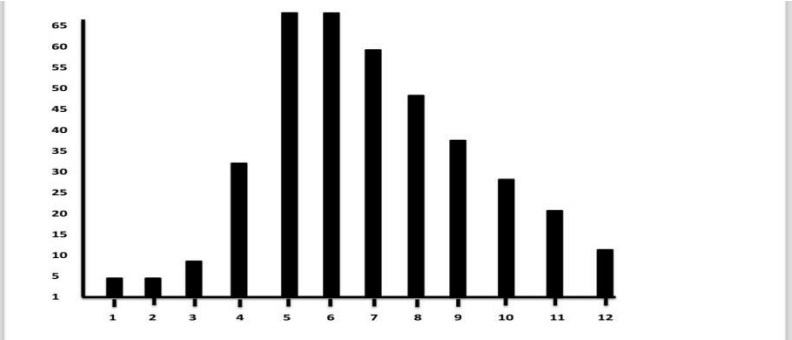

Figure 5: Distribution of laboratory-confirmed case that occurred during the 2021,2022,2023 according to outbreak time (months of the year)

According to this table, it was found that the months with the most recorded infections were May and June, with a total number of both monthes positive confirmed cases amounting to 64cases. We found that the number of confirmed infections for the fifth month (n=53, 82%) of the total number of recoveries and the number of deaths. (n=11, 7%), then the month of June (n=51, 80%) and the number of deaths (n=13, 20%), then followed by the months of July, August, and April, respectively [22].

We noticed that the number and percentage of infections is proportional to the increase in temperature during the months, as the severity of infections began in the spring (the month of April), and confirmed infections increased to 31 infections after there were only 3 infections in the month of March. These results suggest that the reason is due to environmental conditions and the increase in temperature. It is the increasing of the activities of the main vector of this disease, ticks, especially the genus (Hyalomma), which is the most widespread type and is active at the beginning of spring with the increase in temperature [23] ..

And other factors such as humidity, the spread of rodents, and the density of vegetation. The results showed strong Positive associations of CCHF with rodent numbers, temperature, solar radiation, and . (24) Or the illegal slaughter of animals outside slaughterhouses. This led to widespread outbreaks of ticks that served as viral vectors. (25) .Then the number of infections gradually returns to September and October

This explains the relationship between the increase in vector activity and the increase in infection cases.[26] The highest rate of recovery of cases was during the month of December (n=5, 100%), and the second highest rate of recovery of cases was during the month of August, 92%, followed by the month of April, 87%, then the month of May 5, and the month of July, 82%. Then comes October 81%, then comes the months (June 78%, November 75%, September 71%

We also found that the highest death rate was in September at 28%, followed by October at 18%, followed by November at 25%, then June at 20%, then May and July at 17%, then April at 12%, and August at 7%.

Table 4. Distribution of laboratory-confirmed cases of Crimean-Congo hemorrhagic fever that occurred during the years 2021, 2022, and 2023 in Dhi Qar Governorate by geographic location 2021, 2022, 2023.

City	Deaths	Recovery	Deaths	Recovery	Deaths	Recovery	Deaths	Recovery
Nasiriya (87 -27.6%)	1(50%)	1(50%)	16(40%)	24(60%)	4(8.7%)	42(91.3%)	21(24%)	66(76%)
Shatrah (39-12.4%)		2	4(18.2%)	18(81.8%)	1(6.7%)	14(93.3%)	5(12.8%)	34(87.2%)
Suq Al Shuiokh (27-8.6%)		3	3(23.1%)	10(76.9%)	2(18.2%)	9(81.8%)	5(18.5%)	22(81.5%)
Sayed Dakhil (24-7.6%)			1(6.7%)	14(93.3%)		9	1(4.2)	23(95.8%)
Al Rafaei (23-7%)			2(14.3%)	12(85.7%)	1(11.1%)	8(88.9%)	3(13%)	20(87%)
Qal'at sukkar (17-5%)			1(9.1%)	10(90.9%)		6	1(5.8%)	16(94.1%)
Al Garraf (17-5%)	1(50%)	1(50%)	3(30%)	7(70%)		5	4(23%)	13(76.5%)
Al Naser (15-4.8%)	1(50%)	1(50%)		6	2(28.6%)	5(71.4%)	3(20%)	12(80%)
Al Aslah (13-4%)			3(33.3%)	6(66.7%)	1(25%)	3(75%)	4(30.8%)	9(69.2%)
Al Dawaya (11-3.5%)		1	2(25%)	6(75%)		2	2(18.2%)	9(81.8%)
Grmatbanisaaed (9-2.9%)				3	1(16.7%)	5(83.3%)	1(11.1%)	8(88.9%)
Alfajr (7-2%)			1(33.3%)	2(66.7%)		4	1(14.3%)	6(85.7%)
Al Batha (7-2%)				3	2(50%)	2(50%)	2(28.6%)	5(71.4%)
Chibayish (7-2.2%)		1	1		1(25%)	4(75%)	2(28.6%)	5(71.4%)
AL-Fadhliya (4-1.3%)						4		4(100%)
Alfhood (4-1.3%)				1		3		4(100%)
كرمة حسن (3-1%)			1(50%)	1(50%)		1	1(33.3%)	2(66.7%)
Total								

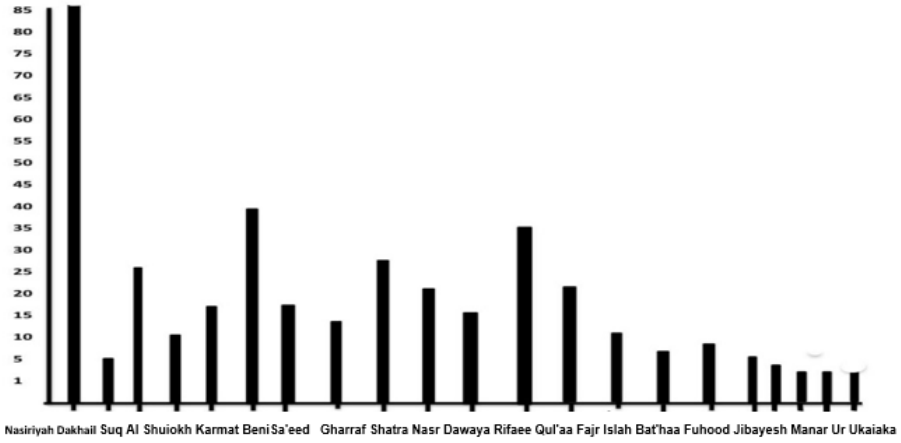

Figure 6. Distribution of laboratory-confirmed cases of Crimean-Congo hemorrhagic fever that occurred during the years 2021, 2022, and 2023 by geographic location

We found in this table that the district with the most recorded infections in Dhi Qar Governorate is Nasiriyah district, where the cases were (n=87, 27%) of the total number of cases, the number of recoveries was (n=66, 76%), and the number of deaths among them was (n= 21, 24%).

We believe that the reasons that led to an increase in the number of infections in the Nasiriyah district over the past three years. We begin with the main reason, which is the availability of the main vector that causes the disease.[27] as the disease is endemic in the governorate in general

and the district in particular. The endemicity of the virus in &, which is abundant in the area, and the absence of tick control campaigns. Widespread during these years, especially due to the Corona pandemic that shook the world in 2019, and in addition to the lack of veterinary campaigns, the absence of health awareness has greatly contributed to the emergence of the disease again in the governorate [28]

We believe that what distinguishes the district of Nasiriyah in particular is the heavy population of the governorate. This district is located in the center, and the increase in commercial activity there and the exchange of animals has led to an increase in the number of actually infected animals .[29]

The environmental nature there and environmental conditions play a significant role, and the most important condition is the temperature, which characterizes the governorate, providing a suitable environment for the main vector of the disease [30] .Then the Nasiriyah District is followed by the Shatra District In the number of recorded infections, the number reached (n=39, 12.3%) of the total number of cases, the recoveries among them reached (n=34, 87.2%), and the deaths among them amounted to (n=5, 12.8%) .Then comes Souq Al-Shuyoukh in terms of the number of infections (n=27, 8.5%) of the total number, and the number of recoveries among them reached (n=22, 81.5%) and deaths reached (n=5, 18.5%).

The district of Sayed Dakhil is followed by Al-Rifai in almost similar rates . The reason is likely to be the increase in livestock in this main district, and the disease is also endemic there. The increased contact of people with infected animals and their lack of awareness of the seriousness of the disease led to the emergence of infections [31], in similar rates and distributed approximately according to population densityThen these districts are followed by Sukkar Castle, Al-Gharraf, and then Al-Nasr District Then the rest of the districts in less gradual proportions.

Table 5. Distribution of laboratory-confirmed cases of Crimean-Congo hemorrhagic fever that occurred during the years 2021, 2022, and 2023 in Dhi Qar Governorate according to jobs

Comforted Cases / Occupatio	Confirmed cases in 2022		Confirmed cases in 2023		Total confirmed case(percent%)	
	Deaths	Recovery	Deaths	Recovery	Deaths	Recovery
Housewife (109-36.1%)	16(27.6%)	42(72.4%)	6(11.8%)	45(88.2%)	22(20.2%)	87(79.8%)
Freelance workers (57-18.9%)	4(18.2%)	18(81.8%)	2(5.7%)	33(94.3%)	6(10.5%)	51(89.5%)
Animal breeder (33-10.9%)	5(26.3%)	14(73.7%)		14	5(15%)	28(85%)
Butcher (31-10.3%)	6(35.3%)	11(64.7%)	4(28.6%)	10(71.4%)	10(32.3%)	21(67.7%)
Livestock dealer. (26-8.6%)	4(28.6%)	10(71.4%)	1(14.3%)	6(85.7%)	10(38.5%)	16(61.5%)
Student (20-6.6%)	1(6.7%)	14(93.3%)		5	1(5%)	19(95%)
Employed (7-2.3%)		5		2		7
Military (7-2.3%)		4		3		7
Other (13-4.3%)	2(33.3%)	4(66.7%)	1(14.3%)	6(85.7%)	3(23.1%)	10(76.9%)
Total (302)	38(23.6%)	123(76.4%)	15(10.6%)	126(89.4)	53(17.5%)	249(82.4%)

According to the table above, we show that the group most vulnerable to infection is housewives,

as the number of confirmed infections reached(n=109, 34.6%) out of the total number of cases. 315 cases recovered 87(79.9%) of these cases, and (n=22, 20%) of them died .

The most important factor that was obtained is that (86%) of these cases were in contact with animals, numbering 75 cases, while the rest of the infect -ions were explained by dealing with meat that contained the virus in more detail . [32]It is believed that the reason is due to direct handling of meat (and tissues and fluids that contain the virus).The number of recoveries was (n=87, %),. We found that (n=75, 86.2%) of the cases had contact with animals, which is the primary source of infection, and this explains the increase in infections

This category, as we mentioned above, constitutes the most dangerous category, as the death rate reached (20%). We also found that (86.3%) of the deaths were in contact with animals .Then followed by the guest of the winner, whose number in this statistic reached (n = 57, 18%). In detail, the cases of recovery (n = 51, 89.3%), knowing that (n = 38, 74.5%) were in contact with animals and the cases of death (n = 6, 10) .

The following jobs: animal breeders, butchers, and livestock traders. They recorded similar percentages, respectively, because they are in contact with animals and the main vector is ticks (animal breeders (n=33,10%), butchers (n=31,9.8%), and livestock traders (n=26, 8%) .In detail:. (Animal breeders: recoveries (n=28.84%) and deaths (n=5.15%), all with contact with animals) Livestock traders recovered cases (n=16.61%) and died (38.5%, n=10) and collected them in contact .We noticed that the highest death rate was recorded among livestock traders, at 38%, as they are high riska group to death,Positive cases ofr butchers31, recoveries (n=21.67%) and deaths (n=10.32%) are the second most dangerous category after livestock traders in terms of death rates. The reason is that the random slaughter shops spread in cities that are not subject to health supervision and veterinary administration[30], Where infected animal carcasses are common,negligence during work and handling of the carcass with wounds is one of the most important reasons for this high result

This increase may have occurred due to the absence of pest control activities during the coronavirus disease 2019 (COVID-19) pandemic. In addition, there is a lack of awareness about CCHF and its mode of transmission among butchers, farmers and the community. This is an important factor in increasing the infection rate, because humans are susceptible to infection after a history of tick bites or handling animals (17). Followed by students, the total number (n=20.63%), recovery cases (n=19.95%), and deaths (n=1.5%). They are the least dangerous categories in terms of infection and recorded the lowest death rate. As for the rest of the categories, they recorded a high recovery rate compared to these main categories

Conclusions

An analysis of the epidemiological survey results from 2021 to 2023 in Dhi Qar Governorate reveals distinct trends. In 2021, the emergence of Crimean-Congo haemorrhagic fever (CCHF) saw the lowest number of cases, a shorter outbreak duration, and limited geographic spread. By 2022, the outbreak intensified, with a significant increase in confirmed cases, a wider distribution across the region, and an outbreak period that lasted twice as long.

In 2023, the number of confirmed cases showed a slight decrease compared to 2022. The geographic distribution of cases remained similar, but the outbreak lasted the longest, spanning from January through December. The surge in cases during 2022 can be attributed to insufficient preventive measures against ticks, low health awareness among at-risk populations, and the availability of advanced diagnostic tools like PCR in central health laboratories. Improved diagnostic efforts in 2022 revealed cases that may have been missed in 2021 due to limited awareness and diagnostic resources during the initial re-emergence of the outbreak after a prolonged hiatus.

By 2023, the decrease in cases was due to enhanced health measures, the use of insecticides, and more intensive preventive campaigns led by veterinary teams in Dhi Qar Governorate. Rapid

responses to new infection foci helped contain the disease, though some foci persisted due to incomplete eradication of tick habitats. Sustained efforts, including removing vector shelters and consistent insecticide use, remain critical for long-term control.

Recommendations

1. **Implement Comprehensive Preventive Campaigns**

Focus on eliminating the disease vector by not only spraying insecticides but also targeting tick reservoirs. These efforts should involve collaboration with livestock breeders to ensure effective results.

2. **Enhance Diagnostic Capabilities**

Establish PCR diagnostic laboratories within Dhi Qar Governorate and expand their availability across all health institutions. Ensure that all suspected cases of CCHF or similar diseases are promptly tested.

3. **Raise Public Awareness**

Increase education and outreach efforts to inform at-risk populations about the severity and impact of CCHF. Engage local and national media to emphasize the dangers of the disease, its transmission routes, and its effects on public health.

4. **Promote Research and Vaccine Development**

Continue studying the most common tick species that transmit the virus and explore other transmission methods. Encourage research into vaccine development and focus on isolating disease foci to provide immunity to high-risk groups.

References

1. Al-Abri SS, Abaidani IA, Fazlalipour M, Mostafavi E, Leblebicioglu H, Pshenichnaya N, et al. Current status of Crimean-Congo haemorrhagic fever in the World Health Organization Eastern Mediterranean Region: Issues, challenges, and future directions. Int J Infect Dis. 2017;58:82-9.
2. Sharma S, Kumawat R, Singh SK. Good Medical Entomology Laboratories Practices (GMELP) in India: A concept note. J Commun Dis. 2022;54(1):150-5.
3. Abdiyeva K, Turebekov N, Dmitrovsky A, Tukhanova N, Shin A, Yeraliyeva L, et al. Seroepidemiological and molecular investigations of infections with Crimean-Congo haemorrhagic fever virus in Kazakhstan. Int J Infect Dis. 2019;78:121-7.
4. Portillo A, Palomar AM, Santibáñez P, Oteo JA. Epidemiological aspects of Crimean-Congo hemorrhagic fever in Western Europe: What about the future?. Microorganisms. 2021;9(3):649.
5. Dhakil.A.A. (2024). Sero-epidemological evaluation with pro-inflammation response to Crimean – Congo hemorrhagic fever (CCHF) in small ruminants in southern Iraq. Master Thesis , collage of veterinary mesicine. Basrah university.
6. Fanelli A, Buonavoglia D. Risk of Crimean Congo haemorrhagic fever virus (CCHFV) introduction and spread in CCHF-free countries in southern and Western Europe: A semi-quantitative risk assessment. One Health. 2021;13:100290.
7. Kularatne SA, Dalugama C. Dengue infection: Global importance, immunopathology and management. Clin Med. 2022;22(1):9-13.
8. Ricco M, Baldassarre A, Corrado S, Bottazzoli M, Marchesi F. Seroprevalence of Crimean Congo hemorrhagic fever virus in occupational settings: Systematic review and metaanalysis. Trop Med Infect Dis. 2023;8(9):452.

9. Belobo JT, Kenmoe S, Kengne-Nde C, Emoh CP, Bowo- Ngandji A, Tchatchouang S, et al. Worldwide epidemiology of Crimean-Congo Hemorrhagic Fever Virus in humans, ticks and other animal species, a systematic review and meta-analysis. PLoS Negl Trop Dis. 2021;15(4):e0009299.
10. Temur AI, Kuhn JH, Pecor DB, Apanaskevich DA, Keshtkar-Jahromi M. Epidemiology of Crimean-Congo hemorrhagic fever (CCHF) in Africa—underestimated for decades. Am J Trop Med Hyg. 2021;104(6):1978.
11. Kouhpayeh H. A Systematic Review of Treatment Strategies Including Future Novel Therapies in Crimean- Congo Hemorrhagic Fever. Int J Infect. 2021;8(2):e113427.
12. Kar S, Rodriguez SE, Akyildiz G, Cajimat MN, Mears MC, et al. Crimean-Congo hemorrhagic fever virus in tortoises and Hyalomma aegyptium ticks in East Thrace, Turkey: potential of a cryptic transmission cycle. Parasites Vectors. 2020;13:1-3.
13. Fletcher TE, Gulzhan A, Ahmeti S, Al-Abri SS, Asik Z, Atilla A, et al. Infection prevention and control practice for Crimean-Congo hemorrhagic fever—A multi-center crosssectional survey in Eurasia. PloS one. 2017;12(9):e0182315.
14. WHO. Crimean-Congo haemorrhagic fever [Internet]. Geneva: World Health Organization; 2022 [cited 2023, 8 August]. Available from: https: fact-sheets / detail/crimean-congo-haemorrhagicfever
15. Gürbüz E, Ekici A, Ünlü AH, Yılmaz H. Evaluation of seroprevalence and clinical and laboratory findings of patients admitted to health institutions in Gümüşhane with suspicion of Crimean-Congo hemorrhagic fever. Turk J Med Sci. 2021;51(4):1825-32.
16. Mustafa AH, Lami F, Khaleel HA. Epidemiological profile of Crimean-Congo hemorrhagic fever, Iraq, 2018. MedRxiv [Preprint]. 2023 [cited 2024, 2 May]. Available from: https://www.medrxiv.org /content/10.1101/2023.11.22.2 3298722v1
17. Alhilfi RA, Khaleel HA, Raheem BM, Mahdi SG, Tabche C, Rawaf S. Large outbreak of Crimean-Congo haemorrhagic fever in Iraq, 2022. IJID Reg. 2023;6:76-9.
18. Jasim HS, Ali MK. Crimean-Congo hemorrhagic fever: A systematic review. Haya Saudi J Life Sci. 2024;9(3):54-62.
19. Taqi FMM, Noori TA, Shaker EM. Knowledge level about Crimean-Congo hemorrhagic fever among a sample of medical students in Mosul City, Iraq. Rawal Med J. 2023;48(3):614-7.
20. Vesga JF, Clark MHA, Ayazi E, Apolloni A, Leslie T, Edmunds WJ, et al. Transmission dynamics and vaccination strategies for Crimean-Congo haemorrhagic fever virus in Afghanistan: A modelling study. PLoS Negl Trop Dis. 2022;16(5):e0010454.
21. Ak Ç, Ergönül Ö, Gönen M. A prospective prediction tool for understanding Crimean-Congo haemorrhagic fever dynamics in Turkey. Clin Microbiol Infect. 2020;26(1):123.e1-7.
22. Baghdadi GA, Aakef IR, Abdulraheem Y. Upsurge of Crimean-Congo hemorrhagic fever during Eid-Al-Adha period 2023 in Iraq. Al-Rafidain J Med Sci. 2024;7(1):72-7.
23. Zia A, Khalil AT, Alam N, Khan AQ, Khan MA, Yosafzai Y, et al. Prevalence of Crimean Congo hemorrhagic fever in Khyber Pakhtunkhwa, Pakistan. Travel Med Infect Dis. 2024;59:102722.
24. Nili S, Khanjani N, Jahani Y, Bakhtiari B. The effect of climate variables on the incidence of Crimean Congo Hemorrhagic Fever (CCHF) in Zahedan, Iran. BMC Public Health. 2020;20(1):1893.

25. Atim SA, Ashraf S, Belij-Rammerstorfer S, Ademun AR, Vudriko P, Nakayiki T, et al. Risk factors for Crimean-Congo Haemorrhagic Fever (CCHF) virus exposure in farming communities in Uganda. J Infect. 2022;85(6):693-701.

26. Qaderi S, Mardani M, Shah A, Shah J, Bazgir N, Sayad J, et al. Crimean-Congo Hemorrhagic Fever (CCHF) in Afghanistan: A retrospective single center study. Int J Infect Dis. 2021;103:323-8.

27. Mourya DT, Yadav PD, Gurav YK, Pardeshi PG, Shete AM, Jain R, et al. Crimean Congo hemorrhagic fever serosurvey in humans for identifying high-risk populations and highrisk areas in the endemic state of Gujarat, India. BMC Infect Dis. 2019;19(1):104.

28. Atwan Z, Alhilfi R, Mousa AK, Rawaf S, Torre JDL, Hashim AR, et al. Alarming update on incidence of Crimean- Congo hemorrhagic fever in Iraq. IJID Reg. 2024;10:75-9.

29. Al Salihi KA, Younise H, Zuhair Mahmoud Z, Hussain T. The 2022 Crimean-Congo hemorrhagic fever outbreak in Iraq. Austral J Vet Sci. 2024;56(1):35-40.

30. Karakecili F, Cikman A, Aydin M, Binay UD, Kesik OA, Ozcicek F. Evaluation of epidemiological, clinical, and laboratory characteristics and mortality rate of patients with Crimean-Congo hemor -rhagic fever in the northeast region of Turkey. J Vector Borne Dis. 2018;55(3):215-21.

31. Shahid MF, Yaqub T, Ali M, Ul-Rahman A, Bente DA. Prevalence and phylogenetic analysis of Crimean-Congo hemorrhagic fever virus in ticks collected from Punjab province of Pakistan. Acta Trop. 2021;218:105892.

32. Salehi-Vaziri M, Vatandoost H, Sanei-Dehkordi A, Fazlalipour M, Pouriayevali MH, Jalali T, et al. Molecular assay on detection of Crimean Congo Hemorrhagic Fever (CCHF) virus in ixodid ticks collec- ted from livestock in slaughterhouse from South of Iran. J Arthropod Borne Dis. 2020;14(3):286-92.