Crimean-Congo haemorrhagic fever in Iraq

Ghazwan A Baghdadi[1], Ihab Raqeeb Aakef[1], Sinan Ghazi Mahdi[1] and Raghad Ibrahim Khaleel[2]

[1]Communicable Diseases Control Centre, Baghdad, Iraq (Correspondence to Ghazwan Baghdadi: ghazwancommunity2015@yahoo.com). [2]Central Public Health Laboratory, Baghdad, Iraq.

Abstract

Background: Crimean-Congo haemorrhagic fever (CCHF) is the most common tick-borne viral disease worldwide. Its incidence has increased rapidly in the Eastern Mediterranean countries and has been endemic in Iraq since it was first identified in 1979.

Aim: To describe the sociodemographic, epidemiologic and clinical characteristics of CCHF patients in Iraq.

Methods: This cross-sectional study was conducted using data from the national surveillance system of the Communicable Diseases Control Centre, Baghdad, Iraq, for the period 2021–2023. We included all confirmed cases and analysed the data using SPSS version 27.

Results: A total of 986 cases of CCHF were identified during the period, mean age 36 ± 15.4 years, male 58.9%. The majority of cases were reported in the southern provinces and during the summer months. Animal contact was reported by 52.8% and slaughtering by 45.7% of the patients. Bleeding from injection site was observed in 26.6% of the patients, while 24.8% had ecchymosis. Case fatality rate was 16.8%.

Conclusion: The number of CCHF cases was very high during the study period. We recommend actions to intensify tick control in Iraq, including the control of slaughtering, movement of livestock in and out of Iraq, in addition to health promotion and health education activities especially among high-risk groups.

Keywords: Crimean-Congo haemorrhagic fever, CCHF, tick, tick-borne disease, Iraq

Citation: Baghdadi GA, Aakef IR, Mahdi SG, Khaleel RI. Crimean-Congo haemorrhagic fever in Iraq. East Mediterr Health J. 2024;30(8):570–576. https://doi.org/10.26719/2024.30.8.570.

Received: 28/01/24; Accepted: 18/07/24.

Background

Crimean-Congo haemorrhagic fever (CCHF) is the most common tick-borne viral disease in the world (*1,2,3*). It is a life-threatening disease with a case fatality rate as high as 50% or more. It is also considered a potential bioweapon. The disease is prevalent across more than 30 countries in Asia, Africa, Southeast Europe, and the Middle East, including Iraq. The majority of cases are sporadic, and outbreaks do occur in some regions. Recently, CCHF incidence has increased rapidly in the Eastern Mediterranean countries (*1,2,3*).

The CCHF virus (CCHFV) was first identified during an outbreak in the Crimean Peninsula in 1944 and then in the Democratic Republic of Congo in 1956, hence the name Crimean-Congo (*1,2,3*). CCHFV is an enveloped ribonucleic acid (RNA) virus (nairovirus) belonging to the Bunyaviridae family (*1,2,3*). Ixodid ticks, mainly from the genus Hyalomma, act as a vector and a reservoir for the virus. Various wild and domestic animals, such as cattle, sheep, goats, small mammals, and rodents are amplifying hosts for CCHFV.

CCHFV infection shows no noticeable symptoms, and no specific vaccine is available for its prevention (*1,2,3*). A recent University of Oxford study administered a new vaccine against CCHF to healthy volunteers aged 18–55 years in the Oxfordshire area (*4*), but no vaccine has been approved.

The incubation period in humans depends principally on the viral load and the route of transmission; typically, 1–9 days after a tick bite and 5–13 days after contact with infected blood or fluids of animals or humans (*5*). Symptoms may include sudden onset of high-grade fever, headache, back pain, joint pain, stomach pain, and vomiting (*5*). Haemorrhagic manifestations, including petechiae and ecchymosis, may occur later during the illness, and complicated cases may experience kidney deterioration, liver or pulmonary failure after the fifth day of disease onset (*6*).

The disease can be confirmed during the acute phase using real-time polymerase chain reaction (RT-PCR) or other serologic tests during the convalescent phase (*5*). Management depends mainly on supportive care, although treatment with ribavirin may be beneficial (*5*). Preventive strategies may include wearing protective light clothing, using approved repellents, tick control in animals, wearing gloves or protective clothing while handling animals (notably during slaughtering), avoiding close physical contact with infected people and washing hands with soap regularly (*7*).

CCHF has been endemic in Iraq since it was first identified in 1979 among 10 patients (7 died) in Ramadi (Anbar Governorate) and around Baghdad (*7,8*). CCHF is also endemic in neighbouring countries to Iraq; Türkiye, Iran and Saudi Arabia (*7*). Up to 50 or more cases of CCHF

are reported in Türkiye and Iran every year, and the WHO map shows that the Hyalomma ticks vector is present in Syria and Jordan (9).

This study aimed to describe the sociodemographic, epidemiologic and clinical characteristics of CCHF patients in Iraq during 2021–2023. There has been unprecedented in Iraq since 1979 and only few limited studies have been conducted on this important disease in Iraq.

Methods

This cross-sectional study was conducted in Baghdad, Iraq, using data from the national surveillance system of the Communicable Diseases Control Centre for the period 2021–2023. We included all confirmed cases diagnosed by the Central Public Health Laboratory (CPHL), Baghdad, using RT-PCR (RealStar® CCHFV RT-PCR Kit 1.0/altona) or ELISA IgM (human Crimean-Congo haemorrhagic fever virus IgM [CCHF-IgM] ELISA Kit/abbexa) techniques. The national surveillance system depends on immediate data notification and routine monthly data collected from zoonotic units of different provinces in Iraq using yearly updated case investigation form and Excel sheet. The case investigation form collects data on sociodemographic characteristics, clinical signs, epidemiology, and outcome of the patients. The data is then transmitted via internet to the Communicable Diseases Control Centre in Baghdad and analysed.

National case definition

The national case definition is as follows (22):

Suspected case

Sudden onset of high fever (>38°c) with headache, back and joint pain, stomach pain, and vomiting, in addition to exposure to one of the following factors, especially in areas endemic with haemorrhagic fever (and within the last 14 days before symptoms onset): history of tick bite or history of removal of ticks from skin or animals; history of contact with tissues, blood or other biological fluids from a possibly infected animal; and history of contact with a CCHF patient (suspected, probable or confirmed).

Probable case

A suspected case with one of the following haemorrhagic symptoms: bleeding from an injection site, petechial or purpuric rash, rhinorrhagia, haematemesis, haemoptysis, gastrointestinal haemorrhage, gingival haemorrhage, thrombocytopenia (< 50 000 platelet/ml), or any other haemorrhagic manifestation in the absence of any known precipitating factor for haemorrhagic manifestation.

Confirmed case

Any suspected or probable case with laboratory confirmation of CCHF using positive RT-PCR test or ELISA (IgM).

Data analysis and presentation

SPSS version 27 and excel 2019 were used for data analysis. Descriptive analysis was conducted and the data were expressed using frequency or percentage and mean or standard deviation according to the type of variable. Serial numbers were used to store the details of the participants to ensure confidentiality.

Ethics approval

Although it is a cross-sectional study, ethics approval was obtained from the Ethical and Scientific Committee of the Iraqi Ministry of Health. All data were kept confidential, anonymous, private, and used only for this study. Verbal consent was obtained from each patient to use their data anonymously for statistical and research purposes.

Results

A total of 986 cases of CCHF were diagnosed using RT-PCR or ELISA (IgM), mean age of the patients was 36 ± 15.4 years, 58.9% were male and 41.1% were female. The most common age group was 25–44 years (42.5%), followed by 15–24 years (24.6%), and the least common was 1–4 years (0.3%). The patients resided in rural (45.2%) and urban (42.9%) areas and most common of them were housewives (35.2%), followed by butchers (14.4%), and livestock breeders (7.4%) (Table 1).

The most affected province was Dhi-Qar (319 cases), followed by Baghdad (117 cases), Basra (105 cases), Maisan (76 cases), Wasit (65 cases), and Muthanna (56 cases). Anbar and Sulaimaniyah reported only 3 and 4 cases, respectively (Figure 1). The majority of cases were reported in May and June (225 cases for each), followed by July (202 cases), while only 1 case was reported in January and 2 in February and 6 in March (Figure 2).

Animal contact was reported by 52.8% of the patients, slaughtering by 45.7%, tick bite 18.3%, contact with raw meat 58.2%, and contact with confirmed case 3.7% (Table 2).

Ninety-seven percent of the patients had fever and 52.1% were bleeding, of which 26.6% bled from injection site, 24.8% ecchymosis, 16.9% in the mouth, 13.8% epistaxis, 13.9% from other body orifices, 6.6% from conjunctival injection, and 4.3% experienced gastrointestinal bleeding. Case fatality rate was 16.8% (166 patients) (Table 3).

Discussion

The number of Crimean-Congo haemorrhagic fever cases in Iraq during 2021–2023 was very high (986 confirmed cases). For the first time since the first reported case in 1979, the epidemic severely affected the southern provinces especially Dhi-Qar. More than half (52.8%) of the patients reported contact with animal, 45.7% reported animal slaughtering and 58.2% reported contact with raw meat. The case fatality rate in our study decreased to 16.8% compared to 38.5% previously. The high number of cases may be due to the cessation of tick control activities

Table 1 Sociodemographic characteristics of Crimean-Congo haemorrhagic fever patients, Baghdad, Iraq, 2021–2023

Characteristics	Frequency (N = 986)	Percentage
Age group (in years)		
1–4	3	0.3
5–14	31	3.1
15–24	243	24.6
25–44	419	42.5
45–64	234	23.7
≥65	56	5.7
Gender		
Male	581	58.9
Female	405	41.1
Residence		
Rural	446	45.2
Urban	423	42.9
Semi-urban	101	10.2
Slum	16	1.6
Occupation		
Housewife	347	35.2
Butcher	142	14.4
Livestock breeder	73	7.4
Farmer	8	0.8
Health sector employee	9	0.9
Cook/restaurant worker	3	0.3
Other	404	41.0

during the COVID-19 pandemic (2020–2021), which caused increases in hard tick infestation among animals and farms. There was increased awareness among smart doctors in Dhi-Qar Province about the clinical presentation of the disease and this may have contributed to the increase in reported cases. In comparison, Iran reported 1068 confirmed cases in 2000–2015 (*1*) and Türkiye reported 9069 confirmed cases in 2002–2014 (*10*).

The majority of patients (90.8%) were aged 15–64 years and male (60%). This is probably because the younger age and male groups work more with animals and are exposed to tick bites. The age and gender distribution are similar to historical records of distribution in the country since 1986. The age range (18–56 years) (mean 30.32 years, 81.63% male) in a study conducted in 2015 in Pakistan among 49 confirmed cases agrees with our study results (*11*). The study also found similar rural and urban distribution (45.2% versus 42.9%). Our findings may be due to the overlap of rural and urban areas in Iraq in the recent decades, with a spread of animal breeding and other related features in urban areas. A study in Türkiye (2021) showed that 69.2% of CCHF patients resided outside the city centre (*12*).

Our study showed that more than 40% of the patients were employed in jobs not related to the known risk groups for CCHF. This may be attributed to inaccurate reporting by the patient or slaughtering of animals for sacrifice, for example, during religious occasions. More than one-third of the patients were housewives, nearly one-seventh were butchers and less than one-tenth were livestock breeders or farmers. This high proportion of housewives may be because traditionally in Iraq housewives commonly have contact with raw meat especially after slaughtering and they are involved in animal breeding in rural areas. In a study in Afghanistan (2021), the most affected occupation groups were butchers (13.7%) and livestock breeders (11.8%) (*13*).

As already mentioned, for the first time, this epidemic severely affected the southern provinces, especially Dhi-Qar, compared with other parts of Iraq since the first reported case in 1979. Historically, from 1986 and according to national data, CCHF cases have been

Figure 1 Distribution of Crimean-Congo haemorrhagic fever cases by province, Baghdad, Iraq, 2021–2023

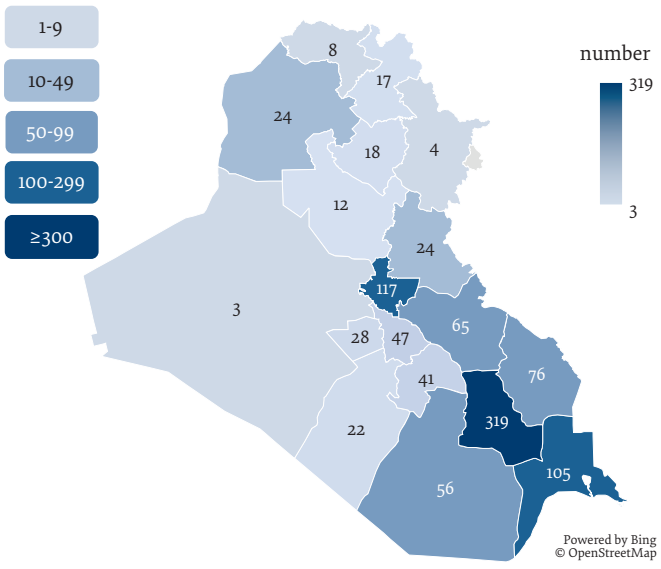
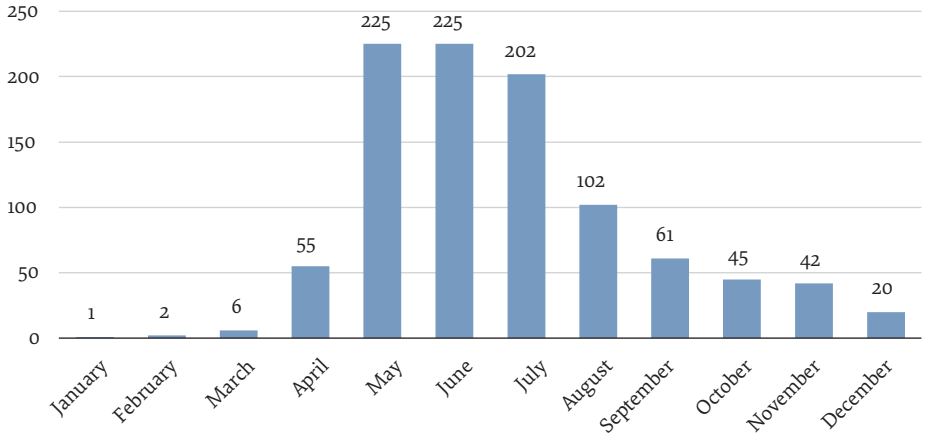


Figure 2 Distribution of Crimean-Congo haemorrhagic fever cases by month, Baghdad, Iraq, 2021–2023



reported in the central and northern provinces especially Baghdad, Babil, Ninewa, Wasit, Diyala, and Anbar (*23*). This unprecedented distribution may be attributed to illegal movement of livestock from Iran to the neighbouring southern provinces and probably the presence of more livestock distribution centres in Dhi-Qar than in other provinces. The situation raises a question about the appropriateness of preventive measures at the borders.

The seasonal distribution from spring to autumn, with a peak during summer, as observed in our study, is similar to historical distribution records for the country. This may be explained by the increased tick activities and tick infestation densities during warmer months (*24*). This distribution agrees with reports from Islamic Republic of Iran (*14*) and Georgia (*15*). In Sudan, most cases occurred between September and January (*16*). We also observed relative increase in cases during and shortly after religious occasions due to illegal and uncontrollable slaughtering activities. A similar finding has also been reported in other Arabic and Islamic countries in the region (*1*).

More than half (52.8%) of patients in our study reported animal contact, less than half (45.7%) reported slaughtering and 58.2% reported contact with raw meat. Nearly one-sixth (18.3%) reported exposure to tick bite during the previous 2 weeks before onset of symptoms. These findings, in addition to the fact that housewives (the most common occupational group in this study) in Iraq often deal with raw meat, may indicate animal contact as a more common way of transmission than tick bite. This finding agrees with reports from Islamic Republic of Iran and Saudi Arabia (*1*) but different from Türkiye where it was estimated that 69% of cases were due to tick bite (*17*). In general, tick bite is considered the main mode of disease transmission (*18*). Contact with a confirmed case was reported by only 3.7% of the patients and this may represent the least common route of transmission.

Fever was reported by 97% of the patients. All patients with CCHF should have fever, therefore, inaccurate history may be the reason for not having all the patients report a fever. More than half (52.1%) of the patients reported any form of bleeding at presentation, which may indicate high-level awareness among Iraqi doctors and their ability to suspect CCHF cases before the haemorrhagic symptoms and signs. However, 68% of CCHF cases were initially misdiagnosed (*17*).

The most common form of bleeding in this epidemic was superficial; bleeding from injection site (26.6%) and ecchymosis (24.8%), followed by mouth bleeding (16.9%), and the least common was gastrointestinal bleeding (4.3%) and conjunctival injection (6.6%). In a study in Türkiye (2015), ecchymosis (with petechia) was observed among 22.2% of non-fatal cases and 8.6% of fatal cases (*19*). In another study in India (2021), 5 of 34 patients had ecchymosis (with petechial rash) and 10 bleeding gums (*20*).

Table 2 Epidemiologic link of Crimean-Congo haemorrhagic fever patients, Baghdad, Iraq 2021–2023

Link	Frequency (N = 986)	Percentage
Animal contact		
Yes	521	52.8
No	465	47.2
Slaughtering		
Yes	451	45.7
No	535	54.3
Tick bite		
Yes	180	18.3
No	806	81.7
Contact with raw meat		
Yes	574	58.2
No	412	41.8
Contact with confirmed case		
Yes	36	3.7
No	950	96.3

Table 3 Clinical characteristics of Crimean-Congo haemorrhagic fever patients, Baghdad, 2021–2023

Characteristic	Frequency (N = 986)	Percentage
Fever		
Yes	956	97.0
No	30	3.0
Any type of bleeding		
Yes	514	52.1
No	472	47.9
Bleeding from injection site		
Yes	262	26.6
No	724	73.4
Epistaxis		
Yes	136	13.8
No	850	86.2
Mouth bleeding		
Yes	167	16.9
No	819	83.1
Bleeding from other body orifices		
Yes	137	13.9
No	849	86.1
Gastrointestinal bleeding		
Yes	42	4.3
No	944	95.7
Ecchymosis		
Yes	245	24.8
No	741	75.2
Conjunctival injection		
Yes	65	6.6
No	921	93.4
Outcome		
Cure	166	16.8
Death	820	83.2

The case fatality rate in our study was 16.8%, while the historical mean fatality rate in Iraq was 38.5%. This reduction may be due to increased awareness among doctors and medical staff about the disease, resulting in early diagnosis and treatment and better experience with management options. Paul W. Blair et al reported 177 deaths out of 1256 cases in Islamic Republic of Iran in 2017, 469 of 10 333 in Türkiye, 88 of 334 in Afghanistan, and 94 of 429 in Pakistan (*21*).

The main CCHF preventive measures include intensive tick control, regulation of slaughtering, management of livestock movement in and outside Iraq, and strengthening health promotion and education programmes especially among risk groups.

Study limitations and strengths

The strength of this study is that the data collected by the Communicable Diseases Centre is the most accurate official data on CCHF in Iraq. The main limitation is the lack of laboratory investigation records for the patients because the data collected by the Communicable Diseases Centre does not include such records. Data on the exact occupation of some patients were not available or inaccurate in cases of uncooperative patients.

Conclusion

The number of CCHF cases (986 confirmed cases) was very high during the study period. For the first time, the majority of cases were reported in the south of Iraq in contrast to previous decades during which cases occurred mainly in the central and northern regions. We recommend actions to intensify tick control in Iraq, including the control of slaughtering, movement of livestock in and outside Iraq, in addition to health promotion and health education activities especially among high-risk groups.

Acknowledgement

The authors thank all members of the zoonotic section of the Communicable Diseases Centre, Iraq, for their support.

Funding: None.

Competing interests: None declared.

Fièvre hémorragique de Crimée-Congo en Iraq

Résumé

Contexte : La fièvre hémorragique de Crimée-Congo (FHCC) est la maladie virale transmise par les tiques la plus courante dans le monde. Son incidence a augmenté rapidement dans les pays de la Méditerranée orientale et elle est endémique en Iraq depuis son identification pour la première fois en 1979.

Objectif : Décrire les caractéristiques sociodémographiques, épidémiologiques et cliniques des patients atteints de FHCC en Iraq.

Méthodes : La présente étude transversale a été réalisée à l'aide des données provenant du système de surveillance national du Centre de lutte contre les maladies transmissibles de Bagdad (Iraq) pour la période 2021-2023. Tous les cas confirmés ont été inclus et les données ont été analysées à l'aide du logiciel SPSS version 27.

Résultats : Au total, 986 cas de FHCC ont été identifiés au cours de la période, l'âge moyen étant de 36 ans (± 15,4), dont 58,9 % étaient des hommes. La majorité des cas ont été notifiés dans les provinces du sud et pendant les mois d'été. Un contact avec des animaux et une pratique d'abattage ont été signalés par 52,8 % et 45,7 % des patients respectivement. Des saignements au point d'injection ont été observés chez 26,6 % des patients, tandis que 24,8 % présentaient des ecchymoses. Le taux de létalité était de 16,8 %.

Conclusion : Le nombre de cas de FHCC était très élevé pendant la période d'étude. Nous recommandons des actions visant à intensifier la lutte contre les tiques en Iraq, y compris le contrôle de l'abattage ainsi que des mouvements de bétail à l'intérieur et à l'extérieur de l'Iraq, en plus des activités de promotion de la santé et d'éducation sanitaire en particulier auprès des groupes à haut risque.

مرض حُمَّى القرم والكونغو النزفيَّة في العراق

غزوان عبد السلام إبراهيم، إيهاب رقيب عاكف، سنان غازي مهدي، رغد ابراهيم خليل

الخلاصة

الخلفية: تُعدُّ حُمَّى القرم والكونغو النزفيَّة المرض الفيروسي الأكثر شيوعًا المنقول بالقُراد على مستوى العالم. وارتفع معدل الإصابة به بسرعة في بلدان شرق المتوسط، وهو متوطن في العراق منذ اكتشافه لأول مرة في عام 1979.

الأهداف: هدفت هذه الدراسة الى وصف الخصائص الاجتماعية السكانية والوبائية والسريرية لمرضى حُمَّى القرم والكونغو النزفيَّة في العراق.

طرق البحث: أُجريت هذه الدراسة المقطعية باستخدام بيانات من نظام الترصُّد الوطني الخاص بمركز مكافحة الأمراض السارية في مدينة بغداد، العراق، وذلك للفترة بين عامَي 2021 و2023. وأدرجنا جميع حالات الإصابة المؤكدة، وحللنا البيانات بالإصدار 27 من برنامج SPSS.

النتائج: حُدِّدت 986 حالة إصابة بحُمَّى القرم والكونغو النزفيَّة خلال تلك الفترة، حيث بلغ متوسط العمر 36 ± 15.4 عامًا، وكان 58.9% منهم من الذكور. وأُبلغَ عن معظم حالات الإصابة في الأقاليم الجنوبية وخلال أشهر الصيف. وأبلغ 52.8% من المرضى عن مخالطتهم للحيوانات، كما أبلغ 45.7% من المرضى عن قيامهم بالذبح. ولُوحِظَ حدوث نزيف من موضع الحقن لدى 26.6% من المرضى، بينما كان 24.8% من المرضى مصابين بكدمات. وبلغ معدل إماتة الحالات 16.8%.

الاستنتاجات: كان عدد حالات حُمَّى القرم والكونغو النزفيَّة مرتفعًا للغاية خلال مدة الدراسة. ونُوصي باتخاذ إجراءات لتكثيف مكافحة القُراد في العراق، بما فيها الرقابة على الذبح وحركة الماشية من العراق وإليه، بالإضافة إلى تنفيذ أنشطة لتعزيز الصحة والتثقيف الصحي، لا سيَّما بين الفئات الشديدة التعرض للخطر.

References

1. Al-abri SS, Al Abaidani I, 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. International journal of infectious diseases 2017;58:82-89. doi: http://dx.doi.org/10.1016/j.ijid.2017.02.018.
2. Salehi-vaziri M, Salmanzadeh S, Baniasadi V, Jalali T, Mohammadi T, Azad-Manjiri S, et al. An outbreak of crimean-congo hemorrhagic fever in the south west of Iran. Jundishapur J Microbiol 2017;10(1):e41735. doi: http://dx.doi.org/10.5812/jjm.41735.
3. Balinandi S, Patel K, Ojwang J, Kyondo J, Mulei S, Tumusiime A, et al. Investigation of an isolated case of human Crimean–Congo hemorrhagic fever in Central Uganda, 2015. Inter J Infect Dis. 2018;68:88-93. doi: https://doi.org/10.1016/j.ijid.2018.01.013.
4. University of Oxford. First volunteers receive vaccine for Crimean-Congo haemorrhagic fever in Oxford clinical trial. Oxford: University of Oxford, 2023. https://www.ox.ac.uk/news/2023-09-12-first-volunteers-receive-vaccine-crimean-congo-haemorrhagic-fever-oxford-clinical.

5. Mirembe BB, Musewa A, Kadobera D, Kisaakye E, Birungi D, Daniel Eurien D, et al. Sporadic outbreaks of crimean-congo haemorrhagic fever in Uganda, July 2018-January 2019. PLOS Neg Trop Dis. 2021;15(3):e0009213. doi: https://doi.org/10.1371/journal.pntd.0009213.
6. World Health Organization. Crimean-Congo hemorrhagic Fever. Geneva: World Health Organization, n.d. https://www.who.int/news-room/fact-sheets/detail/crimean-congo-haemorrhagic-fever.
7. Centres for Disease Control. Crimean-Congo hemorrhagic fever (CCHF). Outbreak distribution map. Washington: US Centres for Disease Control, n.d.. https://www.cdc.gov/vhf/crimean-congo/outbreaks/distribution-map.html.
8. Al-Tikriti SK, Al-ani F, Jurji FJ, Tantawi H, Al-moslih M, Al-janabi N, et al. Congo/Crimean haemorrhagic fever in Iraq. Bull World Health Organ 1981;59(1):85-90. https://iris.who.int/handle/10665/262108 .
9. World Health Organization. Crimean-Congo hemorrhagic fever. Geographic distribution of Crimean-Congo hemorrhagic fever. Geneva: World Health Organization, n.d. https://www.who.int/health-topics/crimean-congo-haemorrhagic-fever/#tab=tab_1.
10. Leblebicioglu H., Sunbul M, Guner R, Bodur H, Bulut C, Duygu F, et al. Healthcare-associated Crimean-Congo haemorrhagic fever in Turkey, 2002–2014: a multicentre retrospective cross-sectional study. Clin Microbiol Infection 2016;22(4):387. doi: http://dx.doi.org/10.1016/j.cmi.2015.11.024.
11. Khurshid A, Hassan M, Alam MM, Aamir UB, Rehman L, Sharif S, et al. CCHF virus variants in Pakistan and Afghanistan: Emerging diversity and epidemiology. J Clin Virol 2015;67:25-30. doi: http://dx.doi.org/10.1016/j.jcv.2015.03.021.
12. Çitil R, Eg˘ri M, O¨ nder Y, Duygu F, Bulut YE, Yas¸ayancan O, et al. Determination of seroprevalence and risk factors of Crimean–Congo haemorrhagic fever (CCHF) in the endemic region in Turkey: A population-based cross-sectional study. J Trop Med. 2021;2021:1-10. https://doi.org/10.1155/2021/9945089.
13. 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. Inter J Infect Dis. 2021;103:323-328. doi: https://doi.org/10.1016/j.ijid.2020.11.208.
14. Ansari H, Shahbaz B, Izadi S, Zeinali M, Tabatabaee SM, Mahmoodi M, et al. Crimean-Congo hemorrhagic fever and its relationship with climate factors in southeast Iran: a 13-year experience. J Infect Devel Countries 2014;8(6):749-757. doi: 10.3855/jidc.4020.
15. Greiner AL, Mamuchishvili N, Salyer SJ, Stauffer K, Geleishvili M, Zakhashvili K, et al. Increase in reported Crimean-Congo hemorrhagic fever cases—country of Georgia, 2014. Morb Mort Wkly Report 2015;64(8):228-229. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4584721/.
16. Ahmed A, Ali Y, Salim B, Dietrich I, Zinsstag J. Epidemics of Crimean-Congo hemorrhagic fever (CCHF) in Sudan between 2010 and 2020. Microorganisms 2022;10(5):928. doi: 10.3390/microorganisms10050928.
17. Tanyel E, Sunbul M, Fletcher TE, Leblebicioglu H. Aetiology of PCR negative suspected Crimean-Congo hemorrhagic fever cases in an endemic area. Pathog Glob Health 2016;110(4-5):173-177. doi: https://doi.org/10.1080/20477724.2016.1213958.
18. Atif M, Saqib A, Ikram R, Sarwar MR, Scahill S. The reasons why Pakistan might be at high risk of Crimean Congo haemorrhagic fever epidemic; a scoping review of the literature. Virol J 2017;14(1):1-7. doi: 10.1186/s12985-017-0726-4.
19. Hasanoglu I, Guner R, Carhan A, Tufan ZK, Yagci-Caglayik D, Guvenet T, et al. Crucial parameter of the outcome in Crimean Congo hemorrhagic fever: Viral load. J Clin Virol 2016;75:42-46. doi: http://dx.doi.org/10.1016/j.jcv.2015.12.006.
20. Sahay RR, Shete AM, Yadav PD, Patil S, Majumdar T, Jain R, et al. Sequential determination of viral load, humoral responses and phylogenetic analysis in fatal and non-fatal cases of Crimean-Congo hemorrhagic fever patients from Gujarat, India, 2019. PLoS Neg Trop Dis 2021;15(8): e0009718. doi: https://doi.org/10.1371/journal.pntd.0009718.
21. Blair PW, Kuhn JH, Pecor DB, Apanaskevich DA, Kortepeter MG, Cardile AP, et al. An emerging biothreat: Crimean-Congo hemorrhagic fever virus in southern and western Asia. Am J Trop Med Hyg 2019;100(1):16-23. doi:10.4269/ajtmh.18-0553.
22. Iraqi Ministry of Health. National Action Plan for Health Security (2019-2023). Baghdad: Iraqi Ministry of Health, 2019. https://moh.gov.iq/upload/998.pdf.
23. Communicable Diseases Control Centre. Unpublished data. Baghdad: Communicable Diseases Control Centre.
24. Ghareeb OA, Sultan AI. Crimean-Congo hemorrhagic fever represents a zoonotic infection: A review. Euras Med Res Periodical. 2023;22:1-7. https://geniusjournals.org/index.php/emrp/article/view/4603