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Biostatistics of Hemorrhagic Fever Patients in Iraq

Ali Ghassan Mahdi
University of Technology / Biomedical Engineering department in Partial Fulfilmentof the Requirements for the Degree of Bachelor's of Science in Biomedical Engineering

Qasim Mohammed Mortadha
Bachelor's Degree in Medical Devices Engineering/ Al-Hussain University College

Dr. Ali Fadhl, Dr. Saad Mahmood
Republic of Iraq Ministry of Higher Education and Scientific Research University of Technology, Biomedical Engineering Department, Biomechanics Branch

Abstract. *In this research, we will talk about Crimean-Congo hemorrhagic fever (CCHF), which is a severe tick-borne disease that spreads over a wide geographical area and has a case fatality rate of 30% or more. Cases due to CCHFV infection are reported throughout Africa, the Middle East, Asia, and southern and eastern Europe.*

Also, during this research, we will discuss some of the statistics and percentages that we collected through the field visit to some hospitals and health centers in Iraq, specifically in Dhi Qar Governorate, and we will also mention the results and suggestions that we reached through this visit.

CHAPTER ONE

1.1 introduction

Crimean-Congo haemorrhagic fever (CCHF) is a severe viral illness that is transmitted to people by ticks or livestock animals. The virus is endemic in Africa, Asia, the Balkans, and the Middle East, and is a major public health threat in these regions. CCHF is caused by a virus in the Nairovirus family called Crimean-Congo hemorrhagic fever virus (CCHFV)

The virus is transmitted to people by bites from infected ticks (Hyalomma), or by contact with the blood or tissues of infected animals. Human-to-human transmission can also occur through contact with the blood or bodily fluids of infected people.

Hyalomma is a genus of hard-bodied ticks common in Asia, Europe, and North Africa. They are also found in Southern Africa. The name is derived from Greek: (hyalos) crystal, glass; and (omma) eye.

The genus is believed to have originated in Iran or Central Asia, and then spread further into Asia, including the Middle East, and to southern Europe and Africa.

Hyalomma are larger in size and do not have protective shields (indistinct festoons), but have eyes and banded legs. *Hyalomma* species are difficult to identify due to their hybridization and genetic and morphological variations, caused by harsh environmental conditions and lack of food sources. *Hyalomma* species are the only ticks to live in such harsh desert conditions. With few hosts available, they are required to be active as soon as a potential host is sensed.

Adult *Hyalomma* can bite humans and transmit serious pathogens. Immature (nymph) *Hyalomma* usually feed on birds, rodents, and hares and can be the cause of viral disease and rickettsias. Nymphs are often transmitted from one place to another by migrating birds. For example, a migrating bird carrying a *Hyalomma marginatum* nymph can cause Crimean-Congo hemorrhagic fever.[1] *Hyalomma* species can also transmit rickettsias like Siberian tick typhus, Boutonneuse fever, and Q fever.

Figure 1: Hyalomma

1.2 Incubation and symptoms

The incubation period for CCHF is typically 1-3 days after a tick bite, and 5-6 days after contact with infected blood or tissues. The onset of symptoms of (CCHF) is sudden, and can include:

- Fever
- Headache
- Muscle ache
- Dizziness
- Neck pain
- Backache
- Sore eyes
- Photophobia (sensitivity to light)
- Nausea
- Vomiting
- Diarrhea
- Abdominal pain
- Sore throat
- Sharp mood swings
- Confusion
- Lethargy

Liver enlargementIn severe cases, CCHF can lead to bleeding from the gums, nose, and other orifices. It can also cause organ failure and death. There is no vaccine or specific treatment for Crimean-Congo haemorrhagic fever. Treatment is supportive, and may include fluids, electrolytes, and blood transfusions. The case fatality rate for CCHF is around 10-40%.

1.3 History of name of CCHF

Crimean-Congo hemorrhagic fever (CCHF) is caused by infection with a tick-borne virus (norovirus) in the Bunyaviridae family. This name came when the disease was first diagnosed in the Crimean Peninsula in 1944 and was given the name Crimean hemorrhagic fever. It was later recognized in 1969 as the cause of the disease in Congo, leading to the current name of the disease.Crimean-Congo hemorrhagic fever is found in Eastern Europe, especially in the former Soviet Union, and throughout the Mediterranean, in northwestern China, Central Asia, southern Europe, Africa, the Middle East, and the Indian subcontinent.

1.4 Development of disease

As a means of studying the evolutionary history of CCHFV and the mechanisms responsible for the observed degree of diversity in its sequences, a number of research groups have generated phylogenetic trees that classify it as follows: CCHF viruses are spherical, about 100 nm in diameter, and the lipid envelope is host-derived. CCHFV is a single-stranded, negative-sense RNA virus with a tripartite genome classified as large (L), medium (M), and small (S), according to size.

Crimean-Congo hemorrhagic fever (CCHF) is the most common tick-borne viral infection in humans, occurring in a wide area from western China through South Asia and the Middle East to southeastern Europe and throughout Africa. The causative agent, CCHF virus, is maintained through vertical and horizontal transmission in several genera of (hard) ticks that spread the virus to a variety of wild and domestic mammals, which develop transient viremia without showing signs of disease. Human infection occurs through a tick bite or exposure to the blood or other body fluids of an infected or sick animal with CCHF. Ticks of the genus Hyalomma are the main source of human infection, probably because both immature and adult forms actively seek hosts for obligate blood meals.

Crimean-Congo hemorrhagic fever virus was first identified as a separate human disease in the Crimean region of the former Soviet Union in 1944, and over the following decades it was reported mainly in a few southern Soviet republics, Bulgaria and South Africa.

However, since 2000, the incidence and geographic range of confirmed Crimean-Congo hemorrhagic fever cases have increased significantly, with the disease being first reported in Turkey, Iran, India, Greece, the Republic of Georgia and some Balkan countries, and cases of the disease having been detected. Viral RNA in Hyaloma ticks extracted from deer in Spain. Remarkably, although the first cases of Crimean-Congo hemorrhagic fever were identified in Turkey in 2002, more than 6,300 cases were diagnosed in the following 10 years. There has also been a significant increase in Iran since the first human infection was detected in 1999

Growing scientific and clinical interest in the Crimean-Congo hemorrhagic fever virus has led to the recovery and sequencing of numerous virus isolates across its geographic range, revealing a degree of sequence diversity greater than that of any other arthropod-borne virus. This marked genetic diversity suggests a long history of geographic spread of the virus in the tick vector, while the identification of Crimean-Congo hemorrhagic fever viruses with diverse sequences within the same geographic region, and similar viruses in more widely distant locations, is consistent with transmission. The virus is transmitted through infected ticks on migratory birds or through international trade in livestock. Genetic analysis also revealed evidence of genome reassembly and recombination during co-infection of a single host, suggesting that new variants may emerge in the future.

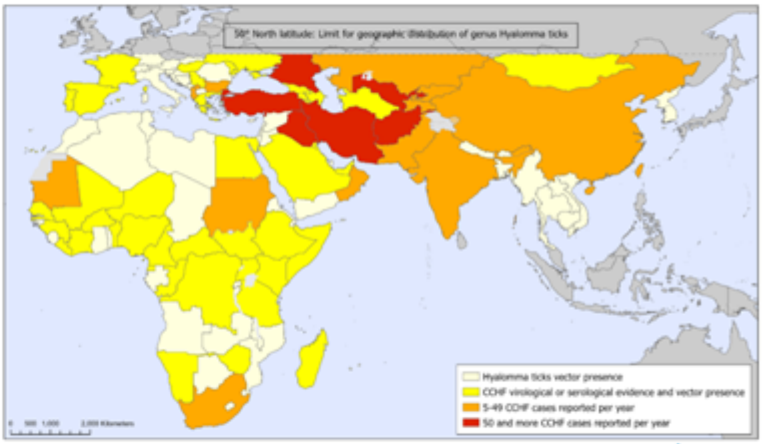


Figure 2: The worldwide geographic distribution of (Crimean-Congo hemorrhagic fever) viral isolates and human disease.

1.5 Effect on human and animal

1.5.1 Effect on human:

CCHF presents a spectrum of severity, from mild, nonspecific fever syndrome to vascular leakage, multiorgan failure, shock, and hemorrhage. Perhaps because doctors are more likely to publish descriptions of seriously or fatally ill patients, the mortality rate in case reports has ranged from 20% to 30% or higher. In contrast, for large case series, the mortality rate is generally lower, perhaps because they also include patients with milder disease; For more than 6,000 cases reported from Türkiye, the fatality rate was only 5%.

Patients with Crimean-Congo hemorrhagic fever exhibit a wide range of clinical symptoms. The typical course of Crimean-Congo hemorrhagic fever disease is to progress through 4 distinct stages, including incubation, prehemorrhagic, hemorrhagic, and convalescent. The incubation period is variable and affected by the method of exposure. This period lasts from 1 day to 3 days, with a maximum of 9 days, when the infection is caused by a tick bite, and from 5 days to 6 days, with a maximum of 13 days, when the infection is transmitted through infected tissue or blood.

After incubation, the prehemorrhagic phase may manifest as fever, chills, photophobia, myalgia, nausea, and severe headache. In severe cases, the hemorrhagic phase appears quickly (3 to 6 days) after the onset of the disease. Symptoms at this stage can range from petechiae to extensive areas of bruising and bleeding gums, nose, internal organs, and digestive system. In documented Crimean-Congo hemorrhagic fever virus outbreaks, mortality rates among hospitalized patients have ranged from 9% to 50%.

Mortality rates from nosocomial infections are often much higher than those acquired naturally through tick bites and may be related to the level of viremia. In fatal cases, there was little evidence of an antibody response; Evidence shows that viral load is higher and antibody production is weaker in fatal cases. For surviving patients, the recovery period begins about 15 to 20 days after the onset of illness. Full recovery may take up to one year. The recovery period is characterized by general weakness, headache, dizziness, weak pulse, hair loss, poor appetite, poor vision, and memory loss.

Common laboratory findings reveal leukopenia and thrombocytopenia in patients with Crimean-Congo hemorrhagic fever and indicate elevated levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatine kinase (CK), and lactate dehydrogenase (LDH),Prolonged prothrombin time (PT), and activated partial thromboplastin time (aPTT).

The pathogenesis of CCHF likely derives from a complex interaction between the virus and host cells. Kupffer cells, hepatic endothelial cells, and hepatocytes are supposed to be major targets in Crimean-Congo hemorrhagic fever disease. Necrosis of liver cells leads to an increase in liver enzymes.

A recent study in Crimean-Congo hemorrhagic fever suggests that the AST/ALT ratio is higher for patients with severe disease than for patients with mild disease. Also, increased myeloperoxidase expression in leukocytes leads to increased leukocyte lysis. Therefore, leukopenia in patients with Crimean-Congo hemorrhagic fever may be attributable to hemolysis. Damage to the lining of blood vessels can activate the coagulation cascade, ultimately leading to decreased platelet numbers or function. Also, coagulation activation may contribute to the development of disseminated intravascular coagulation (DIC) and multiorgan failure. The vascular leakage observed in Crimean-Congo hemorrhagic fever is caused by direct infection with the virus or damage by secreted cytokines.

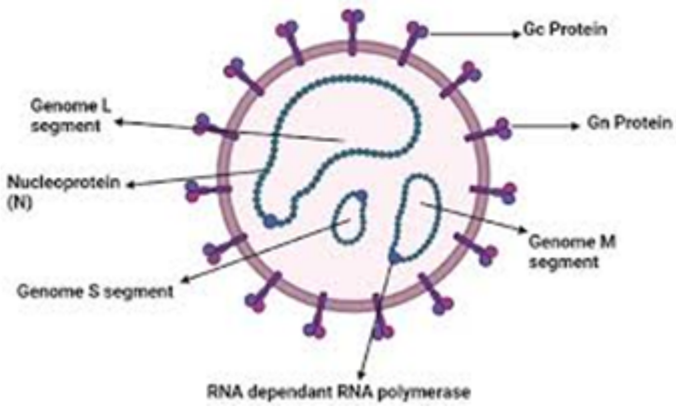


Figure 3: Schematic representation of the CCHFV structure

1.5.2 Effect on animals:

The natural circulation of Crimean-Congo hemorrhagic fever virus involves transovarial and transovarial transmission between oxo ticks and circulation involving various wild and domestic vertebrates. Animals, unlike humans, do not show signs of disease. The role of animals, as a reservoir of virus, has been highlighted by several authors who have reported asymptomatic viremia lasting up to 7–15 days. Some bird species appear resistant to Crimean-Congo hemorrhagic fever; However, its role in the epidemiology of the disease remains unclear. Ground-feeding birds appear to be particularly important in the ecology and zooepidemiology of Crimean-Congo hemorrhagic fever by transmitting ticks potentially infected with the virus.

CHAPTER TWO

2.1 CCHF in Iraq

Iraq is one of the eastern Mediterranean countries where CCHF is endemic. Crimean Congo hemorrhagic fever has been reported in Iraq since 1979 when the disease was first diagnosed in ten patients. Since then, six cases have been reported between 1989 and 2009, 11 in 2010, three fatal cases were reported in 2018, and most recently 33 confirmed cases including 13 deaths (fatality rate 39%) have been reported in Year 2021.

Sheep and cattle farming is very common in Iraq. Studies have shown that these animals are regularly infested by tick species, especially Hylomma species, the main vector of Crimean-Congo hemorrhagic fever.

Human cases of Crimean-Congo hemorrhagic fever are primarily treated with general supportive care. The antiviral drug ribavirin, either orally or intravenously, has been used to treat CCHF infections. However, no evidence from randomized clinical trials has demonstrated the effectiveness of ribavirin in treating CCHF. There is currently no vaccine available for humans or animals.

Fig 4: patient with CCHF

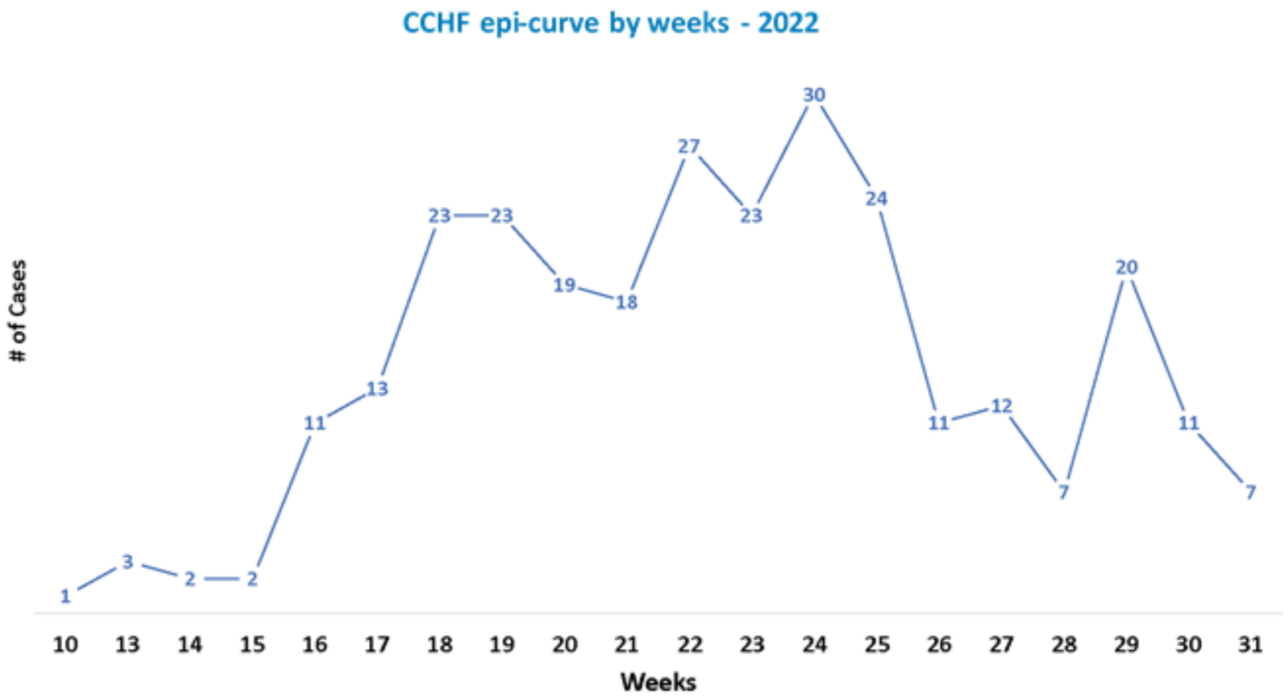


Fig 5: CCHF epi curve by weeks - 2022

The Iraqi Ministry of Health reported that more than 250 cases of Crimean-Congo hemorrhagic fever and more than 35 deaths had been recorded across the country's governorates since the beginning of 2023.

These reports showed that "the highest number of cases of hemorrhagic fever was recorded in Dhi Qar Governorate, with 67 cases, including 10 deaths, followed by Basra, Maysan, and Rusafa on the Baghdad side." Al-Muthanna, Wasit, Babel, and Al-Karkh on the Baghdad side.

These reports also added: There are suspected cases, but they are not included in the statistics if they have not been confirmed.

2.2 Outbreak at a glance

From 1 January to 22 May 2022, health authorities in Iraq reported 212 cases of Crimean-Congo hemorrhagic fever to WHO, of which 115 (54%) were suspected and 97 (46%) were suspected.)

Laboratory confirmed; There were 27 deaths, 14 suspected cases and 13 laboratory confirmed cases. The number of cases reported in the first five months of 2022 is much higher than what was reported in 2021, with 33 laboratory-confirmed cases recorded. Cases have been reported in several regions (provinces) in Iraq.

2.3 Outbreak description

Between 1 January and 22 May 2022, Iraqi health authorities reported 212 cases of Crimean-Congo hemorrhagic fever virus infection to WHO, of which 169 cases (80%) were reported in April. April and May only. Of the 212 cases, there are 115 suspected cases and 97 laboratory confirmed cases. Twenty-seven deaths occurred overall, of which 13 were laboratory-confirmed [case fatality ratio (CFR) 13%; 13/97].

The Iraqi Central Public Health Laboratory confirmed the cases via polymerase chain reaction (PCR).

Among the confirmed cases, most of them had direct contact with animals and were livestock farmers or butchers. Just over half of the confirmed cases are between 15 and 44 years of age (n = 52; 54%) and male (n = 60; 62%).

Nearly 50% of confirmed cases (n = 47; 48%) were reported in Dhi Qar Governorate, southeastern Iraq, and the remaining cases were reported from 12 different governorates; Maysan (13), Al-Muthanna (7), Wasit (6), Diwaniyah (4), Baghdad Al-Karkh (4), Kirkuk (3), Basra (3), Najaf (3), Nineveh (3), Baghdad Al-Rusafa (2).), Babylon (1), and Karbala (1) (Figure 4).

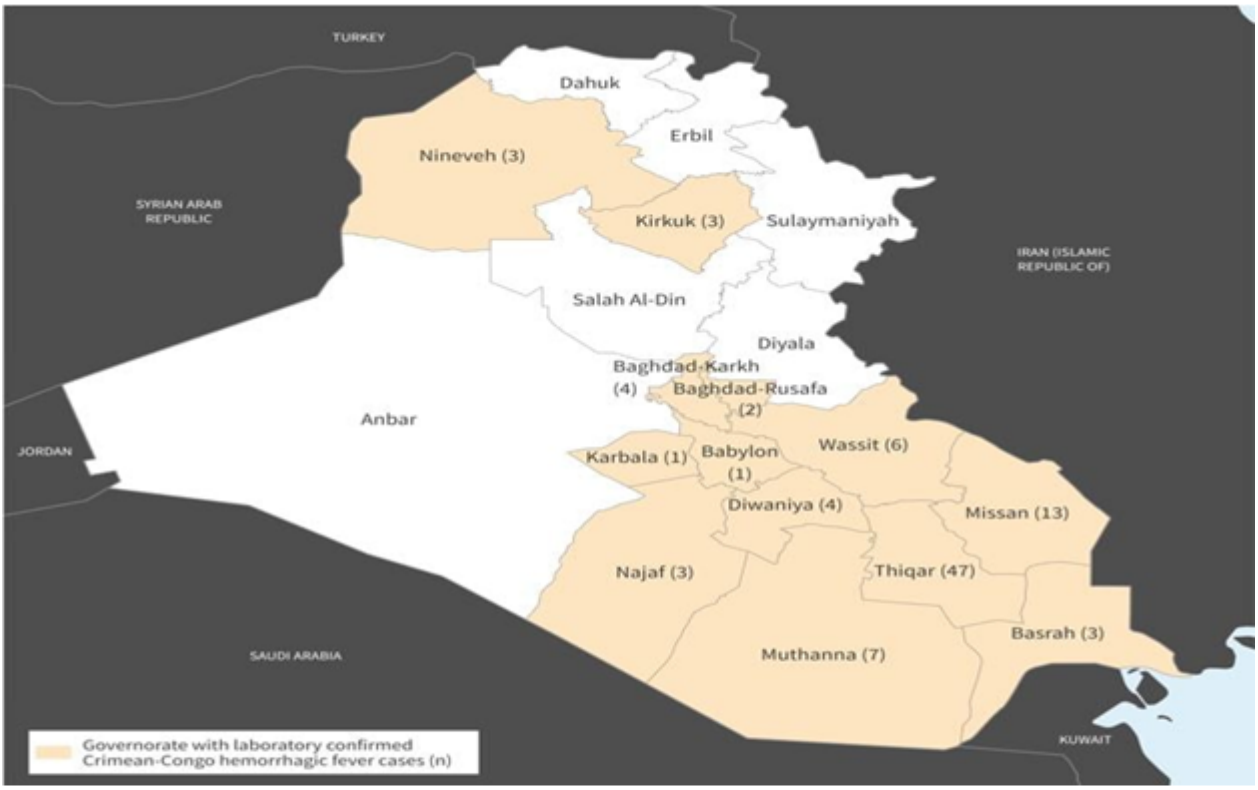
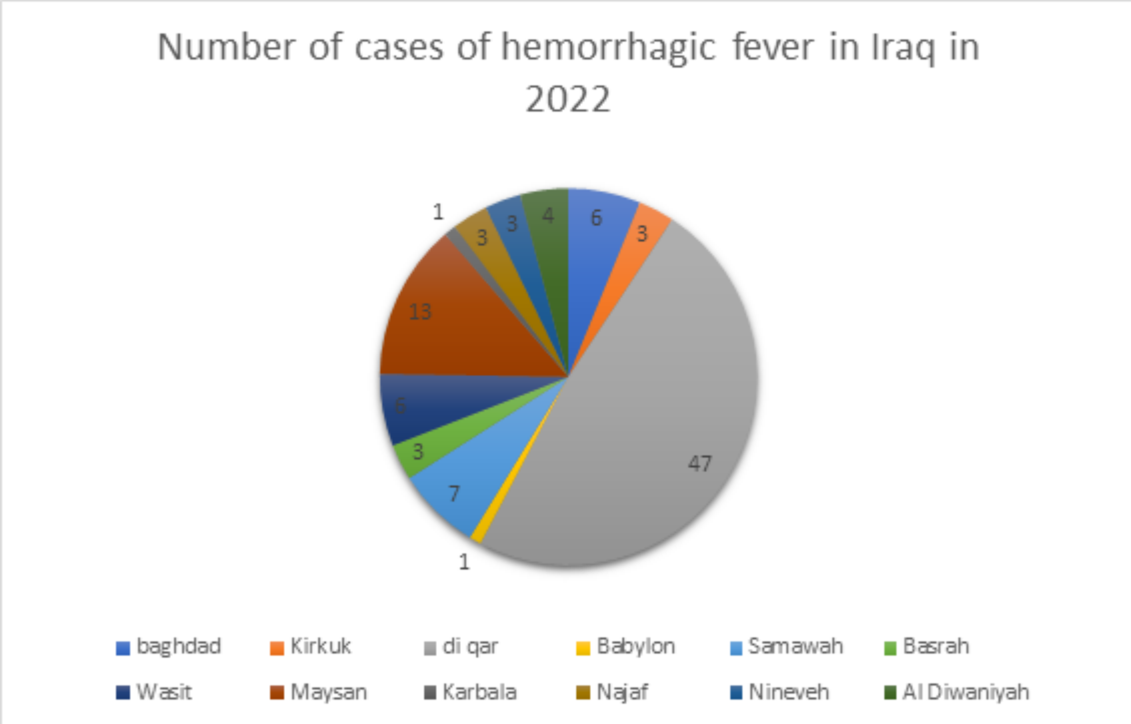


Figure 6: Distribution of laboratory confirmed cases of Crimean-Congo Hemorrhagic Fever by governorate, Iraq, 1 January to 22 May 2022.



2.4 Field visit to hospitals in Iraq:

During our field visit to complete the research, we visited a group of hospitals, including Souq Al-Shuyoukh General Hospital, Al-Chibayish General Hospital, and the Turkish Hospital, in order to follow up on the case of fever Viral hemorrhagic.

When we visited the **Chibayish General Hospital** / Transient Diseases Department, we found that the number of infection cases at that time reached 13 cases, of which 9 were males and only 4 were females, and it was average is 27 years old, as the youngest injury among them was a boy 19 years old, and the oldest case of infection is a 36-year-old man. The symptoms appearing in patients in this case were fever, fatigue, weakness, or a general feeling of malaise, dizziness, pain in the bones, joints, and muscles, in addition to nausea, vomiting, and diarrhea. There were some dangerous symptoms that, once they appeared on the patient, meant that the disease had reached an advanced stage that could cause loss of life, including bleeding under the skin or internal organs.This case was seen in Chibayish General Hospital, where the disease had reached a stage where the patient began vomiting blood from mouth. When we asked patients suffering from viral hemorrhagic fever about the nature and place of residence, we found out that the majority of them lived in or near rural areas, which are areas known for agriculture, where there are plants and where mosquitoes and ticks are abundant, which are among the causes of transmission of the disease, as their bites cause hemorrhagic fever. The virus is also common in rural areas where livestock and cows are raised, which in turn is one of the causes of transmission of the disease. It has become clear to us that some of those infected buy meat from places far from health control due to the low prices at which this meat is sold, which may be from infected livestock. Viral hemorrhagic fever, thus causing the disease to be transmitted from livestock to people in that condition. There is a section of the infected people who live in residential areas that are close to waste dumping areas and where there is a lot of rats, which are one of the reasons for transmitting the disease. Through our questioning of infected patients in the hospital about the nature of their work, it became clear that some of them work in buying and selling livestock, some of them work in agriculture in fields located in the countryside, and others work in areas close to butcher shops. The reason for their infection may be the meat of livestock infected with the disease and being slaughtered Without health supervision.

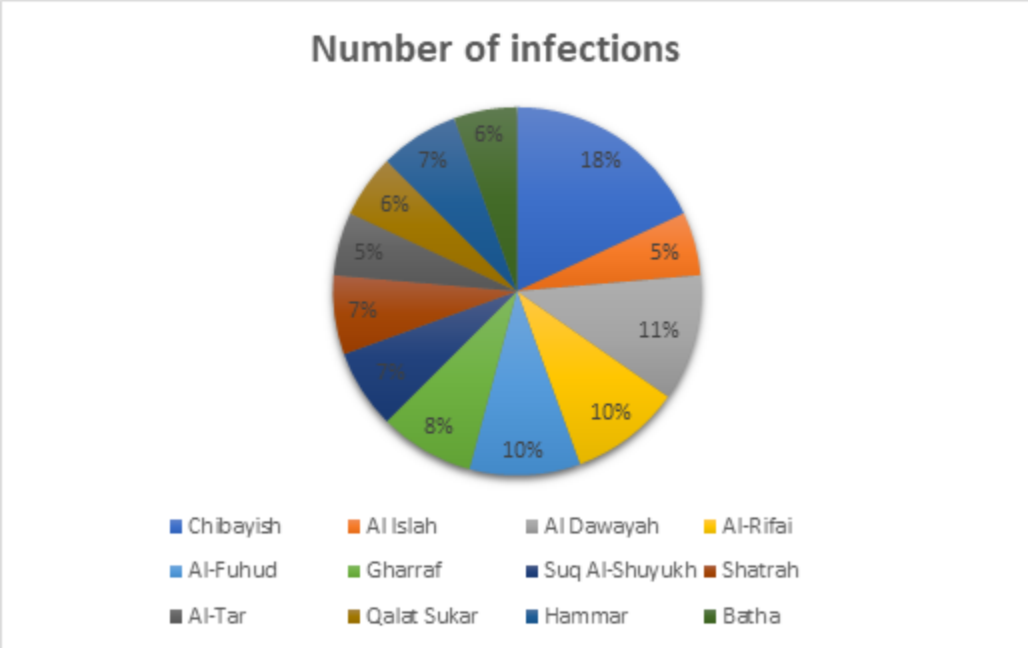
When we visited the **Turkish Hospital** in the center of the city of Nasiriyah, we met a group of infected patients, the number of whom was 17 cases. The infected people in other areas, such as Al-Gharraf, Sayed Dakhil District, and other areas, were transporting the injured to the Turkish Hospital due to the lack of supplies required in the hospitals in those areas. Among the cases of infection, there was a patient suffering from a nervous system disorder and delirium. This caused him to enter a coma before he lost his life days after our visit to the hospital. The official in the Communicable Diseases Department, Sajjad Ahmed Nimah Fares, confirmed to us that the viral hemorrhagic fever disease may appear in its stages. Advanced symptoms include serious symptoms, such as injury to the nervous or respiratory system, in addition to a defect in the functioning of the liver or kidneys, which leads to kidney failure. When we asked the infected patients in this hospital about the nature of their work and place of residence, it became clear that the majority of them live in the city, where the residential population is large and care services are few, which has caused the large presence of waste in many places, especially in the streets, which has caused an increase in the number of rats, which are one of the reasons for transmitting the disease in addition to insects. Parasites such as mosquitoes, whose bites cause hemorrhagic fever, and the nature of their work near these places filled with waste may be a reason for them to become infected with viral hemorrhagic fever.

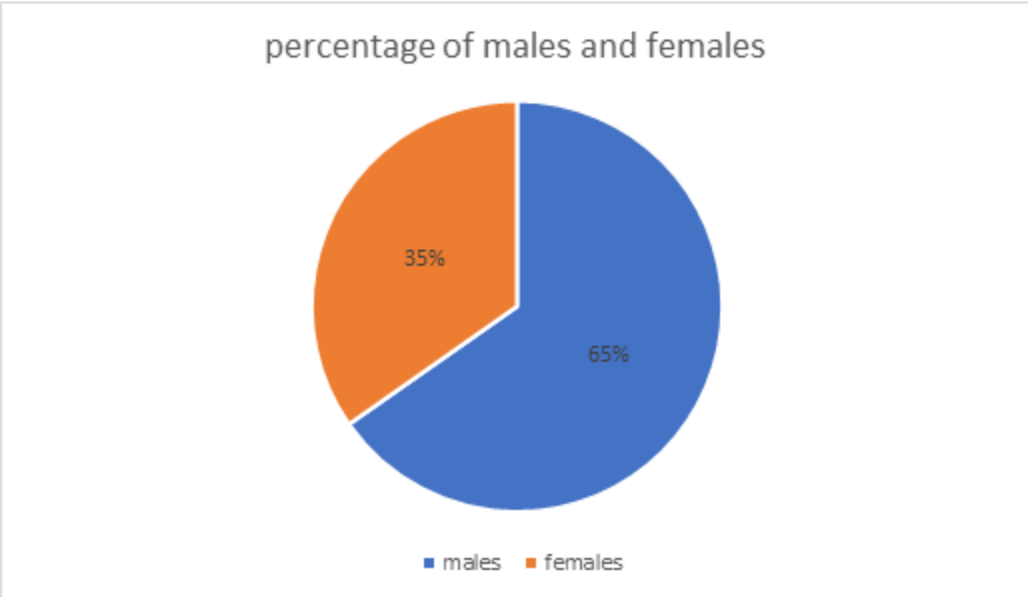
In Souq Al-Shuyoukh General Hospital in Souq Al-Shuyoukh district in Nasiriyah, there were 5 cases of infection, including one girl, 24 years old, and 4 men, all of them 30 years old. They were all working in buying and selling livestock and were related by family ties. The infection may have occurred to one of them because of his dealings with someone. The infected livestock then transmitted the infection to the rest of their relatives. There are also members of their families who were also suspected of being infected with the disease before it was confirmed that they were not infected. The apparent symptoms they had before entering the hospital were fever, fatigue, and a feeling of pain in the joints, in addition to vomiting and diarrhea. After that, they were transferred to the hospital. It was discovered that they were infected with viral hemorrhagic fever During our visit to these three hospitals, we asked the doctors and those responsible for treating people with viral hemorrhagic fever about the procedure taken towards the patient upon his arrival to the hospital. The answer was to give them painkillers in addition to the solutions given intravenously. In some cases, when the patient reaches the stage of kidney failure, an operation is performed. Kidney dialysis. Sometimes, if the patient has the financial ability, he purchases the antiviral drug ribavirin, which may help the patient with viral hemorrhagic fever if he takes the drug in the first 7 days of infection. This drug is an antiviral drug in general and is not a complete treatment for hemorrhagic fever.

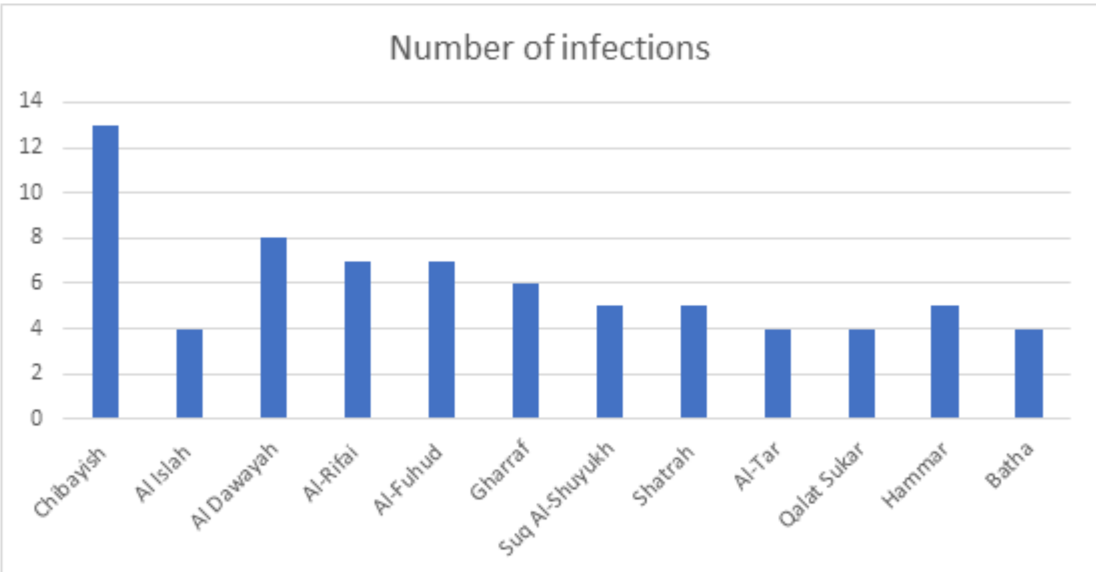
Number of infections	**district**
13	Chibayish
4	Al Islah
8	Al Dawayah
7	Al-Rifai
7	Al-Fuhud
6	Gharraf
5	Suq Al-Shuyukh
5	Shatrah
4	Al-Tar
4	Qalat Sukar
5	Hammar
4	Batha
72	**total**
47	males
25	females

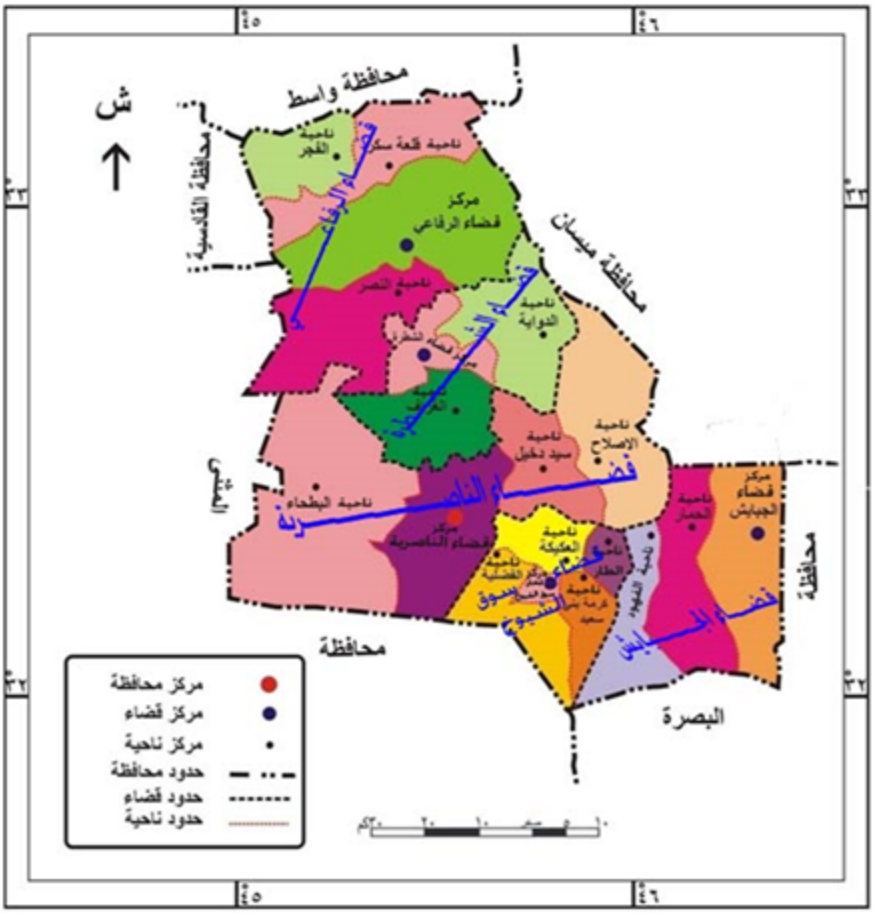
Table 1: Distribution of infections by regions in Dhi Qar Governorate

Note: table 1 includes those infected with hemorrhagic fever from 1/1/2023 to 7/11/2023.


Number of infections
18%
5%
11%
10%
10%
8%
7%
5%
6%
7%
6%
Chibayish
Al Islah
Al Dawayah
Al-Rifai
Al-Fuhud
Gharraf
Suq Al-Shuyukh
Shatrah
Al-Tar
Qalat Sukar
Hammar
Batha


percentage of males and females
35%
65%
males
females


Number of infections
14
12
10
8
6
4
2
0
Chibayish
Al Islah
Al Dawayah
Al-Rifai
Al-Fuhud
Gharraf
Suq Al-Shuyukh
Shatrah
Al-Tar
Qalat Sukar
Hammar
Batha



CHAPTER 3

3.1 Results

There is no official treatment for viral hemorrhagic fever, but drugs such as ribavirin may be used to limit the spread of the virus. In order to avoid infection with the virus and limit its spread, we recommend the following:

1. Dispose of waste in crowded residential areas to prevent the spread of rodents and mice.
2. Use insecticides in the appropriate quantity to eliminate mosquitoes and ticks that transmit the virus that causes the disease.
3. Increasing health control centers responsible for monitoring cows and livestock before slaughter, especially in rural areas.
4. Monitoring butcher shops, ensuring the safety of meat there, and preventing the sale of meat from unknown sources.
5. Build more health isolation centers to treat those infected with communicable diseases, especially in rural areas.
6. Building veterinary centers to monitor the health status of animals in order to treat them and prevent the spread of diseases among them and thus harm the people around them.

3.2 Recommendations:

If you are in a place where there are infections, we advise the following:

1. Avoid going out at dusk and dawn in places where mosquitoes and ticks are common because that is when they are most active.
2. Wear long, light-colored pants, long-sleeved shirts, or clothing coated with permethrin. **Permethrin** is a topical anti-scabies insecticide for the treatment of parasitic infections

(Sarcopticum scabiei, human head lice, human body lice). Permethrin is a pyrethroid, effective against a wide range of pests including lice, ticks, fleas, mites, and other arthropods. It acts on the nerve cell membrane to disrupt the sodium channel that regulates membrane polarization. Delayed repolarization and paralysis lesions are the consequences. It is more expensive than lindane and benzyl benzoate.

3. Apply mosquito repellent with a concentration ranging from 20% to 25% of diethyl toluamide (DEET) on your skin and clothes. DEET: It is a yellow oily substance applied to the skin or clothing, which provides protection against mosquitoes, ticks, fleas, midges, leeches, and other biting organisms. DEET can cause skin irritation if applied in large concentrations or for a very long period of time.
4. Use mosquito nets and mosquito coils if you are staying in tent camps or hotels.
5. Place firewood, piles of bricks, and other materials at least 100 feet (30 meters) away from your home to prevent the presence of rodents and mice near the home.
6. Cut the grass carefully and take care to trim the shrubs within 100 feet (30 meters) of your home to prevent the presence of mice and harmful insects such as mosquitoes near your home.
7. Put the waste in rodent-proof containers and clean it repeatedly, while disposing of the waste regularly.

3.3 Control and Prevention

3.3.1 Control:

Currently, two vaccines have been developed against Crimean-Congo hemorrhagic fever virus. **The first** is a formalin-inactivated vaccine, developed in Bulgaria from the brain of an infected infant mouse. **The second** is a DNA vaccine that was tested on mice. Neither vaccine has been subjected to formal randomized clinical trials.

3.3.2 Prevention:

Effective ways to protect against Crimean-Congo hemorrhagic fever virus are tick control and limiting exposure to infected livestock or humans. To reduce exposure to ticks, it is recommended to wear protective clothing and use repellents. Clothing should be chosen that prevents ticks from attaching, especially those that cover the legs and arms. Health care workers in endemic areas may be exposed to infected blood or tissue from patients with Crimean-Congo hemorrhagic fever. Therefore, these workers should wear gloves, gowns, and face masks to reduce the risk of exposure; They must also follow appropriate infection control precautions to prevent occupational exposure. In addition, Crimean-Congo hemorrhagic fever virus is susceptible to 1% hypochlorite and 2% glutaraldehyde and can be destroyed by heating at 56°C for 30 minutes. Illegal transport of animals between countries may spread the Crimean-Congo hemorrhagic fever virus; Preventing illegal animal transport may reduce the spread of Crimean-Congo hemorrhagic fever virus.

One way to statistically control CCHF is to identify and monitor risk factors for the disease. This can be done by collecting data on the demographics, geographic location, and occupation of people who have been infected with CCHFV. Once the risk factors have been identified, statistical models can be developed to predict the likelihood of infection in different groups of people. This information can then be used to target interventions to those at highest risk.

For example, if it is found that farmers are at increased risk of CCHF infection, then interventions such as tick control programs and training on how to safely handle animals and animal products could be implemented in rural communities.

Another way to statistically control CCHF is to track the spread of the disease over time. This can be done by collecting data on the number of cases and deaths from CCHF in different geographic areas. Statistical models can then be used to identify trends and patterns in the spread of the disease. This information can be used to develop early warning systems and to target public health interventions to the areas where they are most needed.

For example, if a statistical model predicts that there is an increased risk of a CCHF outbreak in a particular area, then public health officials can take steps to prepare for the outbreak, such as increasing the availability of medical supplies and personnel.

Statistical control of CCHF is a complex task, but it is essential to reduce the risk of infection and mortality from this deadly disease. By identifying and monitoring risk factors, tracking the spread of the disease, and developing statistical models, public health officials can develop and implement effective interventions to control CCHF.

Here are some specific examples of how statistical methods can be used to control CCHF:

- Identifying risk factors: Statistical methods can be used to identify the risk factors for CCHF infection, such as age, gender, occupation, and geographic location. This information can then be used to target interventions to those at highest risk.
- Tracking the spread of the disease: Statistical methods can be used to track the spread of CCHF over time and to identify trends and patterns. This information can be used to develop early warning systems and to target public health interventions to the areas where they are most needed.
- Evaluating the effectiveness of interventions: Statistical methods can be used to evaluate the effectiveness of different interventions for controlling CCHF. This information can be used to improve existing interventions and to develop new ones.

Statistical control of CCHF is an important tool for reducing the risk of infection and mortality from this deadly disease. By using statistical methods to identify risk factors, track the spread of the disease, and evaluate the effectiveness of interventions, public health officials can develop and implement effective strategies to control CCHF.

Although a mouse brain-derived inactivated vaccine against Crimean-Congo hemorrhagic fever virus has been developed and used on a small scale in Eastern Europe, there is currently no safe and effective vaccine widely available for human use.

In the absence of a vaccine, the only way to reduce infections in people is to raise awareness of risk factors and educate people about measures they can take to reduce exposure to the virus.

3.3.3 Reducing the risk of tick transmission to humans:

- Wear protective clothing (long sleeves, long pants).
- Wear light-colored clothing to allow ticks to be easily detected on clothing.
- Use approved insecticides (chemicals designed to kill ticks) on clothing.
- Use repellents based on skin and clothing.
- Check clothing and skin regularly for ticks; If found, remove them safely.
- Striving to eliminate or control tick infestations in animals or in stables and barns.
- Avoid areas where ticks are common and seasons when they are most active.

3.3.4 Reducing the risk of transmission from animals to humans:

- Wear gloves and other protective clothing while handling animals or their tissues in infected areas, especially during slaughtering, cutting, and culling procedures in slaughterhouses or at home.
- Isolate animals before entering slaughterhouses or routinely treat animals with pesticides two weeks before slaughter.

3.3.5 Reducing the risk of human-to-human transmission in the community:

- Avoid close physical contact with people infected with Crimean-Congo hemorrhagic fever virus.
- Wear gloves and protective equipment when caring for patients.
- Wash hands regularly after caring for or visiting patients.

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