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Short Communication

Battling the wave of Crimean-Congo hemorrhagic fever in South Asia: Integrated policy recommendations for preempting a regional epidemic

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ABSTRACT

Background: *Crimean-Congo hemorrhagic fever virus (CCHFV)* has been responsible for severe viral hemorrhagic fever outbreaks in South Asia over the past couple of decades, carrying a case fatality rate of 10-40%. The objective of this study is to analyze recurrent *CCHFV* outbreaks in South Asia and propose integrated policy recommendations to prevent regional epidemic spread.

Methodology: Epidemiological analysis of *CCHFV* transmission patterns using a One Health framework, examining synergistic risk factors including livestock vaccination gaps, biosecurity deficiencies, and surveillance system fragmentation across South Asian hotspots.

Results: *CCHFV* maintains persistent transmission through infected *Hyalomma* ticks and direct contact with viremic livestock/human fluids, with case fatality rates of 10-40% depending on healthcare access. Climatic conditions including prolonged monsoons, elevated temperatures, and high humidity favor tick proliferation. Systemic limitations in national health systems prevent standardized prevention protocol implementation, particularly in rural areas.

Conclusion: Authors propose several integrated policy recommendations including community-led tick control initiatives, enhanced livestock vaccination programs, optimizing infection control and biosafety protocols, and strengthened vector surveillance systems to address multifactorial transmission challenges and prevent transnational spread through migratory routes and climate-driven vector expansion.

Keywords: *Crimean-Congo hemorrhagic fever*, *CCHFV*, Epidemic, Healthcare management, South Asia

INTRODUCTION

Crimean-Congo hemorrhagic fever virus (CCHFV) is mainly spread through the bite of *Hyalomma* ticks and/or contact with infected blood or tissue from humans or animals.[1,2] The disease was first detected in the Crimean Peninsula of Eastern Europe in 1944 and was later acknowledged as the main cause of hemorrhagic syndrome in patients from the Congo Basin of Central Africa in 1969. *CCHFV* has a diverse geographical presence being endemic to parts of Asia, Africa, Middle East and Eastern Europe. Regions with high transmission typically exhibit hot and humid climates, poor animal management, improper sanitation at farms, limited pesticide use and inefficient vector control strategies.[2,3]

The most recent resurgence of *CCHFV* in Pakistan's Balochistan province in 2024 has prompted concerns about the weaknesses in the infrastructure of the local and national healthcare systems.[3-5] The intermittent prevalence of *CCHFV* transmission in the province has accelerated dissemination to neighboring provinces across the country.

MATERIAL AND METHODS

This study employed a mixed-methods approach within a One Health framework to analyze *CCHFV* transmission patterns across South Asian hotspots through comprehensive literature review of peer-reviewed publications, case reports, and surveillance data from 2010-2024. Epidemiological data was collected from national health databases and research institutions in Pakistan, India, and neighboring countries. Data analysis employed descriptive epidemiological methods examining temporal trends, spatial distribution, and host-vector relationships to identify critical intervention points for policy recommendations.

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RESULTS

In 2017, a cross-sectional investigation was undertaken in Balochistan province, where ticks from livestock farms were collected and analyzed for *CCHFV* genomes. The findings revealed that 525 out of 529 ticks belonged to the *Hyalomma* genus, with 20 ticks containing the *CCHFV* genome[4]. Confirmed cases have been reported from all provinces in Pakistan, and one possible explanation appears to be inadequate disease surveillance of both human and animal populations.[3]

An alarming situation arose in November 2023, when the health authorities in Balochistan reported 11 new cases in healthcare professionals as part of an ongoing outbreak. According to reports, the illnesses developed after two patients with viral hemorrhagic syndrome were treated at the Sandeman Provincial Hospital. When one of the medical professionals died while being brought to Karachi for further management, the provincial government issued an alert to the appropriate departments to prevent further viral transmission in the province.[6,7]

In India, *CCHFV* was first detected in the Gujrat province amid a nosocomial outbreak in 2011[8]. Later, another outbreak was detected in the state in 2013[9]. Domestic animals in the surrounding regions also tested positive for virus-specific antibodies.[9] In 2015, samples of clinically suspected human cases from several parts of north-western India were screened for *CCHFV* using reverse transcriptase-polymerase chain reaction (RT-PCR). Positive samples were sequenced to ascertain the prevalent *CCHFV* genotype(s). An evolutionary tree revealed the presence of several strains from throughout the region, including strains from Pakistan, Afghanistan, and Iran, which differed from those previously reported from India.[10] Moreover, in a seroprevalence study conducted in March 2024, goats and cattle from tribal-dominated regions were tested for virus-specific IgG antibodies, and 16% of the samples turned out positive. This revealed a lack of effective control and public awareness of zoonotic diseases in the region.[11]

DISCUSSION

The persistent transmission of *CCHFV* in South Asia, driven by ecological, climatic, and systemic health challenges, underscores the urgent need for a coordinated regional response. Our findings highlight significant gaps in surveillance, vector control, and livestock management that facilitate ongoing outbreaks and nosocomial infections.

Integrating community engagement with strengthened veterinary and human health services, alongside climate-adaptive vector monitoring, is essential to curtail the disease's spread. Addressing these multifactorial drivers through the proposed policy measures can enhance early detection, reduce transmission risk, and ultimately prevent a wider regional epidemic. Strengthening cross-border collaboration and data sharing among South Asian countries will be critical to managing migratory vector routes and harmonizing control efforts. Furthermore, investing in public awareness campaigns tailored to rural and high-risk populations can empower communities to participate actively in prevention strategies, reducing human exposure to infected ticks and livestock.

In addition, application of cutting-edge molecular diagnostic methods with the aid of machine learning-based data analysis provides powerful tools for the early detection and full characterization of *CCHFV* strains. The combination of rapid genomic sequencing and machine learning methods can potentially identify viral mutations with increased transmission or increased severity and thereby aid in early risk assessment. The combination of molecular science and machine learning not only accelerates outbreak control, but also aids in the development of vaccines and targeted therapies, which, if applied, could be a significant advancement towards precision public health interventions to counter *CCHFV* in South Asia.

CONCLUSION

We emphasize the critical need to reduce annual outbreaks of *CCHFV* infection in South Asian nations in order to prevent the transmission and spread to the neighboring regions. To achieve this, we present several policy recommendations for the respective governments to combat the increasing prevalence of infections (Table-I).

Table-I: Integrated policy recommendations for pre-empting a regional *CCHFV* epidemic in South Asia

RECOMMENDATION	MEASURES
1. Enhance Public Awareness and Education	• **Community Engagement:** Implement awareness campaigns to educate communities in endemic regions about viral transmission routes, symptoms, and prevention strategies. Target agricultural workers, farmers, livestock dealers, animal rearers, slaughterhouse employees, and healthcare providers, as they are at higher risk. Additionally, educate on tick identification and safe removal practices in case of exposure. • **Training Programs:** Implement training programs for medical professionals that cover infection control practices, emphasizing the importance of personal protective equipment (PPE) and proper handling of infected materials. Also, provide specialist training for laboratory personnel on safe handling and processing of clinical specimens.
2. Improve Vector Control Measures	• **Tick Control:** Persuade farmers to employ acaricides in tick control to kill ticks. This can be combined with training farmers in integrated pest management techniques. • **Protective Clothing:** Encourage wearing of protective clothing, such as long-sleeved shirts, particularly in locations where there are high concentrations of ticks. In addition, ticks can be easily detected on light-colored clothing. • **Insect Repellents:** Encourage the use of appropriate insect repellents on the skin and clothing to decrease the risk of tick bites.
3. Enhance Quarantine, Slaughter Safety, and Livestock Screening	• **Animal Quarantine:** Enforce strict quarantine protocols for animals prior to their entry into slaughterhouses. It is imperative that animals be sprayed with pesticides fourteen days prior to slaughter to mitigate the threat of viral transmission from infected animals. • **Safe Slaughter Practices:** Adopt and enforce policies on safe slaughter procedures, including the use of gloves and protective wear when handling animal tissue. • **Adherence to Disinfection Protocol:** Disinfect the slaughterhouses following every slaughter with 0.5% peracetic acid or 2% sodium hypochlorite, both of which have been demonstrated to be effective against *CCHFV* in published research. • **Screening of livestock animals:** Screening of livestock annually or biannually are important interventions, especially in rural areas where most cases take place.
4. Enhance Healthcare System Preparedness	• **Infection Control and Biosafety Protocols:** Infection control procedures must be adhered to by all health workers to the utmost priority, for example, safe burial in case of death of patients and proper sterilization of health equipment. Laboratory personnel should also carry out sample collection, transport, and processing in accordance with recommended biosafety guidelines for handling viral hemorrhagic fever specimens.

5. Research and Development	• **Surveillance Systems:** Develop and maintain surveillance systems to monitor cases and outbreaks to enable prompt responses and resource mobilization. • **Supportive Care and Treatment:** Ensure that the healthcare professionals are trained to recognize signs and symptoms of the disease early and provide supportive care in time, such as fluid therapy and complication management. • **Vaccine Development:** Fund research for the development of human and animal vaccines. This includes funding research on candidate vaccines and antiviral drugs. • **Understanding Transmission Dynamics:** Support research on disease ecology such as animal reservoirs and tick vectors, to maximize the effectiveness of control efforts.

ETHICAL CONSIDERATIONS

Not required

CONFLICT OF INTEREST

None

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AUTHOR CONTRIBUTION

Moiz Ahmed Khan: Conceptualization, manuscript writing, final approval, agreement to be accountable for all aspects of the work

Syeda Alizeh Noor Zaidi: Drafting and revising article critically for important intellectual content, final approval, agreement to be accountable for all aspects of the work

Saad Ahmed: Revising article critically for important intellectual content, final approval, agreement to be accountable for all aspects of the work

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