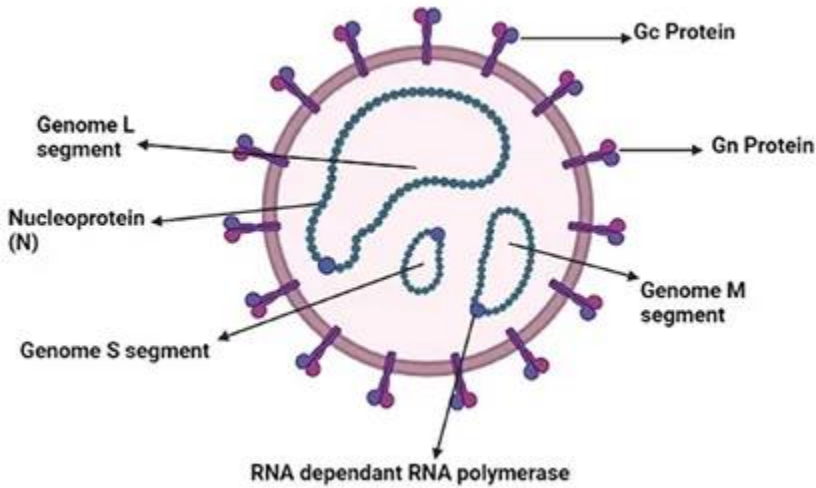# Crimean-Congo haemorrhagic fever cases in South Africa: Epidemiological characteristics and spatiotemporal trends, 1981-2020

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World Epidemiology Congress
24-27 Sep 2024

NATIONAL INSTITUTE FOR
COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Background: Geographical distribution, vectors, reservoirs and of CCHF virus

Munazza Aslam,, Rao Zahid Abbas and Abdullah Alsayeqh, 2023. Distribution pattern of crimean–Congo hemorrhagic fever in Asia and the Middle East. *Frontiers in public health*, *11*, p.1093817.

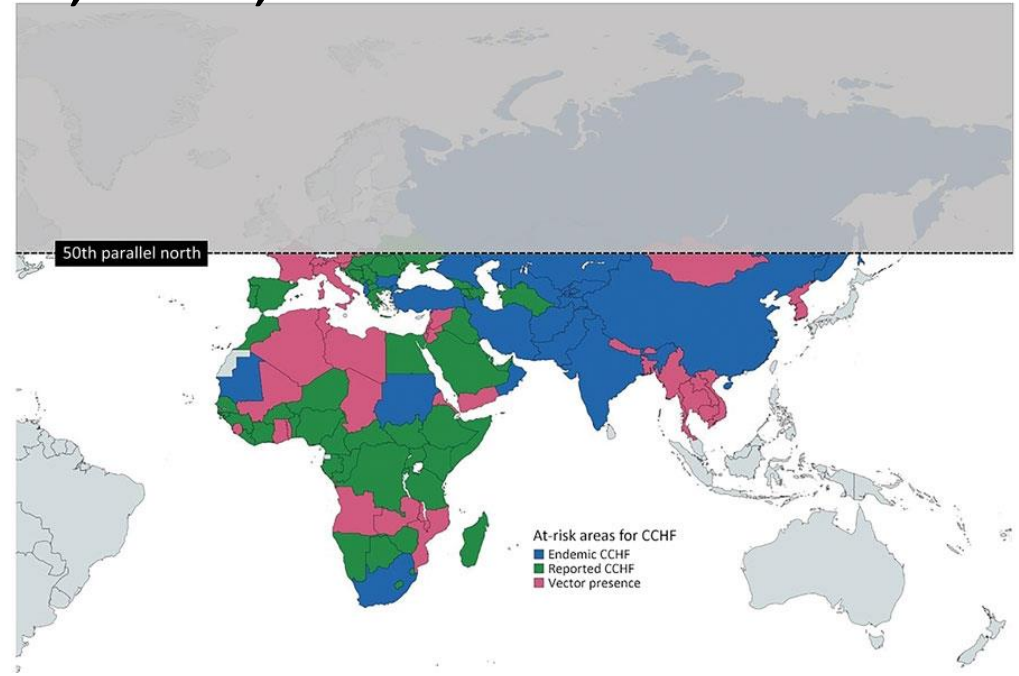Photo *Hyalomma rufipes* courtesy of Alan Kemp (CEZPD-NICD)

Figure. Geographic distribution of CCHF and Hyalomma spp. ticks. CCHF, Crimean-Congo hemorrhagic fever.

Frank MG, Weaver G, Raabe V. Crimean-Congo Hemorrhagic Fever Virus for Clinicians—Epidemiology, Clinical Manifestations, and Prevention. Emerg Infect Dis. 2024;30(5):854-863. https://doi.org/10.3201/eid3005.231647

Background: CCHF transmission and clinical disease
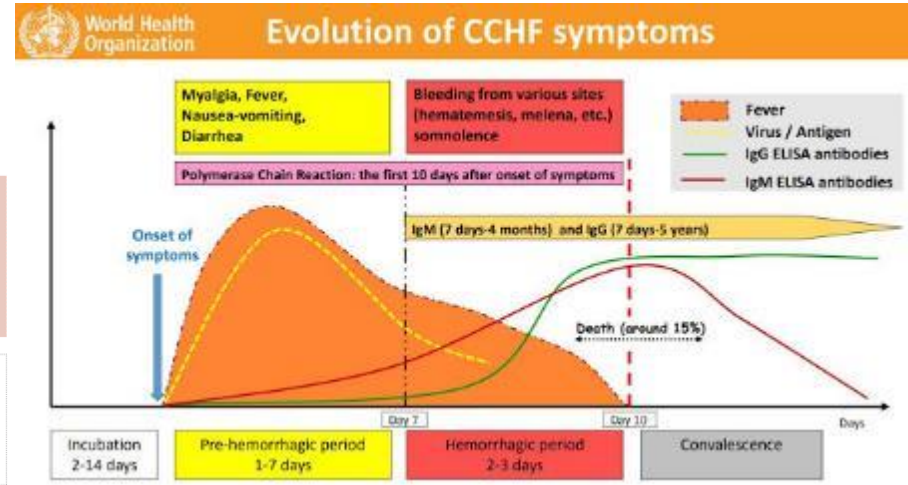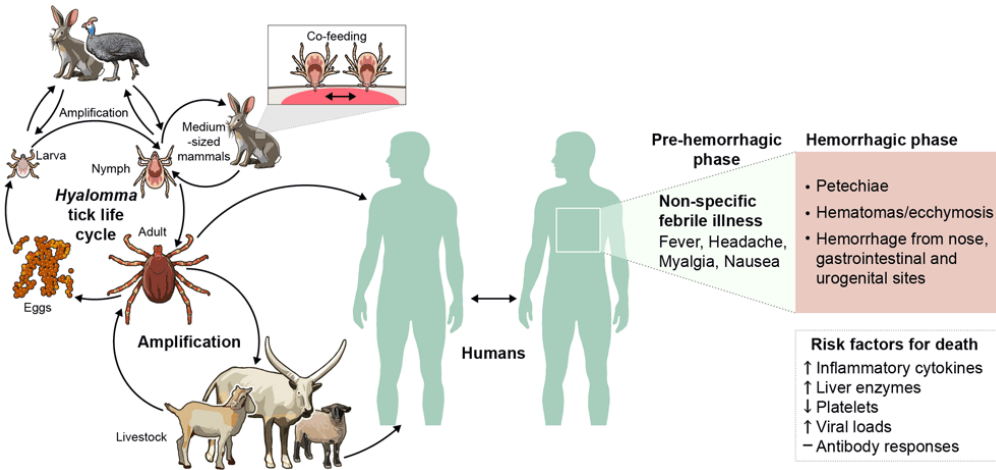
Hawman, D. W. and Feldmann, H. (2018) 'Recent advances in understanding Crimean–Congo hemorrhagic fever virus', *F1000Research,* 7(F1000 Faculty Rev), pp. 1715.

Dr. Pierre Formenty; https://www.cchfvirus.com/2019/07/crimean-congo-haemorrhagic-fever-disease.html

No effective treatment and approved vaccines globally available

- Ascioglu, S., Leblebicioglu, H., Vahaboglu, H. and Chan, K. A. (2011) 'Ribavirin for patients with Crimean–Congo haemorrhagic fever: a systematic review and meta-analysis', *Journal of antimicrobial chemotherapy,* 66(6), pp. 1215-1222.
- Papa, A., Papadimitriou, E. and Christova, I. (2011) 'The Bulgarian vaccine Crimean-Congo haemorrhagic fever virus strain', *Scandinavian Journal of Infectious Diseases,* 43(3), pp. 225-229.
- Mehand, M. S., Al-Shorbaji, F., Millett, P. and Murgue, B. (2018) 'The WHO R&D Blueprint: 2018 review of emerging infectious diseases requiring urgent research and development efforts', *Antiviral Research,* 159:, pp. 63-67.

Research study objective and methods

Objective

- Assess trends of
  - Incidence (Cochran-Armitage chi-square tests)
  - Case-fatality ratio
  - Sex and age
  - Spatial distribution
  - Seasonal change
  - Transmission routes
- Lab-confirmed CCHF cases in South Africa
- In period 1981-2020

Methods

- A cross-sectional, secondary analysis
- CCHF human cases diagnosed at the NICD
- Of past ~ 40 years (4 quasi decades)
- Represent national reported statistics for South Africa
- Retrospective review of lab database and case files
- Variables: demographic information, exposure history, clinical and outcome data, year and month of occurrence and geographic location.
- Department of Economic and Social Affairs, Population Division
- WHREC ethical review
- AARMS-NHLS review
- Excel and Stata and Arcmap versions

Methods-Source data: Surveillance system of CCHF in South Africa

- Guidelines: Swanepoel, R. (1985) Recognition and management of viral haemorrhagic fevers: a handbook and resource directory. Sandringham: National Institute for Virology, Department of Health, South Africa. (First edition)

- The Special Viral Pathogens Laboratory (SVPL) conducts referral laboratory diagnosis of **viral haemorrhagic fevers (VHF)** and human rabies.
- Category I Notifiable Medical Condition
- Criteria for clinical diagnosis Swanepoel, Mynhardt and Harvey – 1987
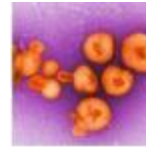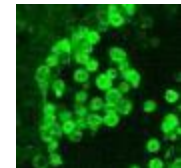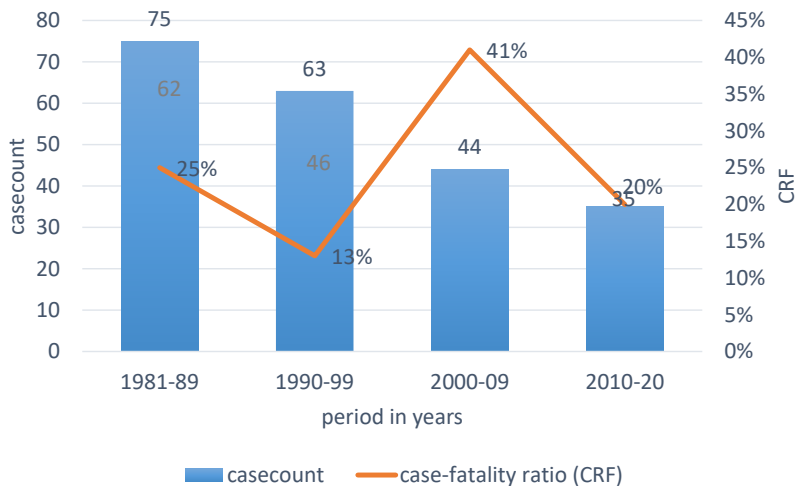

- Lassa
- Lujo
- CCHF
- RVF
- Ebola
- Marburg
- Yellow fever

Laboratory investigation of VHFs
- Virus isolation
- Antigen detection
- Nucleic acid detection PCR
- Antibody detection IFA →

http://www.nicd.ac.za/diseases-a-z-index/crimean-congo-haemorrhagic-fever-cchf/

Results: Temporal trend of SA CCHF cases (decade)

Significant declining trend of casecount (n=217)

Slope = -6.5e-08, std. error = 1.7e-08, Z =   3.801

Overall chi2(3) =   16.403, pr>chi2 = 0.0009

Chi2(1) for trend =   14.448, pr>chi2 = 0.0001

Chi2(2) for departure =   1.955, pr>chi2 = 0.3763

Z-score=0.00; P=1.000: no trend for CRF

Period	Median yearly cases	Range cases	Annual incidence /100,000	Annual incidence /100,000*	Median yearly CFR	Range yearly CFR	Total CFR
1981-1989	10	0-15	0.053	0.044	22%	0-100%	25% (19/75)
1990-1999	5.5	0-20	0.035	0.026	17%	0-67%	13% (8/63)
2000-2009	3.5	0-11	0.023	0.023	40%	0-100%	41% (18/44)
2010-2020	2	0-8	0.016	0.016	0%	0-100%	20% (7/35)
Overall	5	0-20	0.030	0.026	20%	0-100%	24% (52/217)

*Sporadic cases = Excluding nosocomial and common source blood exposure outbreaks

Fig Laboratory-confirmed Crimean-Congo haemorrhagic fever cases, annual incidence and case fatality-ratio, South Africa, for 1981-2020

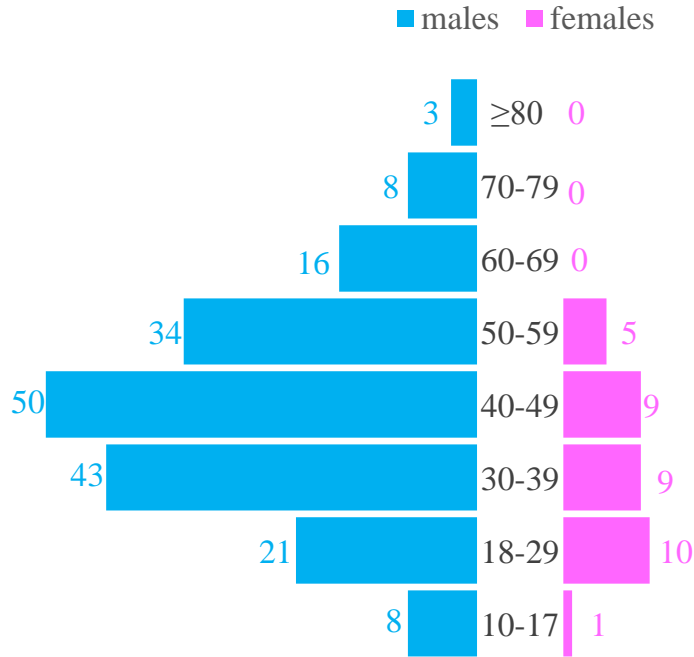# Results: SA CCHF case distribution by age-gender

Figure. Confirmed CCHF cases by age-gender, South Africa 1981-2020 (n=217)
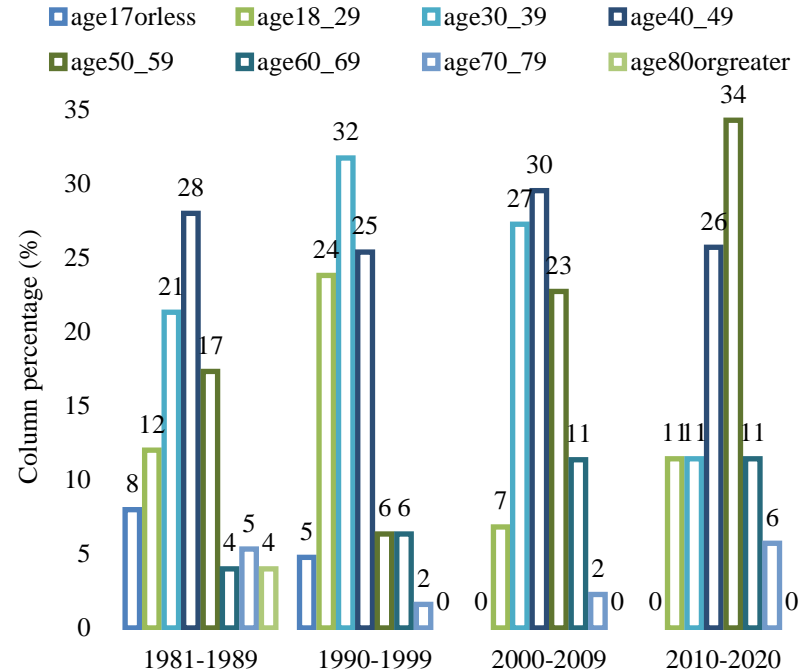

Figure. Confirmed CCHF cases by age-period, South Africa 1981-2020 (n=217)

Results: SA CCHF case distribution by route of infection
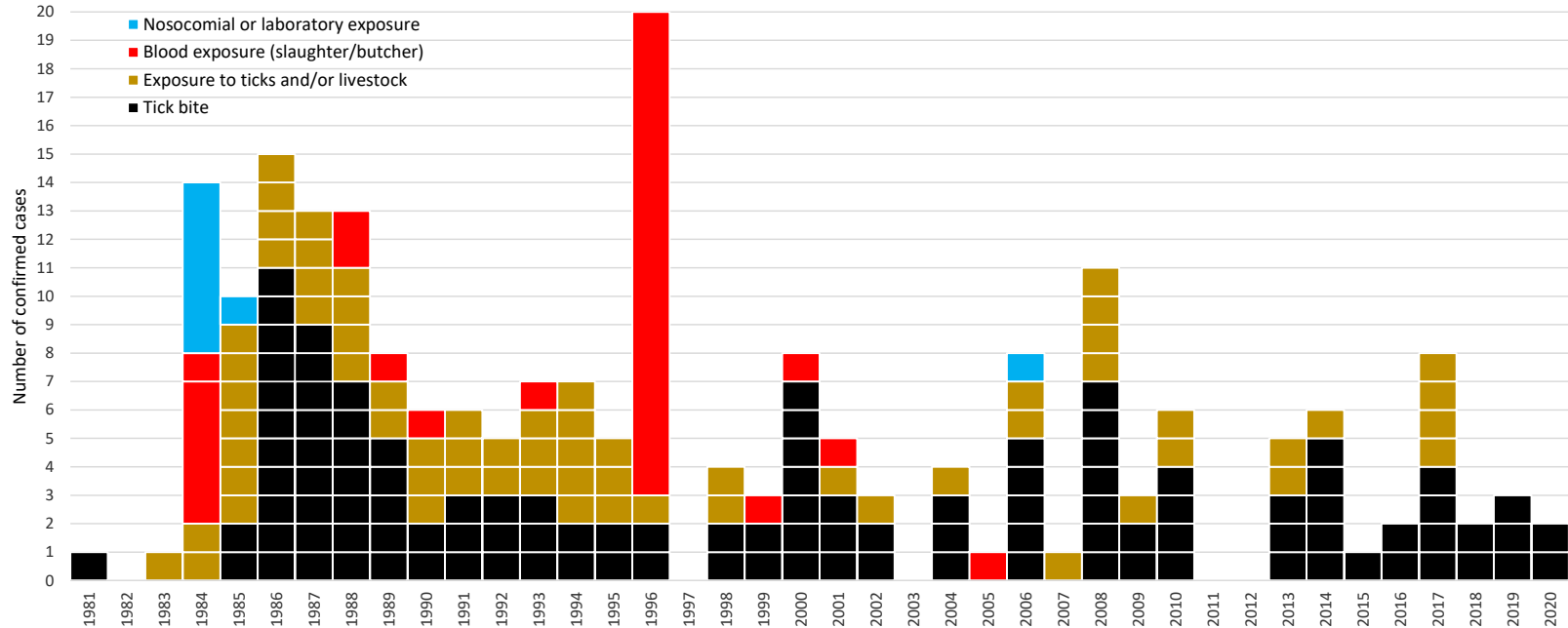

Figure. Confirmed CCHF cases by source of infection, South Africa 1981-2020 (n=217)

Results: Geographical distribution

Crimean-Congo haemorrhagic fever, SA, 1981-2020
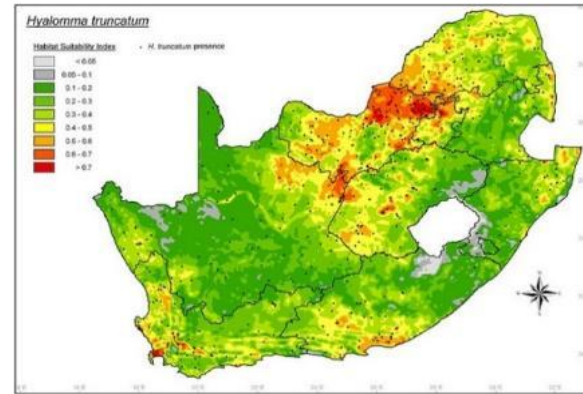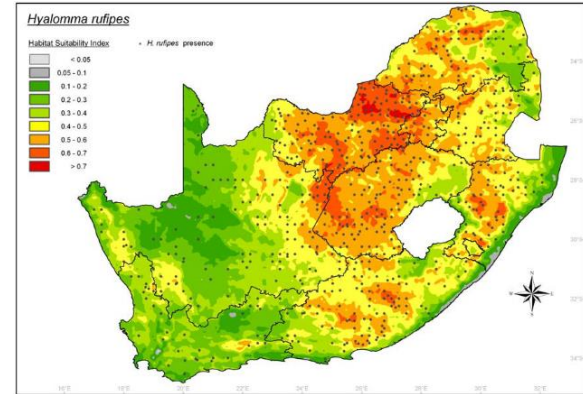
- CCHF confirmed cases

Forest
Fynbos
Grassland
Nama-Karoo
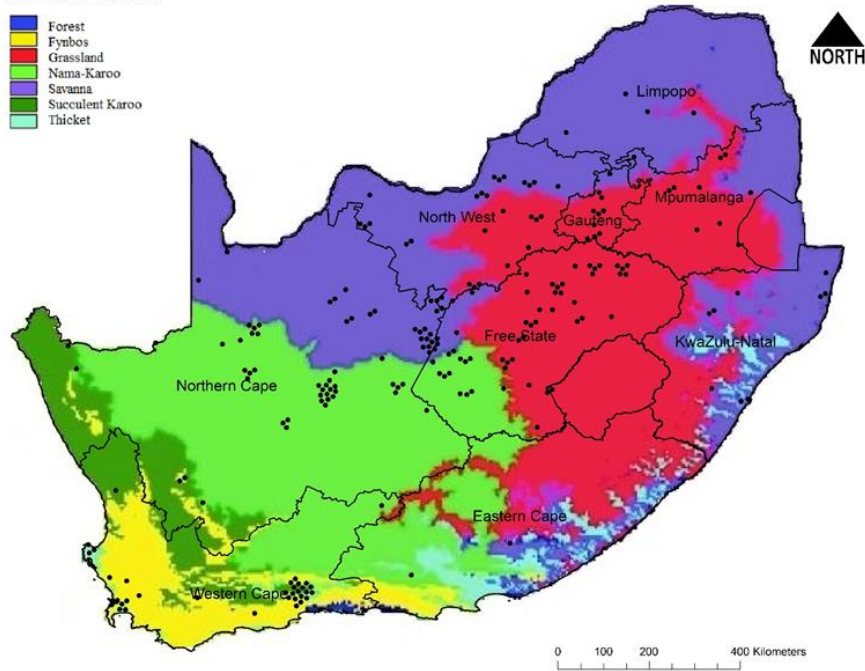Savanna
Succulent Karoo
Thicket

Figure. Distribution of laboratory-confirmed Crimean-Congo haemorrhagic fever cases for 1981-2020 on geographic and provincial background. The map was constructed for the manuscript in Esri ARCGIS 10.2 using country and provincial boundaries from Municipal Demarcation Board and National Geo-Spatial Information and Vegetation of SA, under a Creative Commons Attribution (CC BY 4.0) license.

Hyalomma rufipes and *H. truncatum* distribution in South Africa.
Spickett AM et al. Habitat suitability models of tick vectors of disease in South Africa.

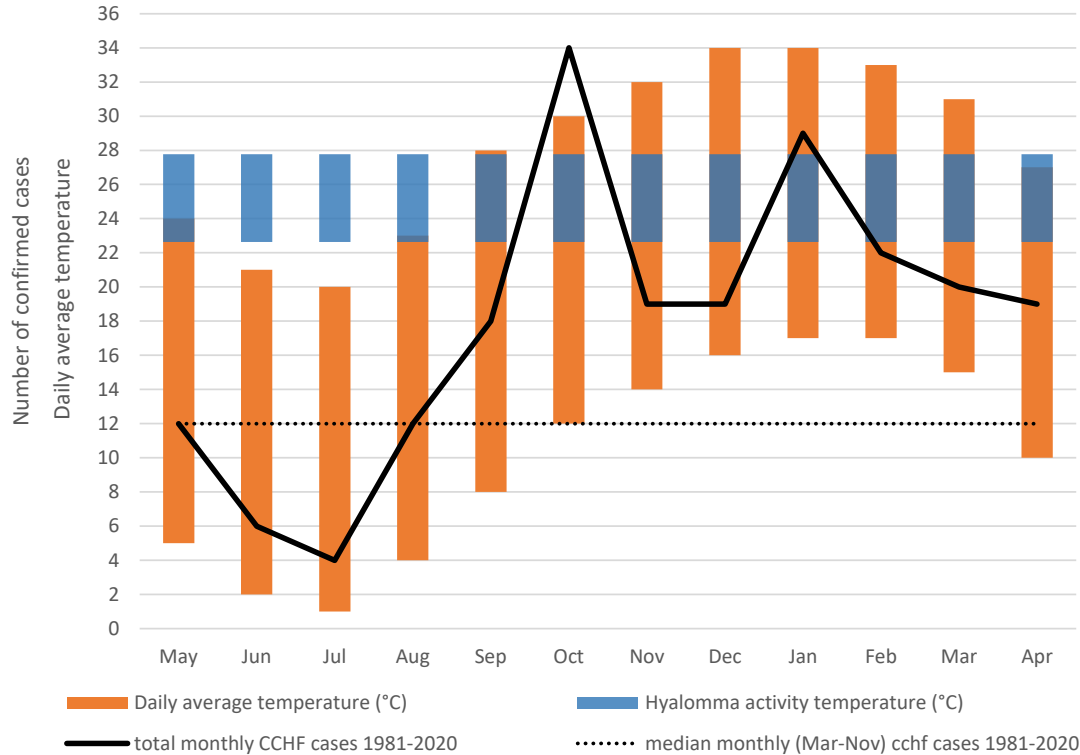# Results: Seasonality of SA CCHF cases

Figure. Laboratory-confirmed Crimean-Congo haemorrhagic fever cases by month and daily average temperature, South Africa, for 1981-2020

Conclusions and next step

1. Cases occur annually and predominantly affect those who have been exposed to ruminant animals and ticks in the country's inland.

2. Diagnostic surveillance has yielded insights in CCHF epidemiology, despite limitations.

3. Outbreak Analytics with R

4. Seroprevalence investigations in animals and people have provided further understanding.*

5. Tick studies have offered further information.*

6. Continued follow-up on a small sample of survivors can provide additional perspective on immunity and re-infection.

*Msimang, V., Weyer, J., le Roux, C., Kemp, A., Burt, F. J., Tempia, S., . . . Thompson, P. N. (2021) 'Risk factors associated with exposure to Crimean-Congo haemorrhagic fever virus in animal workers and cattle, and molecular detection in ticks, South Africa', *PLoS Neglected Tropical Diseases,* 15(5), pp. e0009384.

Acknowledgments