Epidemiology and Ecology of Arboviruses in the Middle East and North Africa: A Systematic Review

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BACKGROUND

• The global distribution and disease burden of arboviruses have increased over recent years.
• In the Middle East and North Africa (abbr. 'MENA'), the epidemiology of arboviruses remains poorly characterized.
• Rapid urbanization, heavy cross-border movements of humans and animals for commerce and religious gatherings, and the geographic expansion of Aedes and Albopticus mosquitoes are thought to be increasing the risk of arboviral diseases in the MENA.
• To date, much of the published literature detailing the epidemiology of arboviruses in MENA relies on case reporting, which may underestimate prevalence and disease burden, and in areas with limited surveillance and diagnostic capacity. Seroprevalence surveys can provide valuable insight into disease epidemiology in such settings.

METHODS

Aims: 1) undertake an in-depth assessment of the peer-reviewed literature of the prevalence of globally-relevant arboviruses in the MENA. 2) Describe the epidemiology of these arboviruses in the MENA through descriptive analysis of prevalence studies in humans, animals, and vectors.

Methods: Following the PRISMA guidelines, we systematically reviewed available records across the WHO, World Bank, and UNAIDS-defined MENA region describing the human, animal, and vector prevalence of arboviruses (CHIKV, Crimean-Congo hemorrhagic fever (CCHFV), dengue (DENV), Rift Valley fever (RVFV), yellow fever (YFV)), Geospatial prevalence maps were generated using ArcGIS software.

RESULTS

- **Systematic Search**
  - **West Nile**
    - YFV has been recognized in Sudan for decades, where a single locality has reported prevalence of 1 in the southern part of the country.
    - In 2007, a WHO human survey was negative for YFV. However, a 2005 animal survey found 1.4% YFV-specific antibodies in wildlife.
  - **Yellow Fever**
    - Limited seroprevalence studies in laboratory and field personnel, in other Bosvittine species (sheep and goats) (N=718).
  - **Chikungunya**
    - Our small-sized data suggests a prevalence of 10% among cases (N=2217) followed by 10% in (N=2217).
  - **Dengue**
    - From 1986-2016, the majority of vaccinated studies were performed in the Red Sea region.
  - **Rift Valley Fever**
    - The majority of Rift Valley fever studies were performed in Sudan and Syria.
  - **Crimean-Congo Hemorrhagic Fever**
    - We identified 264 human and animal studies for CCHFV infection. The highest prevalence was seen in humans in Turkey and Egypt.

- **Tick**
  - The majority of tick seroprevalence studies were performed in Morocco, Egypt, and Turkey.

- **Vectors**
  - The majority of arbovirus vector studies were only identified in areas of known diagnostic capacity. Sudan and Syria have the largest prevalence in Egypt and Saudi Arabia.

- **References**
  - Full reference lists and detailed search criteria are available upon request from jmh9013@med.cornell.edu

CONCLUSION

- Arboviruses are endemic to the MENA region, though mapping the location of prevalence studies suggests significant discrepancies in epidemiologic research intensity across the MENA.
- The Red Sea region is a focus of arbovirus research in the MENA, with indications of endemic circulation for all six study viruses.
- North Africa may harbor substantially understudied serotypes of arboviral diseases based on mid to high-level prevalence measures despite low annual case reporting.
- There is a paucity of research on the prevalence of arboviruses in vectors across the MENA.
- The movements of animals throughout the MENA pose risk of transmission of CCHFV and RVFV.
- Wide variations in study designs and tests limit definitive conclusions about disease pressures in many countries.

References

Epidemiology:
• Countries with no published human/animal prevalence data for any of the study viruses were Algeria, Bahrain, Palestine, Qatar, and Syria
• CCHFV was identified in ticks from Somalia and Iran despite the absence of any published prevalence studies in humans/animals for either of these countries.

Prevalence Study Methodologies:
• 75% of human seroprevalence studies used either convenience samples or did not specify their sampling methodology.
• Neutralization testing, the gold standard for flavivirus serology testing, was used in only 40% of flavivirus seroprevalence studies in humans/animals.
• 65% of human prevalence studies utilized in-house assays in total, though following the first use of commercial assays in 2003, in-house assay use declined to 35% of studies.

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• No disclosures.

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