Rodent Consumption and Zoonotic Threats: Investigating MPXV Transmission in Central and West Africa

Katharina Kreppel (Institute of Tropical Medicine Antwerp); **Matthew Baylis** (University of Liverpool); **Justin Pulford** (Liverpool School of Tropical Medicine); **Justin Masumu** (National Institute of Biomedical Research); **Bassirou Bonfoh** (Swiss Centre of Scientific Research, Abidjan)

BACKGROUND

Mpox virus (MPXV), emerged as a zoonotic disease originating from captive monkeys in Denmark in 1958. The first documented human case occurred in 1970, within the Democratic Republic of the Congo (DRC). Since then, MPXV has triggered recurrent outbreaks spanning across 11 African nations, encompassing the DRC, Republic of Congo, Central African Republic, Cameroon, Liberia, Sierra Leone, South Sudan, Nigeria, Côte d'Ivoire, Gabon, and Benin Republic. In May 2022, a few Mpox cases were detected in the UK without an associated travel link to Mpox endemic countries. By July 2022, over 30,000 cases had been reported in more than 90 countries, leading the World Health Organization to declare the global Mpox outbreak a public health emergency of international concern and by November 2023, the WHO reported a cumulative 92,783 confirmed Mpox cases and 171 deaths (CFR 0.2%) globally. During the same period, 2,126 confirmed cases of Mpox and 22 related deaths (CFR 1.0%) were reported in the African region, but the African case data are thought to be significantly underreported.

Two distinct clades of MPXV have been identified: Clade I (formerly Central African Clade) and Clade II (formerly West African Clade). Clade I, with a higher associated case fatality rate (CFR) of up to 10%, predominantly impacts Central African countries. In contrast, Clade II strains, comprising IIa and IIb, featuring a CFR of less than 1%, were predominantly localized in West Africa but were also exported internationally, exemplified by the 2003 outbreak in the USA originating from Ghana.

Historically, Mpox outbreaks in Africa, particularly within the DRC, were often linked to animal-to-human spillover incidents in rural rainforest environments, disproportionately affecting children under 15 years old. Human-to-human transmission, primarily occurring through household contact or droplets, was less frequent and not sustained.

To address the pressing concerns surrounding MPXV, our study aims to illuminate its transmission dynamics, particularly in regions such as the DRC and Côte d'Ivoire, where consumption of wild meat, including rodents like cane rats, is commonplace. Through collaboration with local partners, we investigate transmission risks by examining the practices of breeders, traders, and consumers, as well as systematically sampling and testing both wild and captive cane rats. This comprehensive understanding will inform targeted strategies to mitigate potential outbreaks, not solely within Africa but also on a global scale.

Bred cane rat in Côte d'Ivoire

Wild cane rat and civet on the wild meat market in Côte d'Ivoire

Rattus norvegicus (brown rat) caught for dinner in a village in DRC

METHODS

Survey in a rural village in DRC

Our aim was to investigate the infection risk for MPXV by exploring the practices of hunters, consumers, breeders, and traders, and by sampling and testing rodents to provide insights into transmission risks from wild and captive rodents to humans. Employing mixed methods in the Democratic Republic of the Congo (DRC) and Côte d'Ivoire (CI), we delved into socio-demographics, attitudes, and consumption practices across 57 households.

In the DRC, we utilized questionnaires to gather data on species consumed and hunting, handling, and preparation practices in four rural villages in Masi-Manimba. This was complemented by four focus group discussions, observations, and the sampling of 35 rodents intended for consumption. In CI, key informant interviews were conducted, involving visits to the national cane rat breeder's association, three private cane rat breeders, two wild meat markets, and three restaurants serving wild meat.

Thematic analysis was employed to identify codes and themes from discussions and interviews, supported by main factor analysis of the survey data. This comprehensive approach allowed us to gain a deeper understanding of MPXV infection risks and transmission dynamics within these communities.

RESULTS

Democratic Republic of the Congo

Transmission risk of zoonotic pathogens in rural villages in DRC:

- All family members from about 4 years of age have contact with live, wild rodents.
- Small mammals (predominantly rodents) and birds as well as insects and reptiles are hunted, trapped and consumed regularly by every member of the family.
- Animals found dead or injured are also prepared and eaten.
- Children often assist with the gutting and washing of the raw meat.
- Certain rodent species are favoured and some are also used in traditional medicinal treatments.

Knowledge of rodent ecology:

- Little knowledge of the separate rodent species and their ecology, such as seasonality, was recorded.
- Beliefs around disease risk: No-one linked rodents or wild meat in general with pathogens and disease

Samples:

- Testing for MPXV ongoing in DRC
- Several sampled rodents had internal and external parasites

Côte d'Ivoire

Breeding of cane rats:

- Yearly, 50 breeders are trained at the national breeders'association centre
- Animals come from Benin and Ghana, that have similar programs
- Private breeders usually keep about 5 breeding animals
- Selling the animals as breeding stock has bigger returns than selling as them as meat
- The majority of bred cane rats does not reach the bushmeat market

Consumption of wild meat:

- Cane rats are a preferred type of wild meat
- Bushmeat is in high demand
- Ban of wild meat during the Ebola outbreak reduced private consumption but increased customers in restaurants
- Wild meat is openly advertised and live animals are on display in restaurants

Transmission risk of zoonotic pathogens in urban CI:

- The source of wild meat is not always clear at markets and in restaurants
- The breeders' association has strict hygiene and quarantine rules
- The same was not evident with private breeders
- Rodent meat preparation is not following any hygiene standards in restaurants

SUMMARY

Our research in the Democratic Republic of Congo and Côte d'Ivoire has revealed that rodent consumption poses a significant transmission risk for zoonotic pathogens among the population. Strikingly, none of the individuals in our study associated diseases with the consumption of bushmeat, despite the government of Côte d'Ivoire informing them about Ebola and implementing a bushmeat ban. The traditional methods of hunting, trapping, and preparing rodents expose men, women, and children to potential risks. Additionally, the current cane rat breeding program in Côte d'Ivoire does not serve as an alternative source for consumers. As we move forward, the critical next step is to establish links between human cases of zoonotic pathogens and bushmeat consumption, enabling us to better understand and address this pressing public health concern. It is essential clarify the epidemiology, identify potential spill-over events, and pinpoint hot spots to enhance surveillance and preparedness efforts.

Acknowledgements

Funding was received from the Pandemic Institute Pump Priming Fund 2022

We thank Patrick Mpoya wa Mpoyo in DRC and Dr Arlette Dinde in CI for their hard work and support during data collection