



# Latin America: Situation and preparedness facing the multi-country human monkeypox outbreak

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Still without ceasing the Coronavirus Disease 2019 (COVID-19) pandemic, a new viral threat has now emerged outside its endemic niche in Africa affecting multiple countries and continents. After its appearance in May 2022, a multi-country outbreak of monkeypox disease (MPX) has triggered significant concerns due to its rapid spread and potential for sexual transmission (as suggested by the detection of viral DNA in sexual fluids); this, in addition to the previously known transmission routes described throughout endemic countries of Africa over the last decades or the imported or travel-related cases reported since 2003.<sup>1</sup>

By June 28, 2022, at least 48 cases in seven Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela) have been PCR-confirmed, with at least 16 additional suspected cases (Figure 1).<sup>2</sup> Most countries in the region have settled their epidemiological surveillance to detect probable and suspected cases according to national and international case definitions (by the World Health Organization). In addition, the Pan-American Health Organization has issued an epidemiological alert (<https://bit.ly/3MUwYNI>), with a series of considerations addressing the identification of cases, isolation, follow-up, contact tracing, clinical management, prevention and control. Nevertheless, multiple concerns have been raised, mainly from the healthcare sector,

regarding currently available treatments and vaccination. Despite the absence of specific therapeutic alternatives for MPX, drugs with proven experimental efficacy and potential clinical impact such as cidofovir (especially its lipid conjugate brincidofovir) and tecovirimat, are not widely available in the region. Also, although MPX vaccination has been implemented for contacts of positive cases, at this stage, neither non-replicating/replicating-deficient live vaccinia virus-based vaccines with low reactogenicity, such as JYNNEOS®, nor classical anti-smallpox vaccines are available in most Latin American countries.

On a more positive note, as a consequence of the COVID-19 pandemic, several countries have ramped up their current molecular testing capacity and have established broad laboratory networks sharing genomic surveillance data, resulting in better preparedness against other emerging threats such as the current MPX multi-country outbreak. Therefore, in addition to those countries throughout the region which have already confirmed cases, many others are also assessing suspected and probable cases through nucleic acid amplification tests (NAATs). Improvement in data integration between different sectors in the society, including healthcare and public health authorities, enhanced sanitary infrastructure, use of drugs with proven efficacy and safety, as well as the issuing of evidence-based



**Figure 1.** Current situation of MPX in Latin America (confirmed and suspected cases), up to June 28, 2022. Data sources: <https://www.ilpandacentrostudio.it/uk.html>, <https://www.cdc.gov/poxvirus/monkeypox/response/2022/world-map.html>.

guidelines in multiple countries has prevented a larger-scale expansion of the disease. Although it is expected that most cases of MPX will present as a mild disease, the last two and half years of the COVID-19 pandemic have positively impacted the quality of primary care interventions, build-up of intensive care units (ICU) capacities, equipment provisions and personnel training, among other advances.<sup>3</sup> One of the great challenges

and lessons learned from the pandemic relates to failures in risk communication. In this sense, strengthening epidemiological surveillance systems, and disseminating adequate information through reliable channels (official social media and web pages) with clear and assertive messages could contribute to gaining greater confidence from the broad public and assisting in the early case detection, thus halting transmission

chains and preventing further outbreaks. Public health professionals, physician communities and organizations, healthcare authorities and scientific experts should combat misinformation and disinformation proactively based on clear, direct, culturally responsive messaging that is free of unnecessary scientific jargon.<sup>4</sup>

Despite the significant advances achieved as a consequence of the pandemic, the Latin American region still faces a complex scenario with multiple unfolding syndemics, including communicable diseases, such as HIV infection, malaria, tuberculosis, orthohantavirus, arboviral diseases (particularly dengue, Zika, chikungunya, and yellow fever),<sup>5</sup> among other endemic diseases. The still-prevalent large pockets of poverty present in the region are part of an unavoidable context that influences disease emergence having a higher impact in Latin America when compared to other high-income countries. More recently, this region has also witnessed the re-emergence of some vaccine-preventable diseases, such as chickenpox, a top differential diagnosis when assessing a suspected case of MPX. Thus, vaccination programs need to be enhanced in order to recover optimal coverage. In the context of the current preparedness, there is an urgent need for healthcare workers' education on the many clinical and epidemiological aspects of MPX, including considerations about its characterization and inclusion as a part of the differential diagnoses with other endemic diseases that may overlap with similar clinical findings,<sup>6</sup> and even result in co-infections including other sexually transmitted pathogens like *Treponema pallidum* as well as other causative agents of endemic trepanomatosis like yaws (*T. pallidum* subsp. *pertenue*) and pinta (*T. carateum*) also known to be prevalent in Latin America.<sup>8</sup>

A major global concern among research and public health personnel relates to the risk and implications of the potential zoonotic transmission of MPX outside its endemic niche in several African countries. Can we have endemicity and animal hosts that may sustain further transmission cycles outside Africa? Some likely hosts, such as *Didelphis marsupialis*, *Monodelphis domestica* (opossums), *Sus scrofa domestica* (domestic pig), among others, have proved susceptible and are present in Latin America. These aspects of potential spillover to other susceptible species in the Americas deserve careful consideration and close monitoring.<sup>9</sup> Several clinical, virological, and immunological aspects also deserve urgent research, mainly because, although the disease was discovered in humans in 1970, there is a significant knowledge gap as evidenced by recent bibliometric studies.

Despite its still moderate risk for expansion, allocation of necessary resources, strengthening epidemiological surveillance systems, and increased capacity building should be promptly prioritized in Latin American countries to detect imported cases and limit onward transmission (including autochthonous cases), which is expected to

occur after the arrival imported cases. Latin America, fortunately, is now more prepared to confront new epidemic threats, as in the case of MPX.<sup>10</sup>

## Contributors

A.J. Rodríguez-Morales wrote the original draft. All authors contributed to reviewing and editing.

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## References

- 1 Reed KD, Melski JW, Graham MB, et al. The detection of monkeypox in humans in the Western Hemisphere. *N Engl J Med*. 2004;350(4):342–350.
- 2 León-Figueroa DA, Bonilla-Aldana DK, Pachar M, et al. The never ending global emergence of viral zoonoses after COVID-19? The rising concern of monkeypox in Europe, North America and beyond. *Travel Med Infect Dis*. 2022;49:102362.
- 3 Rodríguez-Morales AJ, Paniz-Mondolfi AE, Faccini-Martínez Á A, et al. The constant threat of zoonotic and vector-borne emerging tropical diseases: living on the edge. *Front Trop Dis*. 2021;2:676905.
- 4 Rodríguez-Morales AJ, Franco OH. Public trust, misinformation and COVID-19 vaccination willingness in Latin America and the Caribbean: today's key challenges. *Lancet Reg Health Am*. 2021;3:100073.
- 5 Rodríguez-Morales AJ, Cardona-Ospina JA, Collins MH. Emerging and re-emerging vector-borne and zoonotic diseases. *Front Med*. 2021;8:714630.
- 6 Rodríguez-Morales AJ. Monkeypox and the importance of cutaneous manifestations for disease suspicion. *Microbes, Infect Chemother*. 2022;2:e1450.
- 7 Bízová B, Veselý D, Trojánec M, Rob F. Coinfection of syphilis and monkeypox in HIV positive man in Prague, Czech Republic. *Travel Med Infect Dis*. 2022;49:102368. <https://doi.org/10.1016/j.tmaid.2022.102368>.
- 8 Giacani L, Lukehart SA. The endemic treponematosis. *Clin Microbiol Rev*. 2014;27(1):89–115.
- 9 Bonilla-Aldana DK, Rodríguez-Morales AJ. Is monkeypox another reemerging viral zoonosis with many animal hosts yet to be defined? *Vet Q*. 2022;42(1):148–150. <https://doi.org/10.1080/01652176.2022.2088881>.
- 10 Cimerman S, Chebabo A, da Cunha CA, Barbosa AN, Rodríguez-Morales AJ. Human monkeypox preparedness in Latin America – are we ready for the next viral zoonotic disease outbreak after COVID-19? *Braz J Infect Dis*. 2022;26(3):102372. <https://doi.org/10.1016/j.bjid.2022.102372>.