

Analyzing Mpox: Understanding Epidemiology, Public Health Impact, and Mitigation Strategies

Final Report

Introduction

Mpox (Monkeypox) which was previously rare and mostly confined to specific regions, has recently seen an increase in cases and spread to new areas. This emergence presents a challenge for public health systems that are not fully prepared for a disease that was once considered uncommon. Mpox is a zoonotic disease, meaning it can be spread between animals and people.

Clade I & Clade II, which are two strain variants of Mpox, are endemic in parts of Central and West Africa. *Clade I* variant tends to be more severe, with a higher fatality rate and greater potential for human-to-human transmission. Meanwhile *Clade II* has lower virulence causing mild infection and has had lower mortality rates.

Mpox originates from West and Central Africa which are two areas that are known to have very poor healthcare systems resulting in limited access to quality healthcare for most people in the region increasing the chance of a widespread outbreak.

Public health Impact

The analysis of "Monkeypox outbreak" could help by:

Improving public health preparedness, policy-making, and healthcare responses. By detailing trends and mitigation strategies, it helps public health authorities manage outbreaks more effectively and guides policymakers in creating targeted interventions. The findings also boost public awareness and education, reduce stigma, and encourage international collaboration. Additionally, the analysis identifies gaps and opportunities of innovation, driving further research and investment in effective treatments and prevention.

Data

File Name: mpox cases by country as of 31 august 2024.csv

Description: Information on mpox cases, test results, iso3, and test date entry.

Dataset Details: 13230 Rows and 10 Columns

Size: 734KB

Source: [World Health Organization \(WHO\)](https://www.who.int/emergencies/diseases/nipw/monkeypox)

Data Analysis & Computation

Data Profiling:

Check the first and the last five rows in the dataset for a general insight

Examine information about the null values or duplicate values

"ISO3" ISO 3166-1 Country Code published by the international Organization for Standardization (ISO)

Observations & Data Wrangling:

There are duplicate values under "total_confirmed_cases"

All of the data is usable except "Column E"

I'll just be using the max number in "total_confirmed_Cases" for each ISO3

Data Table Schema:

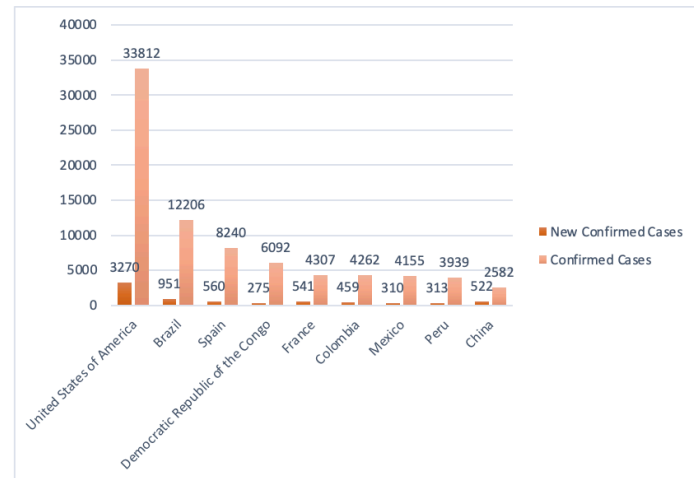
Field	Type	Description
country	String	Country of case entry
iso3	String	ISO 3166-1 Country Code
who_region	String	"Who Regions" A total of six regions; while they are based on geographical terms, are not synonymous with geographical areas.
date	Date/Time	Date of entry
total_confirmed_cases	Integer	Summed amount of total confirmed cases
total_probable_cases	Integer	Summed amount of total probable cases
new_confirmed_cases	Integer	Count of new confirmed cases
new_probable_cases	Integer	Count of new probable cases
total_deaths	Integer	Summed amount of total deaths
new_deaths	Integer	Count of new death entry

Data Analysis:

1 - Total Confirmed Cases

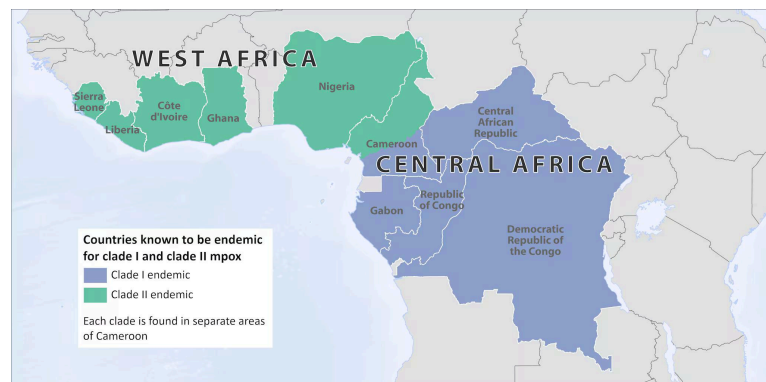
Sum of total number of confirmed cases.

Top 5 are the United States, Brazil, Spain, Democratic Republic of the Congo. This specific chart was made on Excel just to Present the "Top 9" highest countries with their count. There is a map version which was made with Tableau.



2 - Strain Variants

Upon further study Mpox has formed two strains in which originate from West & Central Africa. Clade I taking over the Central Africa region with Infections that tend to be more severe, causing a higher fatality rate and a greater potential for human-to-human transmission. Meanwhile Clade II has a lower virulence with lower mortality rates and milder infections.



3 - Strategies

Given that the endemic area is West & Central Africa there are a number of strategies to combat this outbreak as it is still ongoing. This specific data is up until August 31st, 2024 but there can be worse outbreaks so here are the methods I see most applicable.

Vaccination Campaigns

Considering that West Africa and Central Africa are the two countries known to be the endemic source for both strains of mpox it'd be a wise investment for nations or the government to enable "Vaccination Campaigns" for these two areas specifically as it'll reduce the outgoing transmission.

- It'd be best to administer vaccines to high-risk groups (healthcare workers, individuals exposed to confirmed cases, LGBTQ+ communities, or those in affected areas).

- For more information on recommendations for Vaccine Administration visit, <https://www.cdc.gov/poxvirus/mpox/vaccines/vaccine-recommendations.html>

Surveillance and Early Detection

Focus on high-risk populations and regions, including places where mpox outbreaks have previously occurred. Along with this strengthen surveillance systems to quickly identify new cases. Use case reporting, contact tracing, and genomic sequencing to track the spread of the virus.

- Easiest way to implement this would be with international travel and having passengers fill out a quick health survey.
- Monitor local clinics or other facilities commencing care for anything mpox.

Contact Tracing and Quarantine

Identify and monitor individuals who have been in contact with infected patients to prevent further spread. Digital tools can help track exposure and notify contact in real-time. Provide resources for individuals under quarantine, such as housing, food, and mental-health services, to ensure compliance.

- This method is very popular and has been successful for containing the Covid-19 virus.

Conclusion & Future Work

Conclusion:

Based on current records from WHO it'd be best to control the outbreak from the source and then follow through with countries that follow up. Since the start of this outbreak in 2022 to August 2024 there have been a total of 106,310 confirmed cases throughout the whole world with the US, Brazil, and Spain being the top three countries with Democratic Republic of the Congo being fourth. It's safe to say that by using vaccination campaigns and other methods we are able to confine the number of cases and prevent further outbreaks. There have been measures put in place but increasing public awareness will additionally enhance the defense line towards this virus.

Future Work:

As this is an ongoing virus and an outbreak is possible it'd be best to keep an eye out on endemic areas as there are chances for new strains to be produced considering that the endemic area isn't so fortunate to have a streamlined healthcare.

I've come up with this final report but most of these strategies and foreseeable actions have been done or are currently being done. This is a live on-going virus that is being monitored very closely by "World Health Organization" (WHO).

Most recently there have been a couple of diagnostic tests for emergency use with there being four but only one is fully finished and in use. Manufactured by Abbott Molecular Inc, "The Alinity m MPXV assay" has been helping massively with expanding diagnostic capacity so this will be a pivotal moment for MPOX.

For more information on diagnostics tests

<https://www.who.int/news/item/03-10-2024-who-approves-first-mpox-diagnostic-test-for-emergency-use--boosting-global-access>

All official discovery and other insights are available to the public here

<https://www.who.int/news?healthtopics=c72af405-a7c2-4a06-980e-09adf19eb376>