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Descriptive Analysis of the Burden of Mpox in Nigeria 2022-2024

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Abstract

Aim to study: Nigeria has continued reporting outbreaks of Mpox since 2017 despite control measures instituted by the one health tripartite sector. This study aimed to assess the burden of Mpox in Nigeria between 2022 and 2024 by identifying geographical hotspots and calculating epidemic thresholds based on reported cases.

Material and methods: Mpox outbreak reports from the Nigeria Centre for Disease Control and Prevention (NCDC) for 2022–2024 were reviewed to identify affected states and determine confirmed case counts. Geospatial analysis was conducted using ArcGIS software to identify Mpox outbreak hotspots.

Results: A total of 984 confirmed Mpox cases were reported across 36 states and the Federal Capital Territory (FCT), resulting in 9 fatalities. Lagos State emerged as a major hotspot, accounting for 24.7% of cases (188 cases) in 2022, while Cross River and Plateau States became prominent in 2024. The epidemic thresholds were 115 in 2022, 43 in 2023, and 15 in 2024. Young adults aged 21-40 years were the most affected, and children under 10 years represented an emerging at-risk group in 2024, comprising 30% of reported cases. Geospatial analysis revealed shifting hotspots, contrary to earlier studies that identified Rivers and Bayelsa as major clusters.

Conclusion: These findings underscore the need for enhanced surveillance, targeted public health interventions, and improved healthcare access to mitigate Mpox transmission in Nigeria.

Keywords: Epidemic threshold, ArcGIS, Mpox

Nijerya'da 2022-2024 Yılları Arasında Mpox Yükünün Tanımlayıcı Analizi

Öz

Çalışmanın amacı: Nijerya, tek sağlık çerçevesinde görev yapan üçlü ortaklık tarafından uygulanan kontrol önlemlerine rağmen 2017'den bu yana Mpox salgınlarını bildirmeye devam etmektedir. Bu çalışma, 2022-2024 yılları arasında Nijerya'da Mpox'un yükünü değerlendirmeyi, coğrafi odak noktalarını belirlemeyi ve bildirilen vakalara dayalı olarak salgın eşiklerini hesaplamayı amaçlamaktadır.

Materyal ve yöntemler: Nijerya Hastalık Kontrol ve Önleme Merkezi (NCDC) tarafından 2022-2024 yılları arasında bildirilen Mpox salgın raporları incelenerek etkilenen eyaletler belirlenmiş ve doğrulanmış vaka sayıları tespit edilmiştir. Mpox salgını odak noktalarını belirlemek için ArcGIS yazılımı kullanılarak coğrafi analiz gerçekleştirilmiştir.

Bulgular: 36 eyalet ve Federal Başkent Bölgesi'nde (FCT) toplam 984 doğrulanmış Mpox vakası bildirilmiş ve bu vakalar 9 ölümle sonuçlanmıştır. Lagos Eyaleti, 2022'de vakaların %24,7'sini (188 vaka) oluşturarak önemli bir odak noktası olarak öne çıkmış, Cross River ve Plateau Eyaletleri ise 2024'te önem kazanmıştır. Salgın eşikleri 2022'de 115, 2023'te 43 ve 2024'te 15 olarak hesaplanmıştır. 21-40 yaş arası genç yetişkinler en fazla etkilenen grup olurken, 10 yaş altı çocuklar 2024'te bildirilen vakaların %30'unu oluşturarak yeni bir risk grubu haline gelmiştir. Coğrafi analiz, önceki çalışmalarda Rivers ve Bayelsa'nın ana odak noktaları olarak belirlenmesinin aksine, değişen odak noktalarını ortaya koymuştur.

Sonuç: Bu bulgular, Nijerya'da Mpox bulaşmasını azaltmak için gelişmiş sürveyans, hedeflenen halk sağlığı müdahaleleri ve iyileştirilmiş sağlık hizmeti erişiminin gerekliliğini vurgulamaktadır.

Anahtar kelimeler: Salgın eşiği, ArcGIS, Mpox

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Introduction

Mpox, formerly known as monkeypox, is a viral disease caused by the Monkeypox virus of the family *Poxviridae* and genus *Orthopoxvirus* (Beer & Rao, 2019; WOAH, 2024a). The disease was first reported amongst colonies of monkeys kept for research purposes at the State Serum Institute in Denmark in 1958 (Chieloka et al., 2020, 2022a; Durski et al., 2018). The first human case was identified in 1970 in the Democratic Republic of Congo (Sejvar et al., 2004). Recent studies have identified several populations at risk of Mpox infection, including healthcare workers (Mauldin et al., 2022), reproductive-aged adults who frequently attend crowded social gatherings (Owoicho, 2019), individuals who consume wild rodents known as "bush meat" (Chieloka et al., 2020), and men who have sex with men (WOAH, 2024b). The Mpox virus is classified into two groups/clades: The Central African clade, responsible for severe morbidity, and the West African clade, which causes mild symptoms (Chieloka et al., 2022; Durski et al., 2018; Nolen et al., 2016). The natural reservoirs of Mpox have not been identified (Kaler et al., 2022). However, animal sentinels (Rope squirrel, Gambian pouched rat have been suggested as potential reservoir hosts of Mpox (Abafi et al., 2024; CDC, 2024; Weinstein et al., 2005). Furthermore, the transmission of Mpox infection has been reported through fomites and the exchange of bodily fluids (Heymann et al., 1998). In infected individuals, symptoms may last for 2 to 4 weeks, characterised by fever, headache, muscle pain, and pustular rashes identical to smallpox lesions and swollen lymph nodes (WOAH, 2024a, 2024b; Yale Medicine, 2025). In January 2022, the WHO approved the use of TPOXX (Tecovirimat®) for the management of Mpox cases, and preliminary results have indicated a reduction in the duration of hospital stay (Chieloka et al., 2022; The Guardian UK, 2022). Three vaccines have been approved against Mpox (MVA-BN, LC16, and Orthopox Vaccine). It is noteworthy that individuals who were vaccinated against smallpox have an 85% seroprotective rate against Mpox (Chieloka et al., 2020). Since September 2017, sporadic outbreaks of Mpox have continued to be reported in Nigeria (Chieloka et al., 2020). In a previous study, (Chieloka et al., 2022), identified the hotspots of Mpox in Nigeria from 2017 to 2021 and posited that outbreaks of Mpox were clustered in two geopolitical zones in Nigeria: South-south and South-west. A total of 226 confirmed Mpox cases were reported across 20 states, resulting in eight human fatalities; the most affected age group was young adults aged 21-30 years. The purpose of this study was to describe the burden of Mpox in Nigeria from 2022 to 2024, identify the hotspots of outbreaks of Mpox in Nigeria, and determine the epidemic threshold of the outbreak of Mpox in Nigeria to inform public health actions.

Material and Methods

Study Area and Design

Nigeria is a West African country bordered by the Republic of Niger to the north, Chad to the northeast, Cameroon to the east, and the Republic of Benin to the west. It comprises 36 states and the Federal Capital Territory (FCT), with an estimated population of over 200 million (Worldometers, 2024). This retrospective study analyzed Mpox outbreak situation reports obtained from the Nigeria Centre for Disease Control and Prevention (NCDC) between 2022 and 2024. The study identified affected states and determined the number of confirmed Mpox cases reported during this period.

Geospatial analysis using ArcGIS (Geographic Information System) was conducted to describe the distribution of confirmed Mpox outbreaks. Hotspots were color-coded based on disease burden and classified as major/high, medium, or minor/low clusters. The epidemic threshold

(EPT) for Mpox cases was calculated using the cumulative sum (CUSUM) method for 2022–2024, with the formula:

EPT=Mean number of Mpox cases (Epidemic $Months_{1–12}$) + 3(standard deviations of Epidemic $Months_{1–7}$ of the year under consideration).

Source of Data

The study utilized Mpox outbreak situation reports from the NCDC repository (2022–2024). Data included age distribution of the affected population across the states. Monthly Mpox situation reports were obtained, and confirmed outbreak reports were cross-checked with state-level case reports to ensure accuracy. Variables were displayed in tables, and ArcGIS was used to map Mpox hotspots across affected states.

Participants

This study analyzed data from all 36 states of Nigeria and the FCT, focusing on those with confirmed Mpox cases.

Variables

Includes number of states with confirmed cases of Mpox, number of affected states, age distribution of population at risk. Disease outbreaks were classified based on burden by epidemic week to determine the epidemic threshold.

Data Validation

To minimize bias, Mpox data were validated by comparing NCDC surveillance reports with state-level case confirmations.

In 2024, available Mpox data covered Epidemiological weeks 1–44. Furthermore, backlogs of presumptive positive cases from epidemic weeks 45 to 52 of 2024 which were later confirmed as positive for Mpox was accessed in Epidemic one of 2025.

Quantitative Variables

We identified and determined the number of states with confirmed Mpox cases, determined the number of states with new cases of Mpox, and tabulated variables in tables; cumulative sum statistic was used to determine the epidemic threshold based on the number of cases from epidemic week 1 to 52 of the year (2022-2024).

Results

In 2022, Nigeria reported 762 confirmed Mpox cases across 35 states. Lagos State was the primary hotspot, accounting for 188 cases (24.7%), while the remaining 34 states collectively formed minor clusters, contributing 574 cases (75.3%) (Table 1, Figure 1). Individuals aged 31–40 years (205 cases, 26.9%) were the most affected group (Table 2). Seven fatalities were recorded, and 15 states with no prior history of Mpox reported outbreaks within the period.

In 2023, 98 confirmed Mpox cases were reported across all 36 states. Lagos State remained a major hotspot, with 27 cases (27.6%), while Ogun State, with 17 cases (17.3%), was classified as a medium-risk cluster. The remaining 34 states reported 54 cases (55%), categorized as minor clusters. The most affected age group was 21–30 years (24 cases, 24.5%), and two fatalities were recorded. One state with no previous Mpox cases reported outbreaks in 2023.

In 2024, 124 confirmed Mpox cases were reported in 28 States, Cross River and Plateau State with 13 cases (12%) were major cluster of Mpox, Bayelsa state with 7 cases (6%), Lagos, 10 (9%), Delta, 8 (7%), Akwa Ibom, 8 (7%), FCT Abuja 6(5%), and Edo States with 6 cases (5%) were medium clusters of Mpox, 29 other States were minor clusters for Mpox which represents 37% of cases within the period. There were no human fatalities reported in 2024. Individuals aged 21–

30 years and children aged 0–10 years were equally the most affected groups, each comprising 33 cases (30%). The epidemic thresholds for human Mpox outbreaks were calculated as 115 in 2022, 43 in 2023, and 15 in 2024 (Table 3).

Table 1: Distributions of confirmed Mpox cases from 2022-2024

States	**Mpox 2022**	**Mpox 2023**	**Mpox 2024**	**Cumulative Mpox 2022 to 2024**
Rivers	37	4	3	44
Bayelsa	45	2	7	54
Lagos	188	27	10	225
Delta	31	3	8	42
Cross River	12	1	13	26
Imo	45	5	4	54
Akwa Ibom	12	4	8	24
Oyo	10	1	2	13
Edo	27	4	2	33
FCT, Abuja	25	4	6	35
Enugu	4	4	6	14
Abia	58	6	4	68
Plateau	16	0	13	29
Nasarawa	17	1	1	19
Benue	10	0	5	15
Anambra	25	0	2	27
Ekiti	1	1	0	2
Ebonyi	12	1	1	14
Niger	1	1	1	3
Ogun	40	17	5	62
Ondo	40	2	1	43
Adamawa	16	0	1	17
Borno	11	2	0	13
Taraba	7	0	0	7
Kano	7	0	0	7
Gombe	6	0	1	7
Kogi	5	2	0	7
Osun	5	1	2	8
Kebbi	2	1	1	4
Bauchi	1	0	1	2
Zamfara	1	0	1	2
Yobe	1	0	0	1
Jigawa	0	1	0	1
Katsina	8	1	1	10
Kaduna	15	2	1	18
Kwara	21	0	1	22
Total	762	98	112+12(124)	972

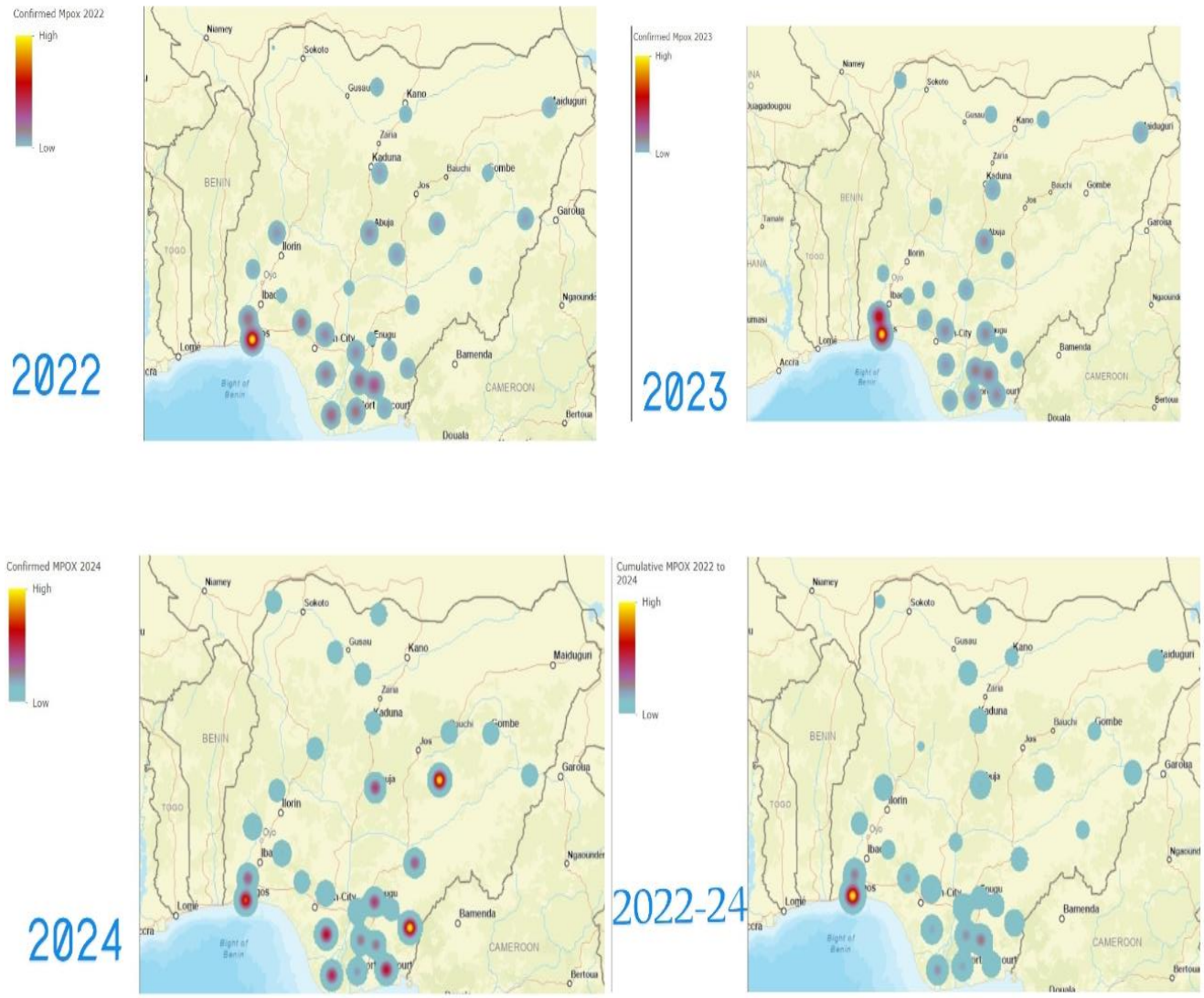

Figure 1: Map of Nigeria showing hotspots and thecumulative Mpox cases from 2022-2024

Table 2: Age distribution of confirmed mpox cases 2022 - 2024

Age group(s)	Number of people 2022	Number of people 2023	Number of people 2024
<10	125	21	33
11-20	123	8	22
21-30	187	24	33
31-40	205	21	18
41-50	89	17	15
51-61	33	7	8
Total	762	98	129

Table 3: Epidemic threshold of Confirmed Mpox from 2022-2024

Epidemic Months	Number of Cases in 2022	Number of Cases in 2023	Number of Cases in 2024
January	3	27	2
February	5	21	4
March	0	18	6
April	0	6	8
May	15	7	3
June	61	1	7
July	72	0	7
August	86	0	11
September	134	0	29
October	181	0	30
November	158	18	6
December	47	0	0
EPT	115	43	15

Discussion

In all, 984 confirmed Mpox cases were reported in Nigeria from 2022 to 2024, with 9 human fatalities across 36 States and the Federal Capital Territory (FCT) young adults and children between 21-30, 31-40, and less than 10 years of age were at a higher risk of infection. The age distribution of the population at risk agrees with findings by (Chieloka et al., 2020). However, children aged less than 10 years appear to be an emerging at-risk group for Mpox, particularly in 2024. Mpox outbreaks were clustered in the six geopolitical zones of Nigeria across the 36 States and the FCT from 2022 to 2024. Lagos State was identified as Major hotspot of Mpox in Nigeria. These findings contrast with (Chieloka et al., 2022), which identified Rivers and Bayelsa States as major hotspots, while Lagos and Delta states were medium clusters of Mpox from 2017 to 2021. It is worth noting that from 2017 to 2021, an outbreak of Mpox was reported in 19 States and FCT Abuja (Chieloka et al., 2022) in contrast to 36 states and FCT Abuja reported by the present study. Furthermore, from 2022-2024, sixteen states with no previous history of Mpox since 2017 reported outbreaks of Mpox. This may be attributed to improvements in the surveillance system, including enhanced sample collection procedures and diagnostic capacity.

As of April 30, 2024, the World Health Organization reported 95,226 laboratory-confirmed cases of Mpox with 185 deaths from 117 countries (WHO, 2024). Nigeria has played an important role in the global spread of Mpox, (Mauldin et al., 2022; Vaughan et al., 2018); this underscores the importance of effective control of current outbreaks of Mpox to prevent its spread across international borders. The epidemic

thresholds (EPTs) for 2022, 2023, and 2024 were 115, 43, and 15, respectively.

In 2022, mpox cases exceeded the epidemic threshold between September and November but declined to 47 cases by week 52 in December. This may have contributed to the sporadic outbreak of Mpox in the first quarter of 2023. The observed number of outbreaks of Mpox in 2023 was below the epidemic threshold, which may be attributed to control measures and policies instituted by one health tripartite subsector to control outbreaks of Mpox. In 2024, observed Mpox cases exceeded the epidemic threshold in Epi week 32 and peaked with 30 cases at week 36 of 2024; this finding agreed with (Chieloka et al., 2022) and may have contributed to the sporadic spread of Mpox from 2022-2024 (Figure 2).

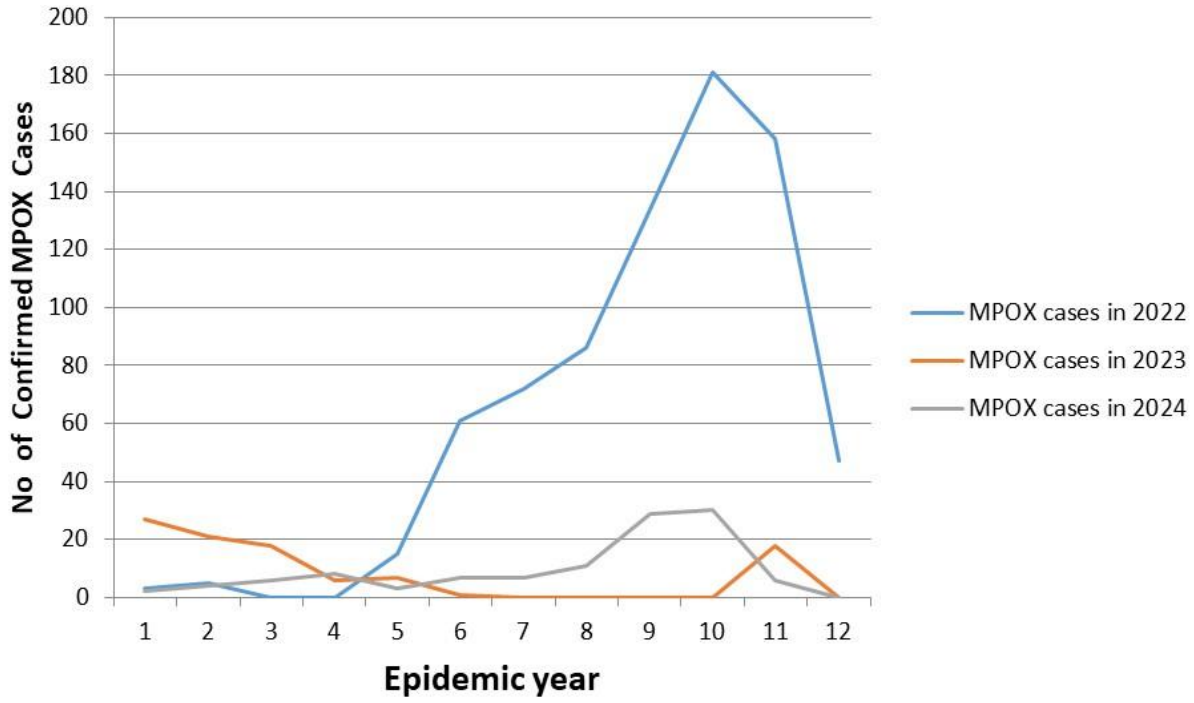

Figure 2: Trend for the outbreak of mpox in Nigeria 2022-2024

Conclusion

Sporadic outbreaks of Mpox were reported across Nigeria from 2022 to 2024, and these may continue unless surveillance and control measures are strengthened. The groups most affected were young adults and children under 10 years old. There is a possibility of horizontal transmission from parent to child, but further epidemiological investigations are needed to confirm this hypothesis. Consequently, the study recommends enhanced surveillance for Mpox at various entry points and healthcare facilities in Nigeria, along with updated demographic information on the affected population and associated risk factors for Mpox infection.

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This study did not receive a grant by any financial institution/sector.

Ethical Statement

This study was approved by College of Veterinary surgeon University of Nigeria Nsukka (5.04.2025.CVSN/VPMF/23/22)

Author Contributions

Dr. Okoli Solomon Chieloka responsible for the conceptual framwork and writing of this manuscript, Dr. Abdulkereem Durosinlorun ensure proper data management, Dr. Ogugua supervised this manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon request.

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