

## An Outbreak of Monkeypox in Doedain District, Rivercess County, Liberia, June, 2017

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**KEYWORDS:** Monkeypox, Liberia, zoonoses

### ABSTRACT

**Introduction:** Monkeypox is a zoonotic virus disease with symptoms similar to smallpox, although less severe. The last confirmed monkeypox case in Liberia was recorded in 1970 from Grand Gedeh County. On June 23, 2017, Rivercess County Health Team received information from Dodain District, Rivercess County about a suspected monkeypox that reported at the clinic on June 19. We investigated to verify the report, confirm the diagnosis, determine the source and magnitude of the disease, and recommend evidence-based control and prevention measures. **Methods:** We defined a suspected case as any person who presented with generalized rash with fever, headache, lymphadenopathy, back pain, myalgia, and weakness in Dodain District from June 1 to July 1, 2017. We defined the probable case as a suspected case in whom the clinician suspected monkeypox. A confirmed case was a suspected or probable case with laboratory confirmed monkeypox. We reviewed patient records, and using the case definitions, we conducted active case search and contact tracing in the affected community to identify cases. We interviewed family and community members to identify cases and contacts. We performed laboratory tests on identified cases to confirm the diagnosis. We monitored and followed up contacts for 21 days to see if any developed signs and symptoms. **Results:** We identified two cases, one confirmed, and one suspected. The confirmed case was an 8-year old male with onset of symptoms on 17 June 2017. He presented with rashes, fever, and headache. His mother (a suspected case/primary case) was a farmer married to a hunter. She had similar symptoms (onset date, 19th April 2017) but recovered two weeks before her son's onset. Although the suspected case's husband was a hunter, there was no clear information that the primary case had been exposed to bush meat. Both the mother and her child had not traveled outside their area of residence. Both cases responded well to symptomatic treatment. None of the 15 contacts developed signs and symptoms in the 21-day follow-up. **Conclusion:** This was a confirmed outbreak of monkeypox in Dodain District, Rivercess County whose source was not identified. The outbreak was most likely spread through person-to-person transmission. The outbreak was controlled through effective case management, awareness in the community and early reporting.

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## Introduction

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Monkeypox is a zoonotic disease caused by the monkeypox virus. The virus is a member of the orthopoxvirus genus from the Poxviridae family [1]. Monkeypox is one of the four orthopoxvirus species that cause diseases for humans. The other three orthopoxvirus species are cowpox virus, vaccinia, and variola virus, the causative agent of smallpox that was eradicated in 1978 [2]. The main difference between monkeypox and smallpox is the lymph node enlargement at onset of fever of a monkeypox patient [3]. The virus is transmitted through saliva, respiratory excretions or contact with lesion of infected persons, animals or materials [4].

The incubation period for monkeypox is usually 7–14 days with the range from 5–21 days [3]. The direct reservoir of the monkeypox virus is not yet known. However, interaction with infected wildlife through activities such as hunting and eating inadequately cooked meat of an infected animal; and handling infected rats are likely routes of infection from wildlife to humans [1]. The disease is usually self-limiting though severe forms occur in children and immuno-compromised persons [4]. The case-fatality rate ranges from 1 to 10% [1].

Monkeypox was first discovered in 1958 in a group of monkeys kept for research purposes [5]. The first human monkeypox virus case was recorded in August 1970 in Bokenda, a remote village in Zaire now DRC [5] and since then, monkeypox has been periodically reported in humans in Central and Western African countries. The first case of monkeypox outside of Africa was seen in the USA in 2003. The disease was believed to have been introduced in the USA by wild rodents and spread to 11 different states in the country [6].

The majority of documented human monkeypox cases crop up in the Democratic Republic of the Congo (DRC), where it was first recognized as a human disease in 1970. During the last decade, there has been an increase in the number of cases in other West and Central African countries. Many of these countries had not reported a case for several decades [7]. Since 2016, monkeypox cases have been reported and confirmed in humans from Central African Republic 19 cases; DRC, about 1000 reported per year; Liberia 2; Nigeria, more than 80 cases; Republic of the Congo, 88 and Sierra Leone, 1 case. An outbreak in captive chimpanzees occurred

in Cameroon with 80 confirmed cases [8]. The largest documented outbreak of human monkeypox in West Africa was in Nigeria in 2017 [9].

The last monkeypox confirmed case in Liberia was recorded in 1970 from Grand Gedeh County [6]. Since then, there have been no confirmed case reported in Liberia. Monkeypox is not considered a priority disease under the Integrated Disease Surveillance and Response (IDSR) in Liberia. However, it is recommended that the surveillance team investigate and report any strange disease condition and event seen in the community. There is no laboratory capacity in Liberia for confirmation of monkeypox [7].

On June 23, 2017 a suspected case of monkeypox was reported from Dodain District in Rivercess County. The case presented with macules rash, fever headache and general body pain. We investigated to confirm the diagnosis, estimate the magnitude of the disease, identify the source of transmission, and recommend evidence-based control and preventive measures.

## Methods

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**Study setting:** The outbreak occurred in Burdue Town, Dodain District, at the northern part of Rivercess County with 3 health facilities (Kangbo, Gozohn, and Bogezeay clinic). Burdue Town has 215 inhabitants within Kangbo clinic catchment. The outbreak started on June 9, 2017 and ended July 29, 2017. To declare the outbreak over, we considered twice the incubation period of the disease from the time the last case was reported.

The district has an estimated population of 15820(8). This population was also confirmed by the stakeholders of the community. The district is bordered by Grand Bassa County to the south, Nimba County to the east, Grand Gedeh to the north, and Jowein District in Rivercess to the west [Figure 1](#). The main livelihoods of inhabitants in the district are hunting, farming, and petty mining. The district has a very large forest land that found between them and Grand Gedeh county. Most of the inherent of the district use this forest for hunting.

## Case definition

We defined the suspected case as any person with a generalized rash, fever, headache, lymphadenopathy, back pain, myalgia or weakness or any person in whom the clinician suspected monkeypox in Dodain District from May 1, to July 1, 2017. We defined the probable case as any patient with unexplained rash, fever and swollen of limb node of the groin or any person in whom the clinician suspected monkeypox. And the confirmed case as a suspected or probable case with laboratory confirmation of monkeypox [9].

## Case finding

To identify cases, we reviewed medical records at health facilities serving the affected community on June 24, 2017. This exercise lasted for a day. During the exercise we extracted data pertaining to socio-demographic information, medical history, signs, symptoms, and duration of illness from the medical book at the health facility. We used the CDC standard case investigation form to collect all our information [3].

With the help of trained health workers and Community Health Assistants (CHA), we also actively looked out for cases in the affected communities and also set up an active case finding team to continue with surveillance activities within the district after the initial outbreak investigation. Additionally, we conducted interviews with town chiefs, religious leaders, youth leaders, and parents of the case patient in the community to obtain information on travel history, the contacts of the case, and exposures including interaction with wild animals and eating of bush meat. We defined a contact as any person who shared the same sleeping space, bathroom, eating in the same pot, providing care for the case without considering IPC measures. We line listed all the contacts based on the above criteria, they were monitored and followed up for 21 days by the community health volunteers (contact tracers). Case was isolated at home and treated by professional health workers from the Kangbo Town community clinic systematically. In providing care for the patient, health workers were orientated on infection prevention and control protocols and which they strictly observed. We raised awareness of risk factors of the disease and educated community dwellers about the measures they could take to

reduce exposure to the virus. Additionally, they were informed of the mode of transmission of the disease. They were also taught to avoid unprotected contact with wild animals, especially those sick or dead, including their meat, blood and other parts. And all foods containing animal meat or parts had to be thoroughly cooked before eating.

## Laboratory investigations

We collected a whole blood sample and lesion swab with photo of the lesion from the probable patient on June 25, 2017 and sent it to Centers for Disease Control and Prevention (CDC; Atlanta, GA) for laboratory diagnosis using reverse transcription polymerase chain reaction (RT-PCR).

## Availability of data and material

The data on which this write up is based belongs to the Ministry of Health Liberia and is not publically available. However, the data could be gotten from the corresponding author with reasonable request, and with permission from the Ministry of Health Liberia.

## Ethical consideration

This was a public health emergency. The National Public Health Institute of Liberia and the Ministry of health, Liberia gave the directive to do the investigation. Community members, contacts, and the patient's family members were educated and informed about the investigation and verbal consent was granted for the investigation.

## Results

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We identified two cases of monkeypox (one confirmed and 1 suspected) in Burdure town community, Dodain District. The index case (confirmed case) was an 8-year old male with an onset of symptoms on June 17, 2017. He presented to the Kangbo Town health facility on June 19, 2017 with skin rashes, fever, weakness, and severe body pain. He reported that the rash started on his face and mouth and then extended to the arms, trunk, and legs [Figure 2](#). Patient was treated symptomatically at the clinic and sent home with oral medication. He was isolated at home and being followed up by clinician from the primary health

care facility in the area. We received laboratory confirmation 6 months after sample collection from the US Centers for Disease Control and Prevention, Atlanta. The sample was collected on June 25, 2017 and result came December 4, 2017.

The mother to the index case had had similar signs and symptoms to her son which included skin rashes, fever, general body pain and weakness, but recovered 2 weeks before the onset of her son's symptoms. She was considered as the primary case. She was a 31-year old farmer from the same community of the index case. She lived in the same household with the index case. Her onset of symptoms was on June 9, 2017. She was a residence of Burdue Town, and she had not traveled out of the town during the past 3 months according to her husband. There was no laboratory specimen collected for the primary case. Her husband was also a resident of the same town and a farmer involved with hunting activities. Although the husband of the primary case was involved in hunting activities, there was no clear information on whether she had consumed or interacted with bush meat before symptom onset.

The index case received symptomatic treatment at the health facility with analgesia and antibiotics. The primary case did not attend clinic during illness. She was treated at home with traditional medicine which could not be identified during the investigation. Both cases recovered fully. There were no unusual deaths and no further cases were identified. Of the 215 habitants in Burdue town, only two persons were affected by the disease (attack rate  $\approx$  1 case per 100 persons).

### Contact tracing and monitoring findings

We identified 15 contacts and they were all family members of the two cases, living in the same household as the cases. The contacts were 5 brothers, 4 sisters, 2 uncles, 1 aunt, father, mother and grandmother. All the contacts listed shared a bathroom and used the same bath bucket. With the exception of the mother who had the disease before the index case, none of the remaining contacts developed the disease.

## Discussion

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This was a confirmed monkeypox outbreak in Burdue Town, Dodain District, Rivercess County. Our study was unable to identify the direct source of infection. However, it may probably be associated with animal-to-human transmission since the index case husband is a hunter. We observed that human behavior and social activity in these populations were largely fulfilled by material and nutritional needs via forest resources rather than purchases at a market. Many villages are surrounded by forest and they do not have markets of their own. This finding is similar to a study which says multiple infection can be associated with communities of low and relatively high socio-economic status [10].

Both cases presented with signs and symptoms typical of monkeypox infection. The cases came from a very remote part of the district with low access to health care services. It has been documented that contributing factors to the re-emergence of disease may include poverty, weak public health infrastructure, and poor access to health facilities [11]. Monkeypox is a re-emerging disease in Liberia. The last case of the disease in Liberia was in 1970. From that time, there was no case reported until 2017 [12]. Monkeypox has also been reported to re-emerge in Nigeria, in areas such as Bayelsa State in 2018 and Zaire in 1997 [13].

There was limited spread of the disease, even though a human-to-human transmission was suspected because symptoms of onset occurred in the close contact of a confirmed case at an interval consistent with the incubation period of 5-21 days of the disease [4]. The limited spread of the disease could have been due to the prompt intervention by the surveillance team at both county and district level.

Even though we did not establish the source of infection, like other cases been reported [14], no specific contact either with a monkey known to be infected or with other bush animal could be identified but the patient lived in dense tropical rain forest where monkeys are frequently eaten.

It is also likely that the index case contracted the disease from the mother since he was quite young and therefore closely interacted with her. The mother used to routinely take care of the boy.

## Limitations

It took 6 months from sample collection to receiving the result. This long duration was because there is no laboratory capacity available in Liberia to diagnose the disease. Specimen had to be taken to the US Centers for Disease Control and Prevention, Atlanta, Georgia for testing which resulted in delayed release of results. We also acknowledged that the source of the disease was not certain in this study. Accordingly, the family head of both cases is involved with hunter activities as mean of living. This information, allows us to make predictions that those patients may have come in contact with bush animal since the disease is transmitted from animal to human.

## Conclusion

This was a confirmed monkeypox outbreak in Dodain District, Rivercess County, with limited spread, and unknown source We educated the affected about potential risky behaviors such as hunting, consumption of bush meat, and contact with ill persons without the recommended protection measures.

## What is known about this topic

- The disease is transmitted from one person to another through contact with infected person
- The first monkeypox human case virus was reported in Zaire in 1970
- The disease was introduced to the USA by wide Rodents in 2003

## What this study adds

- The first Confirmed case of Monkey pox in Liberia since 1970
- This was the first confirmed case of Monkey pox in Dodain District Rivercess County
- It is a re-emerging disease in Liberia

## Competing interests

The authors declare no competing interests.

## Funding

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## Authors' contributions

Lawrence Z. Larway was lead in the investigation, response and manuscript writing. M. Amo-Addae, P. Adewuyi, F. Shannon, H. Wilson, O. Ilesanmi, T. Nagbe, S. Gebeh provided technical guidance during the investigation, response, and manuscript writing. Lilian Bulage provided technical guidance during manuscript writing. All the authors read and approved the final manuscript for publication.

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## Tables and figures

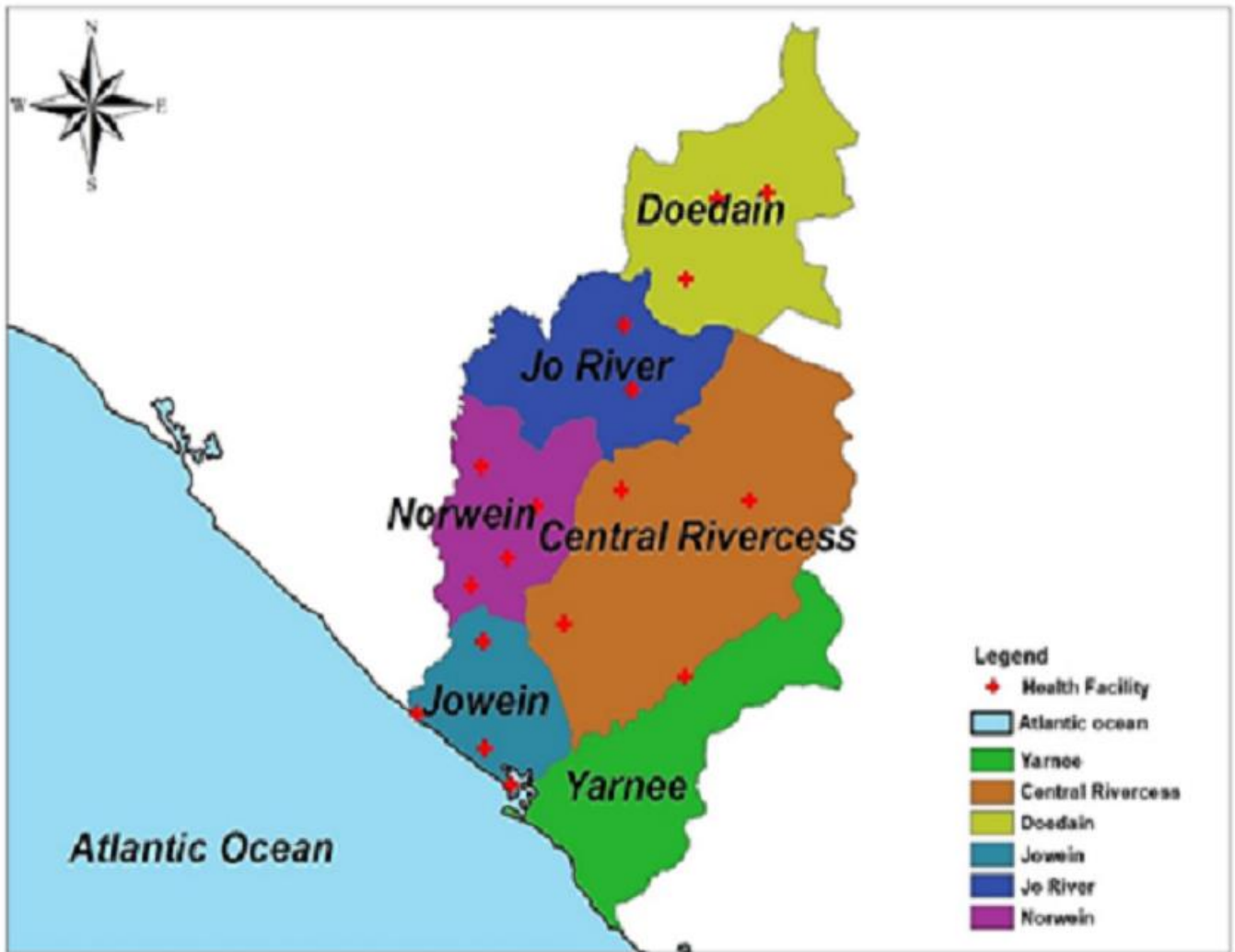
**Figure 1:** Locations of monkeypox outbreak in Dodain District, Rivercess County, 2017

**Figure 2:** Photographs of index case 8 days after onset of illness, Burdue Town, Dodain District, Rivercess County, June 2017

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**Figure 1:** Locations of monkeypox outbreak in Dodain District, Rivercess County, 2017



**Figure 2:** Photographs of index case 8 days after onset of illness, Burdue Town, Dodian District, Rivercess County, June 2017