Journal of Public Health for Tropical and Coastal Region (JPHTCR)
Journal homepage: https:/ejournal2.undip.ac.id/index.php/jphtr/index
ISSN: 2597- 4378

Epidemiology of Chikungunya Outbreak at Pelem Village, Boyolali, 2024

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Abstract
Introduction: There was no reported case of Chikungunya, during the last five years in Pelem Village, Boyolali, but on September 21, 2024, the Simo Health Center found a suspected case of chikungunya in Pelem Village. This study aimed to describe the chikungunya outbreak in Pelem Village, Boyolali Regency in 2024.
Methods: A descriptive observational study was conducted based on epidemiological data according to the characteristics of people, places, and time. Data were collected through active case-finding, interviews using questionnaires, environmental observations, and confirmation cases using a Rapid Diagnostic Test (RDT).
Results: A total of 54 cases were identified from June to September and were distributed across four hamlets. To confirm the outbreak, RDT was performed in 11 cases, and seven cases were positive for chikungunya. Common symptoms included fever and joint pain (100.0%), rashes (66.7%), muscle pain (57.4%), headache (42.6%), and nausea (38.9%). The cases mainly occurred in female (51.9%), those aged 27-46 years (37.0%), and those with a medical history (63.0%). Wonokerti hamlets had the highest attack rate (9%). Of the 26 houses observed in the environmental observations, 11 houses were positive for larvae (42.3%) with a container index of 22.2% and a Density Figure indicating the potential for chikungunya transmission.
Conclusion: The Chikungunya outbreak in Pelem Village occurred from June to September 2024. The 3M+ method (Burying, Draining, and Recycling) should be implemented to increase mosquito nest eradication and conduct periodic larval monitoring.

Keywords: Chikungunya outbreak, Rapid Diagnostic test, epidemiological investigation.

DOI: https://doi.org/10.14710/jphtcr.v8i2.27593

Article History: Received: 07th June 2024, revised: 07th August 2025 accepted: 28th August 2025

Introduction

Chikungunya is a disease with the potential to cause an outbreak.[1] Although Chikungunya infection is often self-limiting and does not cause death, it causes losses in terms of health and economic productivity. [2–4] Health aspects affected by chikungunya infection include paralysis, chronic joint pain, and impaired productivity in patients.[4–6] However, chikungunya infection is more severe in individuals with

diseases such as diabetes, hypertension, and heart disease.[2]

Chikungunya is a vector-borne disease common in tropical climates that is transmitted through mosquito bites carrying the chikungunya virus (CHIKV).[7,8] Transmission of CHIKV infection in Aedes sp. mosquitoes occurs vertically through female mosquitoes to their offspring or through a vertical mechanism (transovarial transmission).[2] The vectors that transmit Chikungunya disease are Aedes aegypti and Aedes albopictus mosquitoes infected with CHIKV.[7,9] Aedes sp. mosquitoes bite during the day, afternoon, and evening.[10]

Individuals infected with CHIKV have an incubation period of 3-7 days.[11] CHIKV remains in the host's blood for 2-7 days and replicates in the joints, liver, and nervous system.[11,12] Common symptoms that arise include fever (>38.5℃), rash, joint pain, muscle pain, seizures, and bleeding.[4,5,11] ,Chikungunya cannot be diagnosed simply through anamnesis. Chikungunya has the clinical symptoms of dengue fever.[13] Therefore, the Chikungunya test can be performed through serological examination of IgM or IgG using a rapid diagnostic test (RDT).[11]

The first case of chikungunya in Indonesia was discovered in 1973 in East Kalimantan and DKI Jakarta.[11] Chikungunya is endemic to Indonesia. In addition, Indonesia has a high chance and prevalence of chikungunya disease in Southeast Asia.[2] Chikungunya is caused by climate change, human mobility, outdoor activities, high mosquito population density, and larvae.[3,8,14] The increase in chikungunya cases can occur due to individual behavior, such as lack of mosquito nest control (PSN) practices and poor environmental sanitation.[8,11,15] This behavior increases the mosquito population density and transmission through household contact.[15]

Chikungunya is declared an outbreak if there is an increase in the epidemiological incidence of morbidity or mortality within a certain period.[15] The requirement to determine a chikungunya outbreak increased in the two previous periods. In addition, enforcement was carried out by examining specimens/blood serum of patients using the rapid diagnostic test (RDT) method in 5-10 specimens if the number of sufferers reached ≥10 sufferers.[11] When an outbreak occurs, it is hoped that rapid outbreak management can be achieved to prevent the expansion of cases, increase in cases, and new deaths in the area affected by the outbreak.[16]

In 2024, Central Java Province reported 71 chikungunya cases through the Early Warning and Response System (EWARS). On September 21, 2024, the Disease Prevention and Control (P2P) Division of the Boyolali Regency Health Office received a report from the Simo Health Center that there was a suspected case of chikungunya in Pelem Village. Epidemiological investigation is required to confirm this finding. This study aimed to describe the outbreak of chikungunya based on people, place, and time, as well as risk factors, so that it could be used as a reference in efforts to prevent and control chikungunya.

Methods

This was a retrospective observational study with a cross-sectional design. This study was conducted in September 2024 in Pelem Village, Simo Sub-District, Boyolali Regency. The population and sample study included individuals who experienced chikungunya symptoms between June and September 2024. Samples were selected using total sampling with an active case-finding approach. Confirmation of the chikungunya outbreak can be performed using the Rapid Diagnostic Test (RDT) on 5-10 specimens, if the number of cases is more than 10.

Case definition of the Chikungunya outbreak

- The confirmed cases were individuals who experienced clinical symptoms of chikungunya (fever, rash, joint pain, muscle pain, etc.) and had positive RDT test results.
- Probable cases were individuals who experienced the clinical symptoms of chikungunya and had an epidemiological link.
- Suspected cases included individuals who experienced the clinical symptoms of chikungunya.

Data were collected using questionnaires and environmental observations. Environmental observations were conducted approximately 100 m from the house. Data were analyzed descriptively based on the characteristics of people, places, and times.

Results

Confirmation Outbreak

The last five years of data from the Early Warning Alert and Response System (EWARS) platform showed no suspected cases of chikungunya in Pelem Village, Simo Sub-District, Boyolali Regency. The results of epidemiological investigations identified 54 cases of chikungunya in Pelem Village that occurred from June to September 2024. The distribution of chikungunya cases consisted of 7 confirmed cases, 43 probable cases, and 4 suspected cases. Confirmation of chikungunya cases was carried out by examining 11 blood specimens using the Rapid Diagnostic Test (RDT), with seven samples positive for chikungunya. Based on epidemiological investigation data from the Chikungunya guidelines and SKDR, an outbreak of chikungunya can be declared (Figure 1).

Clinical Symptomps of Chikungunya Cases

The diagnosis of chikungunya in Pelem Village was based on clinical symptoms and physical observations.

The most common clinical symptoms of chikungunya were fever and joint pain (100.0%), rash (66.7%), muscle pain (57.4%), and headache (42.6%) (Table 1). No deaths due to chikungunya were observed (0%).

Cases Characteristic

The characteristics of chikungunya cases (Table 2) at Pelem Village were mainly female (51.8%) compared to males (48.2%). Cases were mostly experienced by the age group of 47-66 years (29.6%), with jobs as housewives (22.2%) and private sector employees (22.2%). Most of the respondents had a history of treatment (63.0%).

Distribution Cases by Place

Identified 54 cases of chikungunya were found in Pelem Village (Table 3). The cases spread across four hamlets: the Tegalrayung, Sanggrahan, Wonokerti, and Ngadirejo hamlets. Most cases were reported in the Sanggrahan and Ngadirejo hamlets (15 cases). In this incident, the lowest attack rate was observed in the Ngadirejo hamlet (4.8%), and the highest attack rate was observed in the Wonokerti hamlet (9.0%).

Distribution Cases by Time

The distribution of Chikungunya cases in Pelem Village, Simo Sub-District, can be seen in the continuous source epidemiological curve (Figure 2). The epidemiological curve of the chikungunya outbreak in Pelem Village is as follows:

The longest incubation period for Chikungunya disease is 1-12 days, with an average incubation period of 3-7 days. Figure 1 shows that the first case of chikungunya in Pelem Village was found in the period 24-30 June 2024, with one case. In the previous period, the index case traveled to Yogyakarta. The number of cases decreased from August 26 to September 1. However, in the period 2-8 September, there was an increase in the number of cases until it peaked on September 16–22 (seven cases). From September 30 to October 6, the number of cases showed a declining trend.

Environmental Observation

The following are the results of environmental observations of the chikungunya outbreak in Pelem Village:

Environmental inspections of four hamlets in 26 houses. The inspection results showed that 11 houses tested positive for the mosquito larvae. Based on the calculation results (Table 4), the house index (Hi) was 42.3% and the container index (Ci) was 22.2%. The density of the mosquito larvae (density Figure) in the four hamlets was 6.

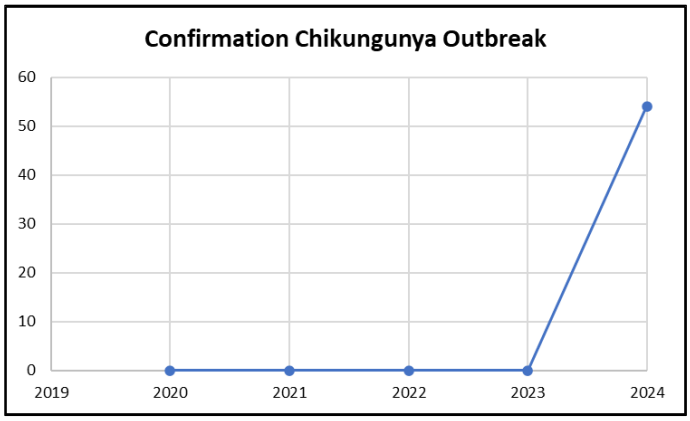

Figure 1. Confirmation of Chikungunya Outbreak

Table 1. Distribution Clinical Symptoms of Chikungunya Outbreak

No.	Symptoms	Frequency	Percentage
1	Fever	54	100.0%
2	Joint Pain	54	100.0%
3	Rash	36	66.7%
4	Muscle Pain	31	57.4%
5	Headache	23	42.6%
6	Nausea	21	38.9%
7	Shivering	12	22.2%
8	Vomiting	6	11.1%
9	Red Eyes	2	3.7%
10	Decreased Appetite	2	3.7%
11	Bleeding	1	1.9%

Table 2. Distribution of Cases by Individual Characteristic

Characteristic	Frequency	Percentage
Sex		
Female	28	51.8%
Male	26	48.2%
Aged Group		
0 – 5 Years	2	3.7%
6 – 12 Years	2	3.7%
13 – 26 Years	10	18.5%
27 – 46 Years	20	37.0%
47 – 66 Years	16	29.6%
≥ 67 Years	4	7.4%
Occupation		
Government Employees	6	11.1%
BUMN Employees	1	1.8%
Housewives	12	22.2%
Self-Employed	8	14.8%
Businessman	1	1.8%
Farmer	3	5.6%
Student	8	14.8%
Private Sector Employees	3	5.6%
Unemployed	12	22.2%
Treatment History		
Yes	34	63.0%
No	20	37.0%

Table 3. Distribution of Chikungunya Cases by Place

Hamlet	Cases	Population	AR (%)
Tegalrayung	12	209	5.7
Sanggrahan	15	294	5.2
Wonokerti	12	133	9.0
Ngadirejo	15	311	4.8

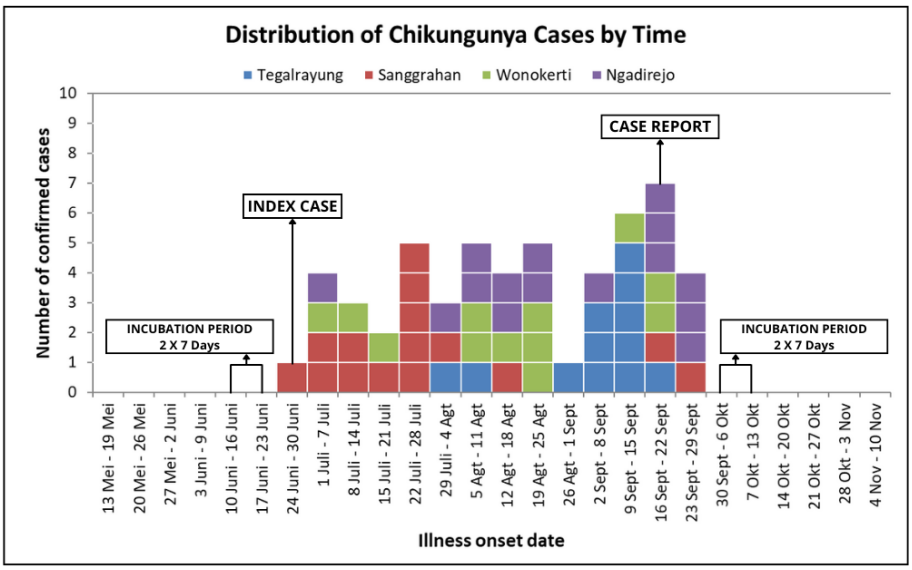

Figure 2. Distribution of Chikungunya Cases by Time

Table 4. Enviromental Observation of Chikungunya Outbreak

Hamlet	∑Checked House	∑Positive House	HI (%)	∑Checked Container	∑Positive Container	CI (%)
Tegalrayung	7	2	28.5	7	15	46.7
Sanggrahan	8	4	50.0	5	23	21.7
Wonokerti	4	0	0.0	40	0	0.0
Ngadirejo	7	5	71.4	8	12	66.7
Total	**26**	**11**	**42.3**	**90**	**20**	**22.2**

Discussion

Determination or confirmation of an outbreak of chikungunya can be performed by confirming clinical symptoms and Rapid Diagnostic Test (RDT) examination. If there are >10 suspected cases of Chikungunya, then an RDT examination of 5-10 specimens is needed to determine the Chikungunya outbreak in an area.[11] Chikungunya in Pelem Village, Simo Sub-District affected 54 people. Based on the results of the rapid diagnostic test (RDT) examination of 11 specimens, there were positive RDT examination results for chikungunya in 7 patients. According to the Chikungunya guidelines and the Early Warning Alert and Response System, this case can be declared an outbreak of Chikungunya.[11,16]

The number of chikungunya cases in Pelem Village increased in the 26th week of 2024. The initial case of chikungunya came from a resident who had experienced clinical symptoms. Within a short period in the same area, several residents began to experience similar symptoms. Chikungunya transmission can occur quickly because the radius or flight distance of the Aedes aegypti or Aedes albopictus mosquito reaches 500m. This increases the risk of Chikungunya transmission if you live in the same residential environment or house as the sufferer.[2]

The epidemiological curve of the Chikungunya outbreak in the village is a continuous source curve. This is because the exposure pattern occurs over a long period (at least one incubation period).[12] The peak of chikungunya cases in Pelem Village occurred from 16-22 September 2024 with seven cases. Based on the longest incubation period of Chikungunya disease, which lasted 12 days, the peak of cases resulted from the incubation period from August 26 to September 1, 2024. After 23-29 September 2024, there were no reports of Chikungunya cases in Pelem Village.

Early detection is crucial in the Chikungunya surveillance system to prevent transmission and increase the number of cases. According to the Chikungunya Prevention Guidelines, if a symptomatic case is detected, one must follow up within 24 hours. Failure to take immediate action can lead to a significant increase in cases.[11] This study found delays in reporting cases from community health centers to health departments. This delay was caused by a lack of public awareness and understanding of the disease as well as a lack of reporting from the private health sector to community health centers. Consequently, Chikungunya cases were detected only after they had spread to the four hamlets.

Chikungunya transmission occurs locally because respondents are in the same environment (home, school, and workplace) during the active hours of Aedes aegypti mosquito biting.[2] The increase in the number of Chikungunya cases in Pelem Village is influenced by the topography. Based on the topography of the area, Pelem Village has a hilly area with a dry soil structure and is used as rain-fed land with an average temperature of 35–36°C, which can accelerate mosquito growth.[17] From the results of environmental observations, it was found that many open water containers and piled-up used goods triggered the presence of larvae and mosquitoes. Other studies have reported that the presence of water containers can increase the presence of larvae and mosquitoes around residence.[2]

In this research, the Chikungunya cases were mainly female, aged 27 – 46 years, housewives, and private sector employees. Several studies have reported a relationship between gender and age. Men and people over the age of 35 years are more likely to be infected with chikungunya. This was because the two groups tended to have higher levels of mobility. However, there was no relationship between occupation and the incidence of chikungunya in the local area.[18,19] Chikungunya cases can be caused by mobilization factors so that they can attack anyone, anywhere, and anytime. This was influenced by the opportunity for Aedes sp. mosquitoes to become bitten.[15] Some patients with chikungunya had no treatment history (37.0%). In Chikungunya endemic areas, people do not receive medical treatment, and only receive supportive treatment. This can affect the severity of symptoms and increase the risk of complications.[20,21]

The highest density of mosquitoes and larvae in the four hamlets was caused by a lack of mosquito eradication (PSN) activities.[2,15] The entomological index in the four hamlets was found to have Hi values >10%, Ci >5%, and DF ≥6, indicating that density increases or poses a higher risk of transmission for chikungunya.[22]

Based on environmental observations of 26 houses in four hamlets, 11 houses were positive for mosquito larvae, with the highest attack rate in Wonokerti hamlets (9%). Wonokerti Hamlet had the highest attack rate, primarily because of its poor environmental conditions and behaviors. These included dry conditions, piles of used items around the house, hanging clothes, not draining the bathub, and open water containers.

The presence of larvae is a risk factor for chikungunya transmission[23]. The existence of larvae is influenced by several factors, such as rainfall, temperature, humidity, and environmental conditions.[24] These factors affect the developmental period of larvae and the period of the viral pathogen, which has an impact on the life span of mosquitoes and the frequency of biting.[15] Individuals living in houses where larvae are found in water containers or stagnant water are at 3.5 times greater risk of suffering from chikungunya.[2]

Efforts to prevent chikungunya transmission include improving the early detection system through surveillance and conducting regular mosquito nest eradication (PSN) and larval monitoring (PJB).[11] Therefore, the Simo Health Center needs to improve and implement a Chikungunya surveillance system for the early detection and prevention of outbreaks.[16] When implementing PSN and PJB, it is necessary to apply the 3M+ method, which includes burying, draining, and recycling. Furthermore, it is essential to educate the community regarding chikungunya and preventive measures that individuals can take, such as using mosquito repellent lotions or insecticide-treated mosquito nets.[6]

This study has limitations, such as limited laboratory tests to diagnose Chikungunya, lack of case collection throughout the village, and descriptive analysis.

Conclusion

The Chikungunya outbreak occurred in Pelem Village in June - September 2024, with a peak in cases on September 16–22, 2024. The transmission of chikungunya cases in Pelem Village was a local transmission, characterized by transmission in the same house and within the residential area. The results of environmental observations revealed the presence of larvae around the residence. Implementation of the 3M + method is recommended to increase mosquito nest eradication (PSN), periodic larva monitoring (PJB), prevention education in the community, and improve surveillance systems to detect cases earlier.

Ethics approval

This study received ethical approval from the Boyolali Health Office (No: 800.1.11.1/1029/40/2024).

Availability of data and materials

The data collected and analyzed during the research were not published because they were private.

Acknowledgement

The authors would like to thank the Boyolali Regency Health office, Simo Health Center, and all respondents who participated in this research

Funding

No Funding

Author Contribution

LP and NA collected and analyzed the data. MSA, S, and TTK corrected the results, and discussed and reviewed the manuscript.

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