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# Outbreak investigation of Chikungunya fever in Kapanewon Banguntapan, Bantul, Yogyakarta: a lesson learned

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## Abstract

**Purpose:** The investigation was conducted to confirm the Chikungunya outbreak in Banguntapan. Bantul. from November 2021 to January 2022 and identify the risk factors for control measures. **Methods:** We conducted a 1:1 case-control study. Cases were residents of the six hamlets in Banguntapan with sudden fever and arthralgia from December 2021 to February 14. 2022. Controls were residents of the same neighborhood with no symptoms. We collected demographics, risk factors, and environmental data using standardized questionnaires through direct interviews and observation. For diagnosis confirmation, we examine the case blood serum for laboratory testing. Logistic regression was used to analyze the risk factors. **Results:** We identified 151 Chikungunya suspects (Attack-rate/AR 13.6%) of 1111 total population. The highest AR by gender and location were in women (16.3%) and Genengan hamlet in Jambidan village (45.6%), respectively. Fever (92.1%) and muscle pain (81.7%) are the significant symptoms. The latest larval rate average was 13% lower than the national target. More than one-third of the cases was in the acute phase of infection. Multivariate analysis showed close contact of cases (aOR 22.79; 95% CI: 7.01–74.17) and community habit of hanging clothes in the house (aOR 2.42; 95% CI: 1.01–5.82) significantly associated with the Chikungunya outbreak. **Conclusion:** There was a Chikungunya outbreak in Jambidan and Tamanan Village, Banguntapan. from November 8, 2021-January 31, 2022. Therefore, we recommend that the DHO strengthen health education related to protective action while having close contact with suspects and the habit of hanging wardrobes in the house as the risk factors associated with the outbreak.

**Keywords**: Banguntapan; case-control; Chikungunya fever; outbreak

## INTRODUCTION

Chikungunya fever is a vector-borne viral infectious disease transmitted through mosquitoes. The vectors are Aedes aegypti and Aedes albopictus, which also transmit dengue fever and serve as the host [1]. The viremia stage starts 1-2 days before the onset, and the virus remains in the blood for 2–7 days. Five to ten blood samples from each outbreak unit are sufficient to confirm transmission, whether the suspect was more than ten people [1].

Chikungunya fever affects all ages and genders. The average incubation time was 2-4 days (3-12 days). The main symptoms were a rapid fever (100%) and joint arthralgia (98%). Furthermore, Chikungunya fever can result in oedema, psoriasis, bleeding, and, in rare situations, headache, myalgia, and neurological symptoms. The resemblance of Chikungunya and dengue fever symptoms increases the risk of misdiagnosis, which can be fatal. Chikungunya virus (CHIKV) does not induce sepsis shock. Thus, it can be detected through a thorough examination. Furthermore, the onset and duration of fever were shorter in CHIKV patients. The maculopapular rash, prevalent in most Chikungunya infections, can also be recognized [2].

No specific treatments or vaccines are available to prevent Chikungunya fever in the population. Despite the difficulties of combating vector control, it is the only approach to prevent transmission [2]. Chikungunya infection history in the neighborhood and houses, environmental temperature, socioeconomic disadvantage, altitude of dwelling, cumulated monthly rainfalls, occupational density, poor knowledge of Chikungunya transmission, obesity urbanization, living in a house with uncovered water containers, hoofed pet ownership, living in a place surrounded by vegetation, and the presence of mosquito larvae are risk factors for Chikungunya fever [3–6].

The Public Health Center (PHC) in charge began to suspect a Chikungunya outbreak in Kapanewon Banguntapan after detecting Chikungunya symptoms in several hamlets during the 44th to 5th epidemiological week of 2021-2022. On December 2, 2021, Banguntapan I PHC reported that 21 people in RT 01 Genengan Hamlet experienced a sudden fever, joint pain, and difficulty walking.The remaining five helmets in the Banguntapan I and II PHC areas reported a similar situation, with 151 suspects and 15-30 cases per outbreak unit.

The incidence of Chikungunya cases that exceeded twice the number of expected points in the same period (last month or year) was categorized as an outbreak [7]. On this occasion, Banguntapan reported no more than thirty Chikungunya cases in November 2021, so the incident during the observation period was an outbreak.

The team investigated Banguntapan. Bantul. from December 2, 2021, to February 14, 2022. to prevent additional cases and identify the risk factors for control measures.

Bantul district was an endemic of the Aedes vector but never experienced a Chikungunya outbreak in the last five years. This study was the first Chikungunya outbreak report from Bantul, Yogyakarta. Through the study, the team aims to identify the risk factors that caused the outbreak so that it could prevent future outbreaks.

## METHODS

An active case-finding with descriptive and analytical study was used in the investigation. Active case finding was conducted to find another case in the reported area and its surroundings. At the same time, an analytical observational case-control study was conducted to determine the risk factor associated with the Chikungunya outbreak in Banguntapan sub-district so that appropriate control measures could be provided. The investigation was held in six affected hamlets in the Tamanan and Jambidan villages of Banguntapan, Bantul, from December 2021 to February 2022. The population at risk was residents of the hamlets within 100 meters of suspected cases [8].

A Chikungunya case was defined as residents with sudden fever and arthralgia in certain hamlets from November 2021 until January 2022. Confirmable cases are cases with at least a positive IgM result of the Chikungunya rapid diagnostic laboratory test (RDT). Control was defined as residents who live in the same neighborhood with cases but without symptoms in the same period. The sample size was calculated using a sample size calculator provided by openepi.com and resulted in 79 samples for each group (95% Confidence interval, 80% power, $P_1$ 22.2%, and $P_2$ 5.6%) [9].

The team collects primary and secondary data during the investigation. Preliminary data was collected by direct interview and environmental observation using an electronic and manual standardized questionnaire. Location coordinates are collected using geopaparazzi application tools. Primary data collecting information includes demographic data, symptoms, medication history, the latest case condition, travel history, visitor history, vector breeding place existence, mosquito larva existence, breeding place elimination program, the presence of close contact of suspects, hanging post-used clothes habits in the house, integrated management vector habit, and repellant use from the

study group. Secondary data collected information about the total population per hamlet and monthly free larval rate as a determinant of the outbreak risk factors gathered from community leaders and PHC in charge.

Microsoft Excel 365. STATA 16.1. and Quantum GIS (QGIS) applications were used to process and display the data in narration, tables, and pictures. In univariate analysis, we describe cases by person (gender, age, and serology result), time, and place variables. Time variables were analyzed based on the epidemic curve. Place variables were analyzed using QGIS to identify the location and mapping cases. The team conducts bivariate analysis using chi-square to determine the preliminary association between risk factors and Chikungunya cases. Furthermore, the team used multiple logistic regression to find the most significant risk factors of the Chikungunya outbreak.

## RESULTS

The investigation was held from December 2021 until February 2022 in Glagah Kidul. Grojogan. Krobokan. and Tegal Tamanan hamlets of Tamanan and Genengan and Jambidan lor Dhuku hamlets of Jambidan village of Banguntapan subdistrict. The outbreak was in the 44$^{th}$ of 2021 to the 5$^{th}$ epidemiological week of 2022. from November 8. 2021-January 31. 2022.

One hundred fifty-one cases (13.6%) from the 1111 at-risk populations were detected. Female cases was higher than males (16.3% (89/546) vs 11.0% (62/565)). Genengan Hamlet had the highest AR by location (45.6%). The Recent cases were in Glagah Kidul (4.6%). Due to study limitations, after the district received a PHC report, the team only interviewed 126 (83.4%) cases. Table 1 shows case frequency by gender, age, and outbreak symptoms. The 41-50 age group and women (58.9%) had the most cases (29.1%). The top three symptoms were fever (92.1%), arthralgia (81.7%), and myalgia (57.9%). Ten suspects are asymptomatic.

Figure 1 shows that two villages, west and east of Kapanewon Banguntapan, had cases during the outbreak. Each town had a clear case pattern. The first case in Tamanan village began in the school, and the community found it in Jambidan.

A total of 44 blood serum was collected from the six hamlets to confirm the diagnosis using the Chikungunya Rapid Diagnostic Test (RDT). The test found that the Krobokan hamlet of Tamanan village had the highest IgM result from Chikungunya RDT (6/7; 85.7%), and the Jambidan hamlet had the highest IgG result (5/6; 83.3%). Each affected hamlet's latest monthly free larval rate was below the national target. The Health Ministry and WHO standard for free larval rate was 95%, but the study found that Genengan, Jambidan had 86%, and Jambidan Lor Dhuku had 76% free larval rate. The average free larvae were 82%, 13% below the target.

**Table 1. Frequency distribution by gender, age group, and symptoms of Chikungunya outbreak in Jambidan and Tamanan village, Banguntapan sub-district Bantul, DIY from November 8, 2021-January 31, 2022.**

| Variable | Total case (n=151) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 62 | 41.1 |
| Female | 89 | 58.9 |
| **Age Group** | | |
| 1-10 | 16 | 10.6 |
| 11-20 | 10 | 6.6 |
| 21-30 | 17 | 11.3 |
| 31-40 | 25 | 16.6 |
| 41-50 | 44 | 29.1 |
| 51-60 | 15 | 9.9 |
| 61-70 | 16 | 10.6 |
| 71-80 | 7 | 4.6 |
| 81-90 | 1 | 0.7 |
| **Symptoms** | **Total interview (n=126)** | |
| Fever | 116 | 92.1 |
| Arthralgia | 103 | 81.7 |
| Myalgia | 73 | 57.9 |
| Difficulty walking | 51 | 40.5 |
| Dizziness | 47 | 37.3 |
| Rash | 46 | 36.5 |
| Nausea/vomit | 29 | 23.0 |
| Swollen foot | 11 | 8.7 |
| Gum bleeding | 5 | 4.0 |
| Diarrhoea | 5 | 4.0 |
| Nose bleeding | 3 | 2.4 |

Typical mosquito vector-borne disease epidemic curves show propagated sources (person-to-person transmission). The outbreak lasted thirteen epidemiological weeks from the 44th of 2021 to the 5th of 2022.

An observational analytic study with a 1:1 ratio case-control was conducted to prove the hypothesis that several risk factors that have been identified are statistically significant with the outbreak. The team found the Case's close contact (P value <0.001; OR 20 95% CI 7.2-71.1), hanging post-used clothes habit (P value <0.001 OR 3.3 95% CI 1.6-6.8), the existence of breeding place (P value 0.003 OR 2.8 95% CI 21.4-6.0) and the

presence of mosquito larva (P value 0.010 OR 2.6 95% CI 1.2-6.1) were statistically associated with the Chikungunya outbreak. The other variables, such as travel history, integrated vector management habits, repellant use, and the community eradication of the mosquito nests program, were not statistically significant in this study.

Multivariable analysis shows that close contact to the Case with OR 22.8 (95% CI 7.01 – 74.1) and hanging post-used clothes habit with OR 2.42 (95% CI 1.03 – 5.82) were significantly associated with the outbreak after controlling the other variables in Banguntapan. Bantul in the last 2021 until the beginning of 2022. These results show that the Chikungunya cases have almost 23 times higher probability of having other suspects in their house compared to those that do not have close contact. On the other hand, the Chikungunya case has a 2.4 times higher probability of having post-used clothes habits in their house.

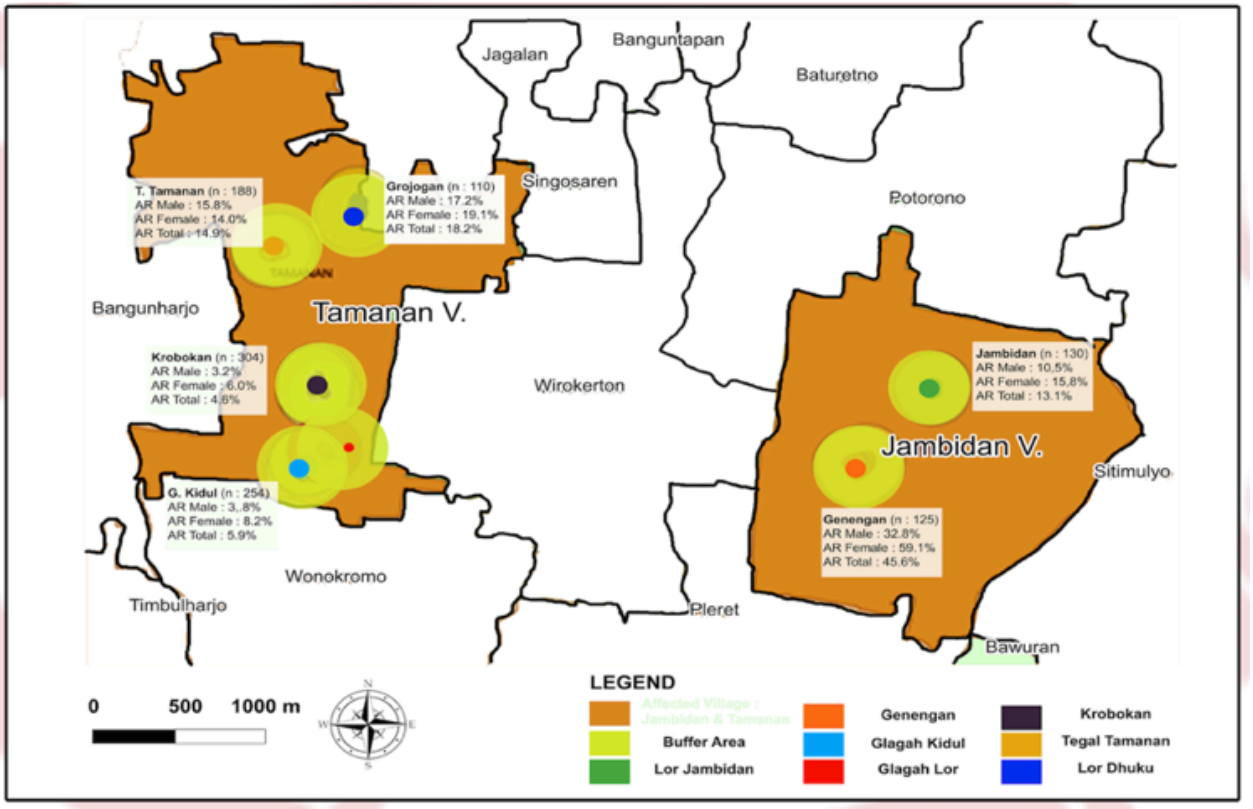


**Figure 1. Chikungunya fever cases spreading in Tamanan and Jambidan Hamlets, Banguntapan, Bantul District, DIY from November 2021-January 2022**

## DISCUSSION

Bantul Sub-district surveillance officer was late in detecting the Chikungunya outbreak in Banguntapan despite already having an Early Warning Surveillance System (EWARS). The national EWARS was aimed to detect an early outbreak in the population. Surveillance sensitivity can detect and respond to public health problems faster [7]. However, the EWARS timeliness indicator was weak (52%) in 2021 due to the COVID-19 Pandemic. Even though the system can detect an epidemiological pattern of disease and potential outbreak in a particular area [10], the regional infrastructure inequity strongly affects the system's effectiveness in outbreak detection [11].

Furthermore, the community chose to seek treatment in a private clinic, so the PHC was late in detecting the case. The involvement of private healthcare facilities in the surveillance system must be expedited since CHIKV can affect almost a third-fourth of the people at risk [4].

Although Chikungunya fever does not affect fatality like dengue fever, CHIKV can cause a disability-adjusted life year (DALYs) impact by its symptoms [12]. People affected by CHIKV mostly experience symptoms of joint/muscle pain. The symptoms can affect the patient for up to two months and disrupt the patient's activities or work.

The team identified case onset symptoms based on the respondent's recall. This method risks false negative results. The delay in detecting an increase in Chikungunya cases at the beginning of the outbreak

limited the diagnosis steps. The diagnosis was confirmed based on Chikungunya prevention guidelines [1] and should be conducted a prompt, precise investigation and consider the results of previous research in the inquiry [13–15].

Furthermore, the limited diagnosis resources tended to be underreported as acute febrile illness [16], with no PIC for Chikungunya fever as in dengue or malaria for vector-borne disease. The case occurred during the pandemic of COVID-19 while the district government focused on controlling the pandemic.

All Chikungunya cases in the six hamlets were spread within a month. Even though the last issue was obtained on January 31, 2022, strict surveillance was continued until mid-February 2022 to anticipate new cases. The District Health Office (DHO) conducts control measures by community empowerment for the eradication of mosquito breeding place, the Integrated Vector Management (IVM) program, larvicides, and fogging focus based on Chikungunya control guidelines [1] followed by biological modification [17].

According to the investigation, all locations have natural (trees, plants), artificial (bathtubs, buckets, flowerpots, reservoirs) mosquito breeding places, and lack of lighting houses. At least 5% of houses investigated had larvae. Limited resources prevented the team from testing the House Index (HI), Container Index (CI), or mosquito density survey.

Travel history cannot be explained further since the team cannot prove the difference between suspects with or without travel history. The suspects were active in Banguntapan outside Yogyakarta (Semarang). The suspected index cases are known to have been studied in the affected hamlet (Grojogan), although there is no information on a similar case in the school. The team in this study cannot find an epidemiological correlation between the two affected villages.

The rainy season from October to February is expected to be a geographical aspect, affecting the high distribution of vectors. However, the team did not directly test the rainfall variable with the incidence of outbreaks in this study.

A mosquito that sucked CHIKV-infected blood could spread the virus. Hanging clothes also contributed to Banguntapan's Chikungunya outbreak. The result supported Semarang's research linking hanging clothes to dengue fever. Human sweat contains the amino acid, lactic acid, body heat, and odour left on used clothes, which attracts the anthropophilic vector Aedes sp. [18].

The researcher found that close contact with Chikungunya suspects are more likely to be infected during the outbreak than those without close contact, along with the study in Reunion Island, France, in 2017 and Malaysia in 2012 [1,3,19]. The district indicated a relationship between the rainy season and Chikungunya cases [20].

This study's significant risk factors show that the community needs to know the characteristics of mosquitoes that can harm humans, such as vector activity time, flight distance, anthropophilic traits, and disease spread patterns. Although this study did not assess CHIKV knowledge, attitudes, and practices, preventive measures should be taken to avoid diseases [1]. A study in Columbia found that knowledge is associated with community characteristics. A study in Malaysia proved that attitudes against dengue in hotspots and non-hotspots are different but not for practice variables [17,19].

An environmental survey in December 2021 found that the average larva-free rate was 13% below the national standard of 95%. The presence of mosquito larvae in Chikungunya outbreaks was not statistically significant in this study. The Depok study linked Chikungunya cases to low larva-free rates and high population density [20]. The larva-free rate, below the national standard, increases mosquito-borne diseases like Chikungunya fever.

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