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Research Article

Investigating a DHF Outbreak in Batuan Village, Gianyar

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ABSTRACT

Introduction: In March–April 2025, an unusual increase in Dengue Hemorrhagic Fever (DHF) cases was reported in Banjar Dentiyis, Batuan Village, Sukawati District, Gianyar, Bali. The case count rose from 8 in the previous year to 20 within two months, including one death. The sharp increase in incidence and mortality met the criteria for a Kejadian Luar Biasa (KLB), or outbreak, as defined by the Indonesian Ministry of Health. This investigation was conducted to characterize the outbreak, identify contributing risk factors, and evaluate the public health response.

Aim: To determine the epidemiological profile and environmental risk factors associated with the DHF outbreak in Banjar Dentiyis and to provide recommendations for prevention and control.

Methods: A descriptive cross-sectional investigation was carried out from April 4 to 30, 2025. Data collection included secondary surveillance data from Puskesmas Sukawati I and primary field investigations involving interviews, environmental inspections, and larval surveys. Cases were analyzed based on demographic characteristics, spatial distribution, temporal trends, and risk factors such as the presence of larvae and container density.

Results: Twenty DHF cases and one death were confirmed, with the highest concentration (12 cases) in Gang Bunut, yielding an attack rate of 12.9% and a local CFR of 8.3%. Most patients were female (60%) and over the age of 15, although the highest attack rate (3.79%) occurred among children under 15. Clinical symptoms were consistent across cases, with all patients experiencing fever and most reporting headaches and nausea. Environmental assessment revealed mosquito larvae in 35% of case households, with bromeliad plants and uncovered containers serving as primary breeding sites. Fogging and vector control interventions were delayed and did not follow recommended intervals.

Conclusion: The outbreak in Banjar Dentiyis highlights the need for timely response, routine vector surveillance, and sustained community engagement. Delays in fogging and inadequate container management contributed to the persistence of transmission. Strengthened preventive measures, improved health literacy, and adherence to dengue control protocols are critical to mitigating future outbreaks.

Keywords*: dengue hemorrhagic fever, epidemiology, Gianyar, larval survey, outbreak investigation, vector control*

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Background

Dengue Hemorrhagic Fever (DHF) is an acute viral disease transmitted by the *Aedes aegypti* mosquito, which has posed a persistent threat to public health in Indonesia [1]. The endemicity of the disease across almost all provinces, including Bali, has made it a recurrent issue that escalates into outbreaks with alarming frequency. Since the virus was first identified in the country in 1968, it has maintained a prominent position among vector-borne illnesses, with its incidence fluctuating and its geographical reach expanding year after year [2]. Despite concerted efforts from health authorities and communities, the disease continues to exert a substantial toll, not just in terms of morbidity and mortality, but also in economic costs and social disruption [3].

In recent years, Gianyar Regency in Bali has emerged as one of the hotspots for dengue transmission, with the incidence rate (IR) climbing sharply. In 2024, Gianyar reported an IR of 578.92 per 100,000 population, markedly exceeding the national target of fewer than 49 cases per 100,000 [4]. This figure represents more than a fivefold increase from the IRs recorded in 2022 and 2023. Among the sub-districts affected, Sukawati has consistently ranked among the top contributors to the regional burden of disease, particularly through the reporting units of Puskesmas Sukawati 1.

Within this context, Banjar Dentiyis, a sub-village of Desa Batuan in Sukawati, experienced a sharp surge in DHF cases in March and April of 2025. From a total of only eight cases throughout 2024, the number rose dramatically to twenty within the span of two months. This upsurge was compounded by the occurrence of a death due to dengue complications, pushing the local case fatality rate (CFR) to 5%, a stark contrast to the 0% reported the previous year [4]. These indicators, combined with the clustering of cases in specific neighborhood lanes, signaled a likely Kejadian Luar Biasa (KLB) or outbreak.

Outbreaks of dengue are not merely the result of isolated biological events but are embedded in a web of social, environmental, and health system factors. These include population density, water storage practices, waste management, community participation in mosquito control, and the responsiveness of public health interventions. The current investigation into the outbreak in Banjar Dentiyis was conducted to provide an evidence-based understanding of its dynamics and to develop actionable recommendations for containment and future prevention.

The primary objective of this outbreak investigation was to characterize the occurrence of the DHF outbreak in Banjar Dentiyis, Gianyar, by describing the temporal, spatial, and demographic patterns of the cases. Moreover, the investigation sought to identify environmental and behavioral risk factors associated with transmission, and to evaluate the timeliness and adequacy of public health responses. The final goal was to inform immediate containment efforts and contribute to broader strategies for dengue prevention in endemic settings.

Method

Study design

The investigation employed a cross-sectional study design with a descriptive epidemiological approach. Conducted from April 4 to April 30, 2025, the investigation took place in Banjar Dentiyis, a densely populated residential area within Desa Batuan. The area spans approximately 410 square kilometers with a population density of 2,176 residents per square kilometer. Banjar Dentiyis itself is home to 731 residents across 156 households.

Sample

Case detection followed the criteria set by the Indonesian Ministry of Health, based on WHO guidelines [1,5]. A suspected case of DHF was defined as an individual with acute fever lasting 2 to 7 days, accompanied by two or more of the following: headache, retro-orbital pain, muscle pain, joint pain, rash, bleeding manifestations, or laboratory-confirmed thrombocytopenia and hemoconcentration [6]. Cases were confirmed either through hospital diagnosis or field assessment supported by laboratory values, including leukocyte counts below 5,000/mm^3, platelet counts below 100,000/mm^3, and a hematocrit increase of more than 20% [5].

Data collection

Data collection combined secondary and primary methods. Secondary data included surveillance records from Puskesmas Sukawati I, hospital case reports, and demographic statistics from the local health department. Primary data were gathered through field visits, during which epidemiologists and local health officers conducted interviews with patients and household members, inspected water containers, tested for mosquito larvae (jentik), and mapped the spatial distribution of cases.

Each household within a 100-meter radius of a confirmed case was surveyed, as per Ministry of Health guidelines for outbreak response. The investigators recorded details such as number and types of water containers, presence of ornamental plants that collect water (e.g., bromeliads), hygiene conditions, and community awareness of dengue prevention. In addition, the team assessed whether any family or neighbors had experienced recent DHF symptoms, in order to understand transmission pathways and potential clustering.

Data analysis

Analysis of the data was conducted using SPSS version 22. Descriptive statistics were applied to evaluate frequencies, proportions, attack rates, and CFRs by demographic group, neighborhood lane, and risk factor category. Epidemic curves were constructed to assess the progression of the outbreak over time, while spot maps illustrated the geographical concentration of cases.

Results and Discussion

The investigation confirmed that the outbreak in Banjar Dentiyis qualified as a KLB under the criteria of Permenkes No. 1501/2010, which stipulates that an outbreak is declared when the monthly case count doubles the average from the previous year, and/or when there is a significant increase in mortality. With twenty cases and one death in just two months, both thresholds were exceeded. In 2024, Banjar Dentiyis had reported only eight cases and no fatalities.

The first cases were reported in epidemiological week 12, with two individuals developing symptoms. This was followed by three new cases each in weeks 13 and 14. The number of cases then surged to nine in week 18, suggesting a pattern of propagated spread, possibly due to inadequate initial control measures. The epidemic curve showed multiple peaks, indicating successive generations of transmission.

Spatially, the majority of cases were concentrated in Gang Bunut, which recorded 12 of the 20 cases. This translated to an attack rate of 12.9% and a CFR of 8.3% in that area alone. Other affected lanes included Gang Palak (6 cases, AR 4.8%), Gang Biola (1 case, AR 11.1%), and Gang Kabetan (1 case, AR 0.67%). The clustering in these adjacent neighborhoods pointed to common environmental exposures and potential breeding grounds.

Demographically, female patients outnumbered males, with 12 cases (AR 3.3%) compared to 8 among males (AR 2.2%). The lone fatality occurred in a female patient over the age of 15. Age-wise, the majority of cases (15) were in individuals older than 15 years, but the highest age-specific attack rate (3.79%) was seen among children under 15. This age group is often at higher risk due to increased exposure during daytime activities near the home and reduced immunity from prior exposures.

Clinical presentation was typical of DHF, with all patients experiencing fever. Headaches were reported in 70% of cases, followed by nausea in 40% and vomiting in 15%. No patients progressed to Dengue Shock Syndrome (DSS) or severe organ failure, although the one fatal case had reportedly delayed seeking medical care.

Larval surveys revealed that 35% of case households had jentik present in water containers. The highest density of larvae was observed in Gang Bunut, which corresponded with the highest case burden. Most positive containers were ornamental plants, such as bromeliads and water lilies, which are common in Balinese homes and often used in religious ceremonies. These plants are seldom emptied and provide an ideal breeding environment for *Aedes aegypti*. Other container types included uncovered bathtubs, buckets, pet water dishes, and discarded bottles. Approximately 45% of households had more than three water-holding containers, a known risk factor for dengue transmission. Moreover, 65% of case households reported a family member or close neighbor who had also been ill with DHF in the previous month.

Public health responses began with a PSN campaign on March 26, which included larval source reduction, door-to-door education, and distribution of larvicide. However, fogging was delayed until April 5, a day after the first death was reported. A second round of fogging was conducted on April 30. The interval between fogging sessions was four weeks, contrary to Ministry of Health recommendations of a one-week interval to effectively interrupt mosquito breeding cycles. Additional interventions included a community education session for local women's groups (PKK) and coordination with community leaders to improve surveillance and hygiene practices.

The results of this investigation confirm the occurrence of a Dengue Hemorrhagic Fever (DHF) outbreak in Banjar Dentiyis, Desa Batuan, Gianyar, in March and April 2025. The sudden increase in cases, from an annual total of eight in 2024 to twenty in just two months of 2025, along with one fatality, clearly meets the criteria for a Kejadian Luar Biasa (KLB) as defined by the Ministry of Health of the Republic of Indonesia (Permenkes No. 1501/Menkes/Per/X/2010). The outbreak's temporal, spatial, and demographic patterns, along with identified environmental risk factors and gaps in public health response, provide a multifaceted understanding of the dynamics driving DHF in this setting.

The temporal pattern, characterized by a propagated epidemic curve with multiple peaks, indicates ongoing transmission through successive generations of Aedes aegypti mosquitoes. This pattern is typical in urban and semi-urban environments where the mosquito vector thrives due to poor water storage practices and high container indices [5]. The highest peak occurred in epidemiological week 18, following an initial increase in weeks 12 through 14, suggesting that control efforts may have been delayed or insufficient during the early phase. Studies in similar endemic areas have demonstrated that early and aggressive intervention during the first wave of cases can significantly limit outbreak magnitude [7].

Spatially, the concentration of cases in Gang Bunut—where the attack rate reached 12.9%—underscores the role of micro-environmental factors in dengue transmission. This clustering likely reflects a combination of factors, including close residential proximity, a high density of open water containers, and frequent social interaction among residents. Numerous studies have found that dengue transmission is highly focal, with a typical transmission range of less than 100 meters from an index case due to the limited flight range of Aedes aegypti [5,8,9]. In this context, the presence of ornamental water-holding plants, such as bromeliads, and uncovered containers used for religious or household purposes created an ideal environment for mosquito breeding.

The demographic profile of the cases also provides valuable insights. Although individuals over 15 years of age accounted for 75% of the total cases, children under 15 experienced the highest attack rate (3.79%). This aligns with national and global findings that children often suffer the brunt of dengue outbreaks due to lower levels of acquired immunity [10]. Interestingly, females were disproportionately affected in this outbreak, accounting for 60% of cases. While dengue does not typically exhibit a strong gender bias in terms of susceptibility, differential exposure—possibly due to time spent at home during peak mosquito biting hours (morning and late afternoon)—may contribute to such imbalances [11]. This also reflects the cultural context in which women in Balinese households may be more involved in domestic activities, including water storage and ceremonial preparations that involve containers.

The clinical presentation of cases was typical of classical DHF. Fever was universal, with headache and gastrointestinal symptoms also common. While only one death occurred, this represents a significant CFR of 5% in the context of the outbreak, and it underscores the importance of early detection and access to care. Delayed recognition and treatment of warning signs such as persistent vomiting, abdominal pain, and rapid thrombocytopenia are well-documented contributors to dengue mortality [5].

The investigation also highlighted several environmental risk factors. Approximately 35% of households with DHF cases had larvae present in domestic containers, and 45% had more than three containers suitable for mosquito breeding. These findings are consistent with the literature, which identifies high container index and pupal density as critical predictors of dengue risk [12]. Particularly concerning was the widespread use of bromeliad plants, which hold small pools of water that are often neglected during routine vector control efforts. These "cryptic breeding sites" are frequently overlooked but can be responsible for a significant proportion of Aedes aegypti pupae [13].

Perhaps the most preventable element of the outbreak was the delay in vector control interventions. Although public health teams began larval source reduction (PSN) on March 26, the first fogging activity was not conducted until April 5—over a week after new cases and one death had occurred. Moreover, the second fogging round was conducted four weeks later, rather than the recommended one-week interval [1]. Vector control studies have demonstrated that insecticide fogging is most effective when performed in two cycles spaced 7–10 days apart to target both adult mosquitoes and those emerging from pupae [14]. The failure to adhere to this schedule likely allowed vector populations to rebound and sustain transmission.

The social response also presented challenges. While health promotion activities were initiated, they may not have been sufficiently targeted or sustained. Community engagement is a cornerstone of dengue prevention. Programs such as "One House, One Jumantik" (an initiative promoting household mosquito larvae inspectors) have shown promise in Indonesia but require consistent implementation and reinforcement through local leadership and peer pressure [15].

The findings of this investigation are consistent with broader evidence that emphasizes the complexity of dengue prevention in hyperendemic areas. While vector control remains the primary method of outbreak prevention, its effectiveness is highly dependent on timing, coverage, and community cooperation. A reactive approach, as seen in Banjar Dentiyis, tends to lag behind transmission dynamics, especially given the rapid reproductive cycle of Aedes aegypti. Proactive strategies, including routine surveillance, environmental management, community education, and contingency planning, are essential to disrupt the cycle before an outbreak gains momentum [16].

Moreover, climatic factors such as increased rainfall and temperature—common in early-year months in Bali—may have contributed to vector proliferation. Although not directly measured in this investigation, climate has been shown to affect both mosquito abundance and virus replication within the mosquito, thereby amplifying transmission risk [17].

Implication

The implications extend far beyond. The lessons learned here highlight vulnerabilities in the surveillance-response continuum, gaps in community-level vector control practices, and the persistent risk posed by traditional practices that inadvertently support mosquito breeding.

Conclusion

The 2025 outbreak of DHF in Banjar Dentiyis constituted a verified public health emergency, with clear evidence of sustained transmission, spatial clustering, and one reported death. The findings highlight the importance of early detection, prompt environmental control, and strong community engagement in vector-borne disease prevention. The high prevalence of mosquito breeding sites, especially in overlooked containers like ornamental plants, presents a persistent challenge.

Moving forward, health authorities must prioritize routine entomological surveillance, community education, and rapid-response protocols. Vector control activities, including fogging, must adhere strictly to national guidelines to maximize their efficacy. Community-led initiatives such as "One House, One Jumantik" should be revived and monitored to ensure sustained behavior change.

Only through a coordinated, multi-sectoral approach that combines health system responsiveness with empowered communities can dengue outbreaks be effectively controlled in endemic regions like Gianyar.

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