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Children Under 5 Years as Predicting Dengue Transmission in Kebumen District, Indonesia: Case Study Mapping Approaches

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ABSTRACT

Background: Dengue disease is still a problem in the world. Factors affecting population main importance for dengue transmission. The dengue cases severity 34.40% in Indonesia, and the study area is an endemic dengue. The study aimed to determine factors causing dengue transmission in the Kebumen district, Central Java Province.
Subjects and Method: A cross-sectional study was conducted in 460 villages in Kebumen district, Central Java. The study was conducted in 2024 by taking dengue data from medical records in the period January 2023 to December 2023. The number of dengue cases during the study period was 395 cases that were diagnosed. The dependent variable is transmission zone. The status village transmission is a number of dengue cases> 2 cases in the village during the study based on medical records. The independent variables are children under 5 years, the incidence rate of dengue, the incidence rate area, the incidence rate density, and population age > 70 years (elderly). Data of dengue cases were obtained from medical record. The data were analyzed with an independent t-test, linear regression test, and survival test (Cox proportional hazards).
Results: The incidence rate averaged 30.17 higher than the government standard, with 10 cases/ 100,000 population for each village, and was higher in March. The population, density, children under 5 years, elderly upper 70 years, incidence density, incidence case, incidence areas, and large no significant differences between village transmission and no transmission p≤0.050, and variable contributing to dengue transmission R2= 0.39 or 39.20%. The hazard time for infection (HR = 0.62; CI95%= 0.46 to 0.83).
Conclusion: The zone is high risk for dengue transmission, 24.6% of the 460. The factors significantly related to dengue transmission in the village as population size, population density, children under 5 years, elderly upper 70 years, incidence density, incidence case, and incidence area contributing to dengue transmission, R^2= 0.39. The main factor contributing to dengue transmission is incidence density, β= 69.95.

Keywords: dengue, transmission, children, mapping, Indonesia

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BACKGROUND

The Dengue disease is still a problem in the world. The WHO (2024) estimates reported more than 7.6 million cases. The incidence rates in Samoa, United States, are 10.2 cases per 1,000 population Ryff et al. (2023). The study (Farag et al., 2022) in Qatar, an incidence of 0.70/100,000 population, increasing to 1.50/100,000 population in 2019. The study by Reza et al. (2024) in Bangladesh, was estimated 79,598 cases, estimated 48.51% in an endemic area, which confirmed dengue cases. In the study by Gomes et al. (2023) in northern Brazil, the incidence rate is estimated at 591 cases per 100,000 population. The study in Timor-Leste by Machado et al. (2024) that dengue disease significantly impacted morbidity and mortality related to urban migration, accentuates this. The previous study showed that 34.40% of dengue cases are severe in Indonesia compared in Malaysia 15.40%. The population has been infected with dengue in order of severity and died at a pediatric age (da Silva et al., 2024). The patient with dengue died in a hospital ICU at 72 years old in Argentina due to dehydration (Saúl et al., 2024). The health ministry of Indonesia in 2024 estimated that dengue in over 53,131 cases, through 404 deaths. The cut-off point of incidence rate (IR) of dengue in Indonesia is ≤ 10/100,000 population.

The based epidemiology approach through time, people, and place shows that the interaction of all in order are components is important for dengue development. The study by Sajib et al. (2024) in Asia addressed 11 countries and found that demographic-environment factors, such as population migration, density, significantly influenced dengue incidence rates. The study by Talbot et al. (2024) in Ontario, Canada that climatic, demographic, socio-economic, and geographic data factors increase the incidence of viral and human infection population. The study by Sarker et al. (2024) found that climate, demographic, and vector importing for assessment of zonation areas are high risk. The indicator time, such as long times of infection and time of transmission main factor in vector development and dengue severity in community endemic areas. The study Zohra et al. (2024) in endemic areas in Pakistan concluded dengue cases increased in October, September, and November. The study by Farag et al. (2022) in Qatar showed that the incidence of dengue is highest in June-September. The study by Nakase et al. (2024) concluded that dengue is increasingly related to rainfall through breeding places for dengue vectors and population density. The structure of the population and activities as factors increasing dengue transmission. The study in Vietnam (Taurel et al., 2023) that the incidence is highest in 5 – 14-year-olds. The study Zohra et al. (2024) in Pakistan that 25.682 dengue infected those high 21 – 30 years of age.

The indicator person, such as a vulnerable group aged under 15 years or upper 65 years, is susceptible to dengue infection. The disease infects in population, influencing the structure of the population, such as life expectancy-related mortality. The study Schumacher et al. (2024) A study related to life expectancy showed that global life expectancy at birth increased 22.7 years (20.8 to 24.8). The study of 65 years and older compared to those younger than 15 years showed an increase in 188 of 204 nations. The study Pruszynski et al. (2024). A study in Florida concluded that structural demographic factors related to dengue transmission in the area. The study showed 22.67% of Ae. Aegypti females enough to transmit the dengue virus after 15 days post-emergence. The daily survival rate of 0.8364 indicates dengue daily mortality. The daily mortality was 13-16%. The factor of popula-

tion density is significant for dengue transmission through easy interaction between one person and another. The study Harsha et al. (2023) indicates the risk zones for dengue in order indicated with factors population density, household density.

The indicator places such as large areas are important for dengue detection as a related vector. The previous study, Reza et al. (2024) concluded that dengue has become a significant issue in Bangladesh, and addressed the population situation related to mosquito breeding places. The mitigating impact of treatment in public health is essential for the zoned area impacted. The study by Pakaya et al. (2023) showed that the endemic area of previous DHF cases is a predictor for dengue. The study showed a spatial model detecting high-risk locations and driving public health. The geographical and environmental factors impact human social dynamics. The study Chen et al. (2024) concluded that identifying of location increases awareness of the community through high-risk areas priority campaigns, reducing breeding sites, and implementing vector control.

Identifying the location of cases helps focus and prioritize efforts in high-risk areas through public health campaigns for awareness, reducing mosquito breeding sites, and implementing vector control policies. Reducing transmission is important to strengthen the surveillance by identifying areas or locations where high-risk vectors develop. The study by Sarker et al. (2024) showed that the indicator of spatial cluster mapped through prevalence rates explains spatial heterogeneity and prevalence rates. The study by Gomes et al. (2023) concluded that ecological factors ecology important for the development of outbreak mechanisms. The early warning system is essential for alerting to potential dengue outbreaks in endemic local areas. The previous study in Sudan trained clinical epidemiologists, strengthening the surveillance system and improving of management of dengue disease (Siddig et al., 2024). The study in Indonesia concludes that the surveillance implemented focused on passive surveillance through some disease event late response (Susanto et al., 2025). The health provider provided information on zoning of dangerous areas with appropriate priority determination of problems.

The prevention effort addressed surveillance response and community participation for the early warning system and prevention efforts by the community, such as observation, reporting, and eradicating mosquito nests. The study Corrales-Aguilar (2024) for decreasing dengue, strengthening the surveillance response. The supporting government for the surveillance function in the local community, participating in dengue prevention and transmission (Susanto et al., 2025). The study by Rodriguez et al. (2024) concluded that the closed health facility in the community contributed to influencing decreased transmission. The early detection-related vector-focused surveillance in rainfall, temperature (Nosrat et al., 2021). The study Kamalrathne et al. (2023) factors governance main role in emergency intervention, preparedness, and response system. The zonation in areas at higher risk of dengue transmission is important for dengue mapping. This study aimed to identify factors causing dengue transmission.

SUBJECTS AND METHOD

1. Study Design

The study design used cross cross-sectional design. The study was conducted in the areas of the Kebumen district health service. The study uses a document review approach. The study was conducted in 2024 by taking dengue data from medical records in the period January 2023 to December 2023.

The study documents used include medical records from hospitals, health center services, and the Central Statistics Agency of Kebumen district.

2. Population and Sample

The population study is all villages in the Kebumen district, as 460 villages were required. The population of cases is the total population of patients who were diagnosed with dengue in the hospital and public health service in Kebumen district during 2023. The sample was conducted using the total sample.

3. Study Variables

The study variables include the independent variable and the dependent variable. The dependent variable is zona transmission. The independent variables are children under 5 years, the incidence rate of dengue, the incidence rate area, the incidence rate density, and population age >70 years (elderly).

4. Operational Definition of Variables

The data collection for village transmission, with a comparison of the disease in the village during the study period.

The variable zona risk of transmission: is the incidence rate of dengue cases above the upper government standard of 10 cases / 100,000 population in each village.

Children under 5 years: is the total number of children under 5 years in the village during the study, per the total population.

Elderly: is the total population aged 70 years or older in the village during the study, per the total population.

The variable incident case: is the total case village/total population x 100,000 population.

The incident area: is the total case village/large village (km^2) x 100,000 population.

The incident density: is a total number of cases per village/total population in the village/total large village x 100,000 population.

5. Study Instrument

The study instrument used a checklist format and document review. The document review was collected from hospital and health center service medical records reporting. The data population was collected from the Central Statistics Agency Reporting. The data on dengue cases were collected through medical records in hospitals and health service centers. The data population was collected from the Central Statistics Agency reporting at the sub-district and district levels. The data incidents were collected with mathematical calculations.

6. Data Analysis

The data were analyzed with an independent t-test, a regression test, survival test (Cox proportional hazards). The differences in children under 5 years, incident rate of dengue, incident rate area, incidence rate density, population age > 70 years between village transmission compare nontrans-mission were analyzed with an independent t test. The effectiveness factors contributing to dengue transmission, such as children under 5 years, incidence rate of dengue, incidence rate area, incidence rate density, and population age >70 years, were analysed with a regression test. The differrences in time transmission during investigation were analyzed with a survival test through the Cox proportional hazards to know the time transmission between village transmission compare nontransmission. The mapping areas were analyzed with Epi Info through the distribution of dengue cases during the study period and the description level of transmission. The multivariate analysis with regression to know factor main factors contributing to village transmission.

7. Research Ethics

The study ethics review was granted research ethics committee No. 060.3/FIKES/PL/ VI/

2024, Faculty of Health Science, Universitas Respati Yogyakarta.

RESULTS

1. Sample Characteristics

The study was conducted in 460 villages in the Kebumen District. The characteristics subject shows that the distribution characteristic of demography in each village higher population of 10.769 and an average of 3211,89. The village with the largest area of 15.26 KM2. The child under 5 years is higher compared elderly upper 70 years. The density of population in each village averages 1432.19 people/ KM2. The incidence rate averages 30.17/100.000 higher government standard of 10 cases/100.000 population for each village shown in Table 1.

Table 1. Distribution and characteristics of the variable total population, population density, incidence density, incidence rate, and incidence areas

Variable	Mean	SD	Minimum	Maximum
Size of population	3211.89	1648.26	504	10769
Population density	1432.19	978.63	193	8284
Child under 5 years	210.15	115.84	32	732
Elderly 70 years	187.72	90.03	33	512
Length of areas	2.78	2.16	0.56	15.26
Incidence density	<0.01	<0.01	0	0.016
Incidence rate	30.17	61.99	0	672
Incidence of areas	0.47	0.936	0	7

Note: Incidence rate is case dengue/total population*100,000; Incident density is total case/ density; Incident area: total case/length of area

Figure 1 shows Mapp's zonation area level of dengue transmission, based number of cases in each village, and the spatial ordinal location of dengue cases in the Kebumen district. Based on the location of transmission, it was found that there were 49 (10.65%) villages in the category of dengue transmission. The risk zone of dengue transmission in each village with dengue cases of more than 2 cases of dengue infection was determined based on medical records. The risk of dengue is higher in urban areas compared to rural areas in the district of Kebumen. The urban area more a higher population size compared rural area. The dengue transmission is higher in beach areas compared to highland areas. Based on the ordinal point the dengue cases the dengue cases spread along the river flow in the Kebumen district.

2. Bivariate Analysis

The based in bivariate analysis shown that variable population density, child under 5 years, elderly upper 70 years, incidence density, incidence of case, incidence of areas significant differences between village state of transmission compare non transmission $p< 0.050$, but large of area no significant differences between village state in transmission compare non transmission $p \geq 0.050$. The population density, children under 5 years, elderly upper 70 years, incidence density, incidence of cases, incidence of areas average higher in villages with state transmission compared to no transmission, see Table 2.

The base hazard risk between villages in transmission compare no transmission shows that significant differences in risk transmission (HR = 0.62; CI 95% = 0.46 to 0.83). The village with transmission higher risk of dengue transmission compared village with no transmission, see Figure 2. HR = 0.62; 95%CI= 0.46 to 0.83; p=0.001;

average village transmission 148.11 and the standard deviation was 99.94 days; village transmission 155.59 and the standard deviation was 106.36 days.

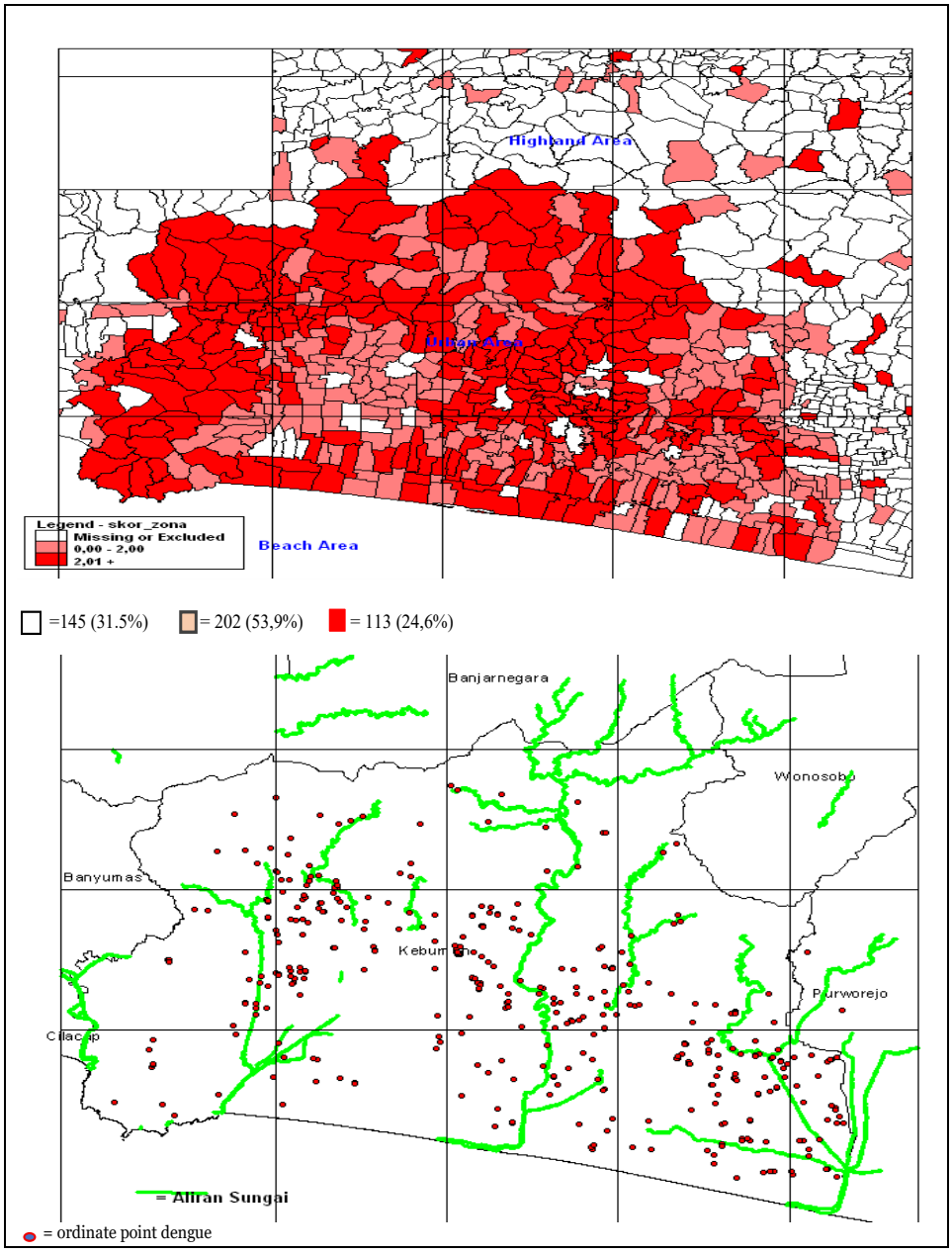

Figure 1. Mapp's zonation area level of dengue transmission, based number of cases in each village and The spatial ordinal location of dengue cases in the Kebumen district

Table 2. Differences in size of population, density, under 5 years, upper 70 years, large area, incidence density, incident rate, incidence area between village transmission and no transmission.

Variable	N	Mean	SD	p
Population density				
Zona Transmission	49	2038.78	1445.00	0.002
No transmission	411	1359.87	882.33	

Variable	N	Mean	SD	p
Child under 5 years				
Zona Transmission	49	256.36	127.66	0.003
No transmission	411	204.64	113.26	
Elderly				
Zona Transmission	49	218.81	86.68	0.009
No transmission	411	184.01	89.80	
Large of areas				
Zona Transmission	49	2.28	1.46	0.087
No transmission	411	2.84	2.23	
Incidence density				
Zona Transmission	49	0.01	0.01	<0.001
No transmission	411	0.01	0.01	
Incidence of case				
Zona Transmission	49	129.20	121.50	<0.001
No transmission	411	18.37	35.53	
Incidence of areas				
Zona Transmission	49	2.06	1.36	<0.001
No transmission	411	0.29	0.65	

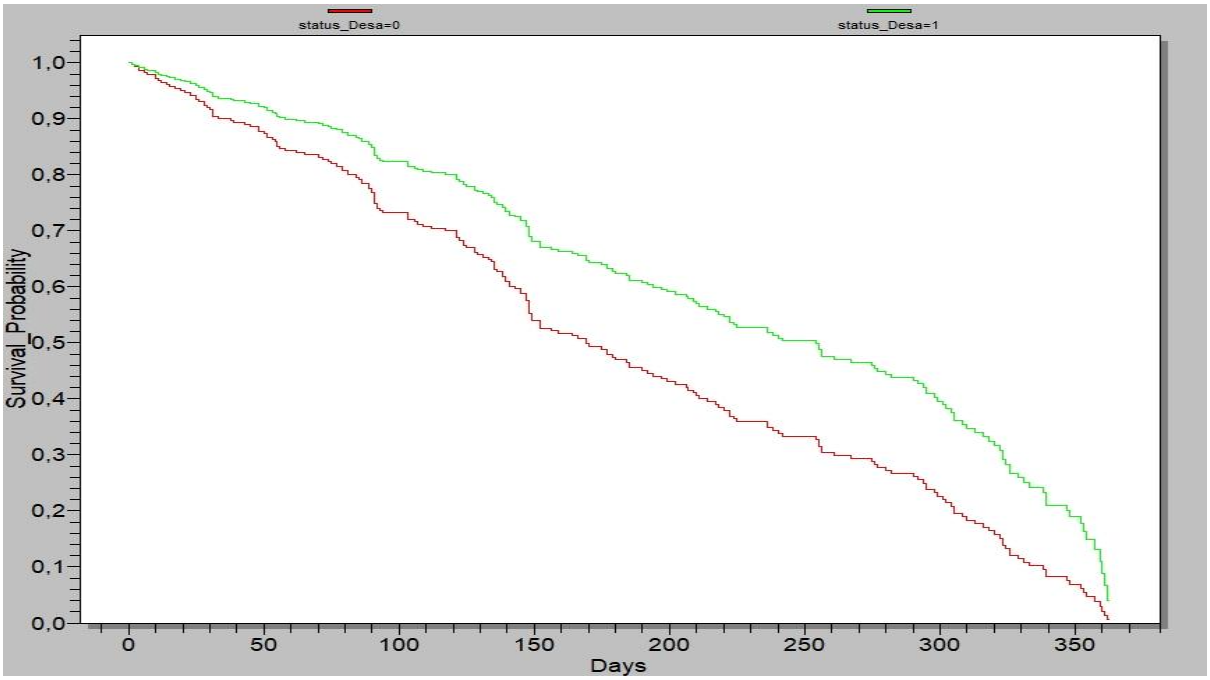

Figure 2. The survival analysis time for dengue transmission in village-based days in kebumen district.

3. Multivariate analysis

The base multivariate analysis showed that variable population density, children under 5 years, the elderly upper 70 years, and large areas contributed to transmission R^2= 0.05 or 5,40%. Variable incident density, incidence case, and incidence area contributing to dengue transmission as R^2= 0.37 or 37.70%. The total variable, such as popularion density, children under 5 years, elderly upper 70 years, large areas, incidence density, incidence case, and incidence area contributing to dengue transmission, as R^2= 0.39 or 39.20%. Based on the model shown that model in effective for explaining dengue transmission is model 3. The base multi-

variate analysis in model 3 shows that the main variable factor contributing to dengue transmission is incidence density, β= 69.95, see Table 3 for multiple linear regression.

Table 3. The multivariate Analysis variable of population, under 5 years, area, incidence density, incidence case, and incident area for dengue transmission.

Variable	b	95CI%		p
		Lower limit	Upper limit	
Population density	0.01	0.01	>0.01	0.012
Child under 5 years	0.01	0.01	>0.01	0.008
Elderly upper 70 years	0.01	0.01	>0.01	0.053
Large areas	-0.01	-0.03	0.01	0.497
incident density	75.39	39.00	111.79	<0.001
Incident case	-0.01	-0.01	0.00	0.128
Incident area	0.17	0.13	0.22	<0.001
Population density	-0.01	0.01	>0.01	0.594
Child under 5 years	0.01	0.01	>0.01	0.003
Elderly upper 70 years	0.01	0.01	>0.01	0.242
Large areas	-0.01	-0.03	>0.01	0.055
Incident density	69.95	29.83	110.07	0.001
Incident case	-0.01	-0.01	>0.01	0.281
Incident area	0.17	0.11	0.22	<0.001

DISCUSSION

The transmission of dengue in epidemiology, such as time, person, and place, describes dengue transmission as an orderly operational component in the community. The village in transmission is a role community complex factor, such as demography, large area, and environment. The previous study in various countries by Reza et al. (2024) concluded that dengue has become a significant issue in Bangladesh, addressing the population situation. The study by Machado et al. (2024) that on minimizing breeding places and vector control. The study identified that an important risk factor for children living in order to inform related interventions for policies. The study by Sarker et al. (2024) interest for spatial modelling, such as climate variables, demographics, and more breeding places. The variable demographic importing for assessment to zonation areas is high risk. Dengue has become a significant issue in Bangladesh, addressing the population situation and climate-related mosquito breeding places (Reza et al., 2024).

The epidemiology approach based place shows that 10.65% area of 460 villages in the Kebumen district has with status of transmission. The study compared in standard government, as 10% of the population, showed higher. The study by Njotto et al. (2024) shown that each country has various predictive factors and outbreaks in different regions. The study Chen-Germán et al. (2024) identifying of location in various awareness of the community through areas of priority transmission, breeding sites, and vector control. The study by Sarker et al. (2024) The shown spatial indicator of cluster mapping prevalence rates explains spatial heterogeneity and prevalence rates. Identifying the location of cases helps us to focus and prioritize treatment in public

health. The treatment for community awareness in reducing breeding sites and vector control. Reducing transmission is important to strengthen the surveillance by identifying areas or locations where high-risk vectors develop. The study that the spatial model offered was valuable to the distribution and factors influencing dengue (Pakaya et al., 2023).

The epidemiology approach in person showed that the size of the population, population density, children under 5 years, and the elderly upper 70 years in the village with transmission status compared to no transmission. The study by Machado et al. (2024) Dengue disease significantly impacted morbidity and mortality related to the population situation, such as urban migration. Urbanization easy contact person to contact other as, potentially transmitting an area endemic. The study by Sajib et al. (2024) that demographic-environment affected outbreaks. The study showed that population migration, population density significantly influence dengue incidence rates. The study by Zohra et al. (2024) In Pakistan, the dengue infection is higher in 21 – 30 years. Dengue significant association with gender, with males more affected compared females. The study by Prattay et al. (2022) shown that urban residents (54.35%) and the age group of 18– 40 years are significantly associated (p=0.013). The study in Vietnam by Taurel et al. (2023) that clinical cases incidence highest in 5 – 14-year-olds.

The factors of social economy related to dengue disease through urbanization in the role community. The study by Dalvi et al. (2023) in Brazil found that social economic condition conditions (HR = 0.43; 95%CI: 0.19 to 0.99; p = 0.047) dengue disease. Urbanization easy for vector transmission to other people related to population density. The study (Farag et al., 2022) in Qatar shown an incidence estimate is 0.70/ 100.000 population, increasing by 1.5/ 100.000 population. The dengue transmission through severe emergency-related vector bites humans (Pruszynski et al., 2024) related Ae. Aegypti females enough to transmit the dengue virus after 15 days post-emergence, and the daily survival rate is 0.8364. The demographic structure factor is related to older individuals' higher dengue transmission in the area. The study of Bangladesh by Reza et al. (2024) shown primary education was associated with a lower risk of severe dengue (OR = 0.47, 95% CI: 0.27 to 0.85).

The epidemiological approach over time has shown that higher dengue cases occur in weeks 13 to 14, and a type of sporadic transmission in the Kebumen district. Based on the government data shown that Kebumen is an endemic area of dengue in Indonesia. The study by Zohra et al. (2024) in Pakistan found that dengue cases increase in October, September, and November. The study by Farag et al. (2022) in Qatar is highest in June-September. The study by Palmeiro-Silva et al. (2024) shows that climate change and population in issue important public health issues. The study showed that transmission protection for a village in status no transmission compared to transmission. The village status in the transmission of higher children compared village with no transmission. The situation caused easy transmission in the village. The study showed that factors transmission significant such as children under 5 years, population density, large area, population aged 70 years or older, incident case, and incident density. The study by Pakaya et al. (2023) that epidemiological factors such as population, demographic, socioeconomic, and previous DHF cases as predictors for dengue. The study (Talbot et al., 2024) found that climatic, demographic, socioeco-

nomic, and geographic factors increase the incidence of virus and human infection population. The study by Gomes et al. (2023) factors social characteristic importance for the development of outbreak predicting mechanisms.

The multivariate analysis shows that factors for children under 5 years are the dominant contributing factors to transmission. The transmission of dengue is primarily in people under 5 years through density in the village. The village with transmission average is higher compared village no transmission. The potential transmission through playing behaviour and household conditions. Children under 5 years are vulnerable to dengue disease and hospitalisation in a dengue case-related dangerous situation. The dengue severity caused late health coverage. The study in Vietnam by Taurel et al. (2023) Clinical cases of dengue appear to be in older age groups. The incidence is highest in 5 – 14-year-olds. The study by Copaja-Corzo et al. (2024) in Peru that 152 patients with dengue, 19,1% developed severe dengue and 20% were admitted to the ICU, and 8,6% died during follow-up and other recovery.

The effort to reduce dengue transmission-related surveillance system includes person, place, and time. The study by Kamalrathne et al. (2023) that governance main role in emergency intervention, preparedness, and response systems. The governance supports intervention in the response system. The health provider provided information on zoning of dangerous areas with appropriate priority determination of problems. The surveillance in its best operational form could function case detector through all components, including social demographics, time infection. The study Morris and Wang (2024) to respond to emerging disease effectively in order to integrate a surveillance strategy applied to human and animal health. The factors that place such a location in potential transmission and a person in a vulnerable condition main focus of the study. Detecting the transmission importance area with high risk for transmission. The study by Pakaya et al. (2023) that spatial model detects high-risk locations and driving initiatives in public health. The study (Chen-Germán et al., 2024) identifying of location increasing awareness. The study (Sarker et al., 2024) that indicator of spatial cluster mapped through prevalence rates explains spatial heterogeneity and prevalence rates. The demographic and vector importing for assessment of zonation areas is high risk. The zonation areas in dengue risk with score component factor person and place main focus of the study for drawing areas higher risk of dengue transmission.

The study conclusion focuses on dengue transmission in terms of population density, especially in children under 5 years old. Population density is the main element in the spread of dengue disease by considering the pattern of interaction in society, especially densely populated communities in urban areas compared to rural areas. This study highlights the importance of zonation of dengue disease transmission related to population density. Efforts to reduce the incidence of dengue disease importance include elements of study results related to population density in considering efforts to prevent dengue disease based regional zonation risk approach.

AUTHOR CONTRIBUTION

The study was chaired by Nugroho Susanto. The data collecting by nugroho susanto. The data entri and analized by Dody Izhar. The reference collected review by Frans Manangsang.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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