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Association between SKDR dashboard utilization and officers' perceived early detection of increased dengue cases in gunungsitoli city: Cross-sectional study

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ABSTRACT

Background: Dengue Hemorrhagic Fever (DHF) surveillance requires timely trend monitoring, alert identification, information verification, and public health response. The Early Warning and Response System (SKDR) dashboard provides data to support these steps. Objective: To analyze the association between SKDR dashboard utilization and officers' perceived early detection of increased dengue cases in Gunungsitoli City in 2026. Methods: This analytical quantitative cross-sectional study was conducted at the Gunungsitoli City Health Office and eight UPTD Puskesmas, involving 95 surveillance officers engaged in dengue surveillance. Structured questionnaires measured dashboard utilization (four dimensions) and perceived early detection (four indicators), each scored 0–100 and grouped into categories, including adequate. Validity was tested using corrected item-total correlation and reliability using Cronbach's alpha. Data were analyzed univariately, bivariately using Pearson correlation, and multivariately using multiple linear regression. Results: Mean utilization was 73.47 (adequate 60.0%), and mean perceived early detection was 74.52 (adequate 57.9%). Most officers (87.4%) had never attended SKDR training. Utilization correlated very strongly with perceived early detection ($r=0.873$; $p<0.001$). After adjusting for SKDR training, working period, internet access, SOP/supervision, and number of officers, utilization remained associated ($B=0.927$; $\beta=0.874$; $p<0.001$; adjusted $R^2=0.875$). Conclusion: Higher dashboard utilization was associated with higher perceived early detection of increased dengue cases. Because both variables were self-reported from the same respondents, the association may be inflated, and the cross-sectional, single-city design prevents causal or generalizable conclusions. Strengthening SKDR training, supervision of alert verification, and data-based follow-up is recommended; future studies should use recorded alert-verification times.

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INTRODUCTION

Dengue Hemorrhagic Fever (DHF) remains a public health problem in tropical and archipelagic regions due to population mobility, settlement density, seasonal variations, and environmental conditions that support Aedes vector proliferation (Ministry of Health of the Republic of Indonesia, 2017). Indonesia faces a high dengue burden, with 2024 recording a substantial number of cases and more than 1,400 deaths (Ministry of Health of the Republic of Indonesia, 2025). Delays in identifying trends, verifying alerts, and initiating responses may increase local transmission and the risk of extraordinary events (KLB) (Saimi, 2026). Therefore, dengue control requires effective epidemiological surveillance that provides timely, accurate, measurable, and actionable information (World Health Organization., 2024).

The Early Warning Alert and Response System (EWARS), known in Indonesia as the Sistem Kewaspadaan Dini dan Respons (SKDR), identifies potential disease outbreaks through weekly reporting (Tsukada et al., 2025). Alerts indicate potential outbreak signals rather than confirmed KLB and must be interpreted, verified, and followed by appropriate responses The SKDR dashboard presents trend graphs, reporting tables, data completeness and accuracy indicators, and alert lists (Ministry of Health of the Republic of Indonesia, 2023a). Its effectiveness depends on officers actively interpreting case trends and using information for follow-up, rather than merely entering reports (Nugroho et al., 2026).

In Gunungsitoli City, dengue cases were recorded across all Puskesmas areas during 2023–2025. Cases increased from 313 in 2023 to 363 in 2024, a rise of 16.0%, before declining to 231 in 2025. Despite this decline, continued vigilance remains necessary. The UPTD of Gunungsitoli District Health Center accounted for 487 of 907 reported cases (53.7%), making it a priority area for monitoring. Because cases occurred in every Puskesmas area and were concentrated in one center, rising cases could appear at any facility, so timely recognition depends on how consistently officers at each facility read the dashboard, not on case counts alone. Surveillance involves officers, dengue program managers, health center heads, laboratories, clusters, and the Health Office (Aisyah et al., 2025). Uneven dashboard understanding and utilization across these functions may delay alert interpretation, trend recognition, and response.

Preliminary data from 95 officers showed that 83 (87.4%) had never attended SKDR training. Among dashboard utilization dimensions, results and follow-up had the lowest mean score (71.97), while verification of information scored lowest among early detection dimensions (73.55). These findings suggest weaknesses in translating dashboard alerts into verified information and practical responses.

Previous studies have highlighted data quality, alert verification, interregional coordination, and rapid response in EWARS implementation (Tsukada et al., 2025). Studies on public health dashboards show that dashboards speed up monitoring and facilitate data interpretation when designed and used appropriately (Schulze et al., 2023), and should be actively used by officers to read changes in cases and encourage initial responses (Rabiei et al., 2024). (Fitriani et al., 2023) emphasized that the benefits of dashboards depend on access, understanding of features, interpretation of alerts, and the use of information for program decisions, while (Sribudaya et al., 2023) dashboard availability alone does not guarantee effective early detection.

However, the research generally focuses on system development, reporting evaluation, data quality, or health digital technology in general (Sribudaya et al., 2023), so empirical evidence measuring the use of the SKDR dashboard as an officer's work practice is still limited (Auliyah, 2021). Critically, the studies above describe what a dashboard or early warning system should provide (design, data quality, and conditions for benefit) but, to our knowledge, do not test which specific utilization practices of officers are associated with their early detection of rising cases. The statement that availability does not guarantee detection, therefore remains untested against measured utilization dimensions. To the authors' knowledge, research specifically examining the relationship between SKDR dashboard utilization and early detection of increasing dengue cases

remains limited. This study addresses that gap by examining dashboard access, feature utilization, data and alert interpretation, and follow-up, while controlling for SKDR training, working period, internet access, SOPs/supervision, and staffing levels in an island city context. The novelty therefore lies in testing these four utilization dimensions against early detection, not in the study location or the control variables, which only serve to specify the relationship.

Dashboard utilization (X) and early detection (Y) are measured as separate variables using distinct questionnaire items. Dashboard utilization covers access and frequency of use, feature utilization, interpretation of data and alerts, and results and follow-up. Early detection covers trend identification, alert recognition, information verification, dissemination, and initial response. Thus, frequent dashboard use is not automatically equated with early detection capability. Utilization describes how officers use the dashboard, while early detection describes what officers recognize and do when cases rise. Early detection is measured as officers' perceived performance, not as recorded alert-to-verification time.

This study aims to analyze the relationship between SKDR dashboard utilization and early detection of increasing dengue cases in Gunungsitoli City after controlling for relevant organizational and operational factors. It also examines the relationships between individual dashboard utilization dimensions and early detection. Using a cross-sectional design, the study tests association, not causation. The findings are expected to inform the Health Office in developing dashboard utilization SOPs, strengthening officer capacity and supervision, improving feedback mechanisms, and accelerating responses to areas experiencing increasing dengue cases.

RESEARCH METHOD

The research method describes the research flow chronologically, including research design, implementation procedures, sources and methods of obtaining data, processing, and data analysis techniques. The research uses an observational quantitative analytical approach with a cross-sectional design (Kusumastuti, 2021). The respondents were 95 officers at the Gunungsitoli City Health Office and the eight UPTD Puskesmas who were involved in dengue surveillance. The sample of 95 gives about 16 respondents per predictor in the regression model (six predictors), above the commonly used minimum of 10 per predictor. Data is obtained through structured questionnaires and secondary data, then processed through editing, coding, scoring, entry, cleaning, and tabulation stages. The research procedures are systematically prepared starting from preparation, licensing and ethical approval, data collection, completeness check, to data analysis using IBM SPSS Statistics version 25 (IBM Corp, 2017). The description of the design and stages of the research is supported by relevant references so that the procedure can be scientifically accountable (Creswell, 2023; Devellis & Thorpe, 2021).

The independent variable was SKDR dashboard utilization, comprising access and frequency of use, feature utilization, data and alert interpretation, and results and follow-up. The dependent variable was early detection of increasing dengue cases, measured through trend identification, alert recognition, information verification, dissemination, and initial response. Both variables were assessed using separate questionnaire items and transformed into scores ranging from 0–100. Utilization describes how officers use the dashboard, whereas early detection describes what officers recognize and do when cases rise. Early detection was measured as officers' perceived performance, not as recorded alert-to-verification time. Because both variables came from the same questionnaire and respondents, conceptual overlap between related dimensions and common-method bias were considered possible and are addressed in the limitations. Control variables included SKDR training, working period, internet access, SOPs/supervision, and number of officers. Data analysis involved validity and reliability tests using Corrected Item-Total Correlation and Cronbach's Alpha, followed by univariate, bivariate, and multivariate analyses using Pearson or Spearman correlation and multiple linear regression. Independence of regression residuals was checked with the Durbin-Watson statistic. All 95 respondents had complete data on

every variable analyzed, so no cases were excluded and no imputation was needed. Ethical approval was obtained from the Health Research Ethics Commission (KEPK) of Universitas Prima Indonesia (No. 116/KEPK/UNPRI/VI/2026), with informed consent, confidentiality, privacy, and voluntary participation ensured throughout the study (Cronje, 2020; Fryer & Dinsmore, 2020). Unlike earlier studies that focused on system design, reporting, and data quality, this study contributes by testing individual dashboard utilization dimensions against early detection.

RESULTS AND DISCUSSIONS

Dengue/Dengue Epidemiological Situation in Gunungsitoli City in 2023 to the 27th Sunday of 2026

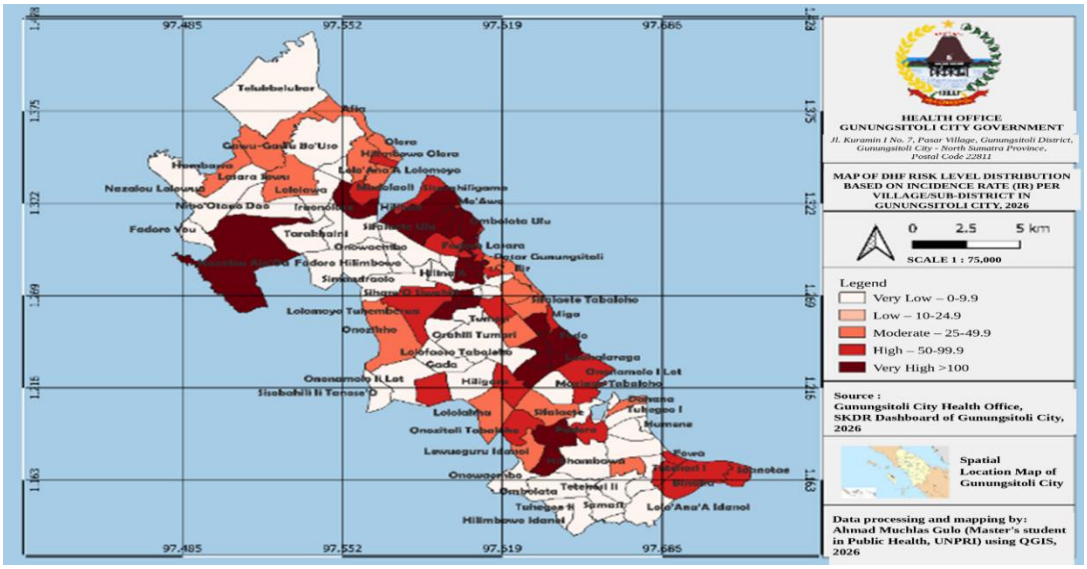


Figure 1, Distribution map of dengue risk level based on dengue IR per Village/Urban Village in Gunungsitoli City

Source: Early Awareness and Response System (SKDR) Dashboard Data of the Gunungsitoli City Health Office for the period until the 27th week of 2026; processing and mapping were carried out by researchers using QGIS

The epidemiological situation of dengue/dengue in Gunungsitoli City in 2023 until the 27th week of 2026 shows that dengue still requires continuous vigilance and monitoring. The number of dengue/dengue cases was recorded at 313 cases in 2023, increasing to 363 cases in 2024, then decreasing to 231 cases in 2025. The increase from 2023 to 2024 was 50 cases (16.0%), while in 2025 there was a decrease of 132 cases (36.4%) compared to 2024. Despite the decrease, dengue/dengue cases are still found in all health centers in Gunungsitoli City (Gunungsitoli City Health Office, 2025, 2026).

Respondent Characteristics

Table 1. Characteristics of respondents

Features	Frequency (n)	Percentage (%)
Education		
D3	45	47,4
S1	48	50,5
S2	2	2,1
Tenure		
< 1 year	17	17,9
1–3 years	38	40,0
> 3 years	40	42,1

Features	Frequency (n)	Percentage (%)
SKDR Training		
Ever/Yes	12	12,6
Never/No	83	87,4
Quantity	95	100,0

Based on Table 1, most of the respondents had a S1 education (50.5%), had a working period of >3 years (42.1%), and had never participated in SKDR training (87.4%). This condition shows that respondents have sufficient educational background and work experience, but exposure to SKDR training is still relatively low.

Univariate Analysis

Table 2. Descriptive statistics on the utilization of the SKDR dashboard, early detection of increase in dengue cases, and control variables in research respondents at the health office and eight UPTD Puskesmas in Gunungsitoli City in 2026

Variables/Dimensions	N	Rerata	Median	SB	Min.	Max.
Utilization of SKDR Dashboard (X)	95	73,47	75,00	9,75	50,00	93,75
Access and frequency of use	95	74,74	75,00	11,13	50,00	100,00
Use of dashboard features	95	73,37	75,00	10,45	50,00	95,00
Data interpretation and alerts	95	74,37	75,00	10,32	50,00	95,00
Results and follow-up	95	71,97	75,00	10,81	45,83	95,83
Early Detection of Increased Cases of Dengue (Y)	95	74,52	75,00	10,35	51,39	95,83
Identify trends	95	73,95	75,00	11,63	50,00	100,00
Alert recognition	95	76,45	75,00	11,03	50,00	100,00
Verify information	95	73,55	75,00	12,08	43,75	100,00
Dissemination and initial response	95	74,25	75,00	10,65	50,00	100,00
Variable Control						
Internet access (score 0–100)	95	76,84	75,00	18,05	25,00	100,00
SOP/supervision (score 0–100)	95	74,74	75,00	18,05	25,00	100,00
Number of officers (people)	95	4,24	4,00	0,83	3	6

Based on table 2, the average utilization of the SKDR dashboard is 73.47, while the average early detection of an increase in dengue cases is 74.52. In the use of dashboards, the highest average is found in the dimensions of access and frequency of use (74.74) and the lowest in decisions and follow-up (71.97). In early detection, the highest average is found in alert recognition (76.45) and lowest in information verification (73.55). Control variables show the average internet access is 76.84, SOP/supervision is 74.74, and the number of officers is 4.24 people. The early detection score in this study reflects officers' self-reported ability to identify trends, recognize alerts, verify information, and carry out an initial response, not objectively recorded detection performance such as alert verification time. Therefore, the score should be read as perceived early detection capability. The high correlation between utilization and early detection should also be interpreted with caution, because both variables were measured from the same questionnaire and the same respondents, which may inflate the association.

Bivariate Analysis

Table 3. The relationship between the utilization of the SKDR dashboard and its dimensions with early detection of the increase in dengue cases in research respondents at the health office and UPTD of the Gunungsitoli City Health Center in 2026

Variabel	N	r	Value p	Strength	Directions	Verdict
Utilization of the SKDR Dashboard	95	0,873	<0.001	Very powerful	Positive	H_0 rejected
Access and frequency of use	95	0,804	<0.001	Very powerful	Positive	H_0 rejected
Use of dashboard features	95	0,814	<0.001	Very powerful	Positive	H_0 rejected
Data interpretation and alerts	95	0,769	<0.001	Strong	Positive	H_0 rejected
Results and follow-up	95	0,807	<0.001	Very powerful	Positive	H_0 rejected

Based on Table 3, there was a positive, strong to very strong, and statistically significant relationship between the use of the SKDR dashboard and the early detection of an increase in dengue cases (r = 0.873; p < 0.001). All dimensions of dashboard utilization also showed a positive and significant relationship with early detection (p < 0.001). The strongest relationship was found in the use of dashboard features (r = 0.814), followed by decisions and follow-up (r = 0.807), access and frequency of use (r = 0.804), and data interpretation and alerts (r = 0.769). Thus, the better the use of the SKDR dashboard, including the use of features, access, interpretation of information, and follow-up, the better the early detection of the increase in dengue cases**.**

Multivariate Analysis

For the regression analysis, internet access and SOP/supervision were entered as continuous scores (0–100), and the number of officers was entered as a count. SKDR training was coded as a binary variable (0 = never, 1 = ever). Working period was coded as an ordinal variable (1 = <1 year, 2 = 1–3 years, 3 = >3 years). Therefore, the coefficient for training represents the difference in early detection score between officers who had and had not attended training, and the coefficient for working period represents the change in score per one-level increase in tenure category.

Table 4. Multiple linear regression coefficient for early detection of increased dengue cases in research respondents at the health office and UPTD of the Gunungsitoli City Health Center in 2026

Predictor	B	Galat Baku	b	t	Value p
Konstanta	-20,803	4,330	-	-4,804	<0.001
Utilization of *the SKDR* dashboard	0,927	0,040	0,874	23,280	<0.001
SKDR Training	5,368	1,205	0,173	4,453	<0.001
Working period	2,177	0,544	0,156	4,000	<0.001
Internet access	0,090	0,022	0,157	4,134	<0.001
SOPs/Supervisors	0,101	0,022	0,176	4,660	<0.001
Number of officers	1,704	0,461	0,137	3,694	<0.001

Based on Table 4 the SKDR dashboard utilization score had a regression coefficient of B = 0.927, standardized β = 0.874, t = 23.280, and a p< value of 0.001. This means that each one-point increase in the SKDR dashboard utilization score was associated with an average increase of 0.927 points in the early detection score of an increase in dengue cases after five control variables were controlled. The standardized β value of the SKDR dashboard utilization was the largest in the model, so this variable had the strongest relative relationship with the early detection of an increase in dengue cases compared to other predictors included.

SKDR training, working period, internet access, SOP/supervision, and number of officers also showed positive and meaningful coefficients in the model after all predictors were analyzed simultaneously. However, the coefficients of the five variables were treated as the result of adjustment and secondary information. The main findings showed that the SKDR dashboard utilization score remained positively and meaningfully related to the score of early detection of increased dengue cases after all control variables were controlled. Because the study used a cross-sectional design, the coefficients were not interpreted as causal effects.

Compared with previous studies on surveillance dashboards, which mainly addressed system design, data quality, or the availability of dashboards, this study contributes three findings. First, it measures dashboard utilization as officers' work practice across four dimensions and shows that every dimension was positively associated with early detection. Second, the association of overall utilization remained the strongest in the model (β = 0.874) after adjustment for training, working period, internet access, SOP/supervision, and staffing. Third, it provides evidence from a small island city with a cross-functional surveillance chain, a setting rarely reported in earlier work. These findings show association, not causation, given the cross-sectional design.

Table 5 Variance analysis of the multiple linear regression model for early detection of increase in dengue cases in research respondents at the health office and UPTD of the Gunungsitoli City Health Center in 2026

Source	Number of Squares	db	Rerata Quadrat	F	Value p
Back	8.883,559	6	1.480,593	110,673	<0.001
Residual	1.177,276	88	13,378		
Total	10.060,835	94			

Based on Table 5, the analysis of the variance of the regression model resulted in F(6, 88) = 110.673 with a p value of < 0.001. Because the p< value is 0.05, the regression model as a whole is statistically significant. Thus, the use of the SKDR dashboard together with SKDR training, working period, internet access, SOP/supervision, and the number of officers simultaneously related to the score of early detection of an increase in dengue cases in the study respondents.

Table 6. Summary of the multiple linear regression model for early detection of increased dengue cases in research respondents at the health office and UPTD of the Gunungsitoli City Health Center in 2026

R	R^2	R^2 customized	Estimation Standard Error	Durbin-Watson
0,940	0,883	0,875	3,658	2,359

Based on Table 6, the regression model yielded R = 0.940, R^2 = 0.883, and adjusted R^2 = 0.875, with an estimated standard error of 3.658 and a Durbin–Watson of 2.359. The adjusted R^2 value showed that 87.5% of the variation in the early detection score of increased dengue cases in the study respondents could be explained together by the use of the SKDR dashboard and five control variables, while the remaining 12.5% were related to factors outside the model and the error component.

Discussion

The results showed that the use of the SKDR dashboard had an average score of 73.47, with most respondents (60.0%) in the sufficient category. The dimensions with the highest average were access and frequency of use (74.74), while the lowest were decisions and follow-up (71.97). Meanwhile, the average early detection increase in dengue cases was 74.52, with the alert recognition dimension having the highest average (76.45) and the lowest information verification (73.55). These findings show that the dashboard has been used in surveillance activities, but the ability to translate information into verification, decision, and follow-up still needs to be strengthened. This is in line with Schulze et al. (2023) who show that public health dashboards function in situation monitoring, communication, and decision-making support, and Rabiei et al. (2024) who emphasize the importance of designing dashboards that meet user needs and produce actionable information. In the context of SKDR, alerts are signals that need to be verified before they become the basis for response. Manurung et al. (2020), Fitriani et al. (2024), and Tsukada et al. (2025) also emphasize the importance of data completeness, timeliness, verification, and response in the success of early warning systems. Thus, the use of dashboards needs to be understood as a series ranging from access to information, use of features, interpretation of trends and alerts, verification, to decision-making and follow-up (Yustian Ario Susanto et al., 2026). The differences between the lowest and highest dimensions are small (about 2.8 points), so verification and follow-up are interpreted as relatively weaker steps, not proven major obstacles. Supporting signals are the wide variation in information verification (SD = 12.08; minimum 43.75) and the low SKDR training coverage (87.4% never trained).

Bivariate analysis showed a positive and very strong relationship between the use of the SKDR dashboard and the early detection of an increase in dengue cases (r = 0.873; p < 0.001). All dimensions were also positively and significantly correlated, with the highest correlation on the use of dashboard features (r = 0.814), followed by decisions and follow-up (r = 0.807), access and frequency of use (r = 0.804), and data interpretation and alerts (r = 0.769). These findings are

conceptually in line with (Faridah et al., 2020) and Fitriani et al. (2024) who show that surveillance information systems provide value when available data is used to recognize changes in the situation and support responses. However, those studies mainly examined system performance, data quality, or the value of information, and did not test officer-level utilization against self-reported detection ability, so direct comparison of effect sizes is limited. The coefficient found here ($r = 0.873$) is stronger than what is usually expected between two distinct constructs, which is consistent with construct similarity and shared-method measurement.The correlation is high likely because both variables came from the same questionnaire and respondents (common method bias), and because the two constructs are conceptually close. It should be read as an association between self-reported practice and self-reported ability. The regression results reinforce these findings, because the use of the SKDR dashboard remains positively and significantly related after being controlled by SKDR training, working period, internet access, SOP/supervision, and number of officers ($B = 0.927$; $\beta = 0.874$; $p < 0.001$). Operationally, $B = 0.927$ means that a 10-point higher utilization score is associated with an early detection score about 9.3 points higher, so routine dashboard review, training, and supervision of alert follow-up are reasonable priorities for officers and program managers. The adjusted R^2 value = 0.875 indicates that the model explains 87.5% of the variation in early detection scores. Practically, these results show the importance of making the dashboard part of routine surveillance activities, strengthening the ability to use alert features and interpretation, and ensuring that each signal is followed by verification, coordination, and initial response. These implications are proposed as priorities for consideration; this study does not show that training or supervision will improve early detection. Internet support, SOPs, supervision, and the adequacy of officers also need to be considered as a supportive environment for information utilization (Vingky Nanda Sari et al., 2025).

This study has several limitations that need to be considered in interpreting the results. The cross-sectional design does not allow researchers to ascertain the time sequence or cause-effect relationship, so the regression results only show statistical relationships and cannot be interpreted as causal effects (Saenong et al., 2025). The use of self-report questionnaires on the same respondents to measure dashboard utilization and early detection also has the potential to cause perception bias, social desirability bias, and common method bias, which can strengthen the magnitude of the correlation (Saptoto et al., 2026). For this reason, the high correlation and R^2 should be interpreted with caution. The study was conducted only in Gunungsitoli City, so generalizations to other regions need to be done carefully. In addition, the study has not used objective indicators such as the frequency of dashboard access recorded by the system, the time between the appearance of alerts and verification, data quality, and the accuracy of field follow-up. Therefore, further research is recommended to use longitudinal design or pre-intervention evaluation and combine questionnaire data with data on the use of dashboards and objective response indicators. Future studies should include alert verification time, weekly report completeness, and the accuracy of field responses to test whether higher utilization is linked to measurable early detection of dengue.

CONCLUSION

Based on the study involving 95 respondents at the Gunungsitoli City Health Office and eight UPTD Puskesmas in 2026, the utilization of the SKDR dashboard and early detection of increasing dengue cases were classified as sufficient, with mean scores of 73.47 and 74.52, respectively. Respondent data demonstrated a strong positive and statistically significant correlation between dashboard utilization and early detection scores ($r = 0.873$; $p < 0.001$). This relationship remained significant after controlling for SKDR training, working period, internet access, SOPs/supervision, and the number of officers. The findings provide empirical evidence of an association between dashboard utilization and early detection scores, particularly regarding situation monitoring, case trend identification, alert interpretation, and follow-up. However, the cross-sectional design,

questionnaire-based measurements, and limited geographical coverage prevent causal conclusions or claims that dashboard utilization directly improves detection capabilities, accelerates response times, or reduces dengue cases. Practically, the findings support consideration of continued training, supervision, and improved data interpretation practices, while recognizing that their effectiveness requires further evaluation. Future research should involve broader study areas, longitudinal or evaluative designs, and objective indicators of dashboard utilization and surveillance performance to assess its effectiveness in supporting early detection of dengue cases.

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