Surveillance of Central Obesity Using the Sehat Indonesiaku (ASIK) App in Denpasar City in 2025: An Evaluation Based on the Logic Model and Surveillance Attributes

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Abstract

Central obesity was a major risk factor for noncommunicable diseases (NCDs), with an increasing trend in Denpasar City, highlighting the need for an effective surveillance system. This study evaluated the performance of the ASIK-based central obesity surveillance system using a logic model framework (input, process, and output) and surveillance attributes. A mixed-methods descriptive evaluative study was conducted among NCD program officers at the Denpasar City Health Office and community health centers. The quantitative component used a cross-sectional approach, while qualitative data were collected through in-depth interviews, involving 12 respondents selected through total sampling. Data were collected using structured Likert-scale questionnaires and in-depth interviews and were analyzed descriptively based on CDC surveillance system evaluation guidelines. The results showed that input components were relatively adequate; however, challenges included dual workloads, limited technical training, and insufficient operational support. At the process level, the system operated as a non-integrated manual-digital hybrid, characterized by delayed data entry, duplication of recording, and lack of routine data verification. At the output level, data utilization remained limited to administrative reporting and was not optimally used for program planning or decision-making. In terms of surveillance attributes, simplicity (83.3%), flexibility (100%), and acceptability (91.7%) were categorized as good, while data quality (16.7%), representativeness (25.0%), stability (8.4%), and timeliness (50.0%) were low. In conclusion, the ASIK-based central obesity surveillance system was operational but not yet optimal. Strengthening system integration, improving data quality assurance mechanisms, and enhancing data utilization were essential to improve surveillance effectiveness and support evidence-based decision-making.

Keywords: ASIK application, central obesity, logic model, surveillance system evaluation.

Introduction

Central obesity is a nutrition-related health problem worldwide, including in Indonesia. Central obesity is an accumulation of excess abdominal fat in the abdominal region. The criteria for central obesity, as assessed by waist circumference, are ≥90 cm for men and ≥80 cm for women (Keller et al., 2026). According to data from the World Health Organization (WHO), globally there are more than 1 billion adults who are overweight, and about 300 million of them are obese. Obesity is prevalent in developing countries, with the number of sufferers reaching more than 115 million people. In Europe, the obesity rate has increased significantly, from 10% to 40% over the past decade. The WHO also reports that the global obesity rate has nearly tripled from 1975 to 2016, with approximately 650 million adults classified as obese in 2016 (WHO, 2021).

According to the 2023 Indonesian Health Survey, the prevalence of central obesity in Indonesia reached 36.8%, indicating that more than one-third of the adult population faces a high risk of complications from noncommunicable diseases. Meanwhile, in Bali Province, the prevalence of central obesity is slightly lower but remains concerning, at 36.2% (Survey Kesehatan Indonesia, 2023). This figure indicates that the burden of central obesity in Bali is nearly on par with the national average. Denpasar, as the administrative and urban center of Bali, is one of the areas with a high potential risk of central obesity. Rapid urbanization, coupled with shifts in dietary patterns toward foods high in sugar, fat, and simple carbohydrates, as well as low physical activity due to a sedentary lifestyle, also contribute to the rising incidence of obesity (Ghosh et al., 2023).

Within the jurisdiction of the Denpasar City Health Office, early detection data on central obesity collected from all community health centers (Puskesmas) in Denpasar City indicate that central obesity is widespread across the entire region, with varying numbers of cases. However, screening coverage and case detection varied among health centers and may not yet fully reflect the program targets established by the Denpasar City Health Office. In North Denpasar District, the highest number of early detection participants was at Community Health Center II with a total of 4,414 participants, with 643 cases of central obesity (14.6%), while the lowest number of participants was at Community Health Center I with a total of 206 participants and 69 cases of central obesity (33.5%). In South Denpasar Subdistrict, the highest number of early detection participants was recorded at Community Health Center II with a total of 1,970 participants and 515 cases of central obesity (26.1%). Meanwhile, Community Health Center I had the fewest participants, with 389 participants and 89 cases of central obesity (22.4%). In the West Denpasar area, Community Health Center II recorded the highest number of participants, at 949 people, with 274 cases of central obesity (23.9%), while Community Health Center I recorded 749 participants with 481 cases of central obesity (28.9%). Meanwhile, in East Denpasar, Community Health Center II recorded the highest number of participants at 1,115 people with 514 cases of central obesity (46.1%), and the lowest at Community Health Center I with 121 participants and 29 cases of central obesity (24%). This central obesity

screening program is intended for individuals aged 15 and older, in accordance with nationally applicable guidelines for the early detection of NCD risk factors. Additionally, the Sehat Indonesiaku (ASIK) application system only allows one registration per year based on the participant's National Identity Number (NIK).

The increasing prevalence of central obesity has become a major public health concern because it is strongly associated with noncommunicable diseases such as type 2 diabetes, hypertension, dyslipidemia, and cardiovascular disease. If not properly addressed, central obesity may increase morbidity, premature mortality, healthcare costs, reduced productivity, and the overall burden on the healthcare system. In Denpasar City, surveillance of noncommunicable diseases has been implemented through the ASIK application in accordance with Ministry of Health Regulation No. 45 of 2014 on Health Surveillance Implementation. However, studies evaluating the performance of the ASIK-based central obesity surveillance system, particularly using a comprehensive framework that integrates logic model components and CDC surveillance attributes, remain limited. The absence of such evaluations may hinder efforts to identify operational gaps, ensure data quality, and optimize the use of surveillance data for evidence-based decision-making. Therefore, this study aimed to evaluate the performance of the ASIK-based central obesity surveillance system in Denpasar City by assessing input, process, and output components, as well as key surveillance attributes including simplicity, flexibility, data quality, acceptability, sensitivity, representativeness, stability, and timeliness based on CDC surveillance evaluation guidelines (CDC, 2001; Rahajeng & Wahidin, 2020; Kalil & Abdulle, 2021).

Method

This study used a mixed-methods descriptive evaluative design. The quantitative component applied a cross-sectional approach, while qualitative data were obtained through in-depth interviews. The study evaluated the performance of the ASIK-based central obesity surveillance system in Denpasar City. The study population consisted of all NCD surveillance officers at the Denpasar City Health Office and 11 community health centers (*Puskesmas*). A total stakeholders was applied, resulting in 12 respondents.

Data were collected through structured questionnaires, in-depth interviews, and document review. The questionnaires were administered to all respondents and used a four-point Likert scale to assess the performance of the surveillance system. The questionnaire was developed based on the Centers for Disease Control and Prevention (CDC) guidelines for evaluating public health surveillance systems (CDC, 2001) and covered two main components: (1) the logic model, including input, process, and output components, and (2) surveillance attributes, including simplicity, flexibility, data quality, acceptability, sensitivity, positive predictive value, representativeness, stability, and timeliness. Each variable was measured using predefined indicators.

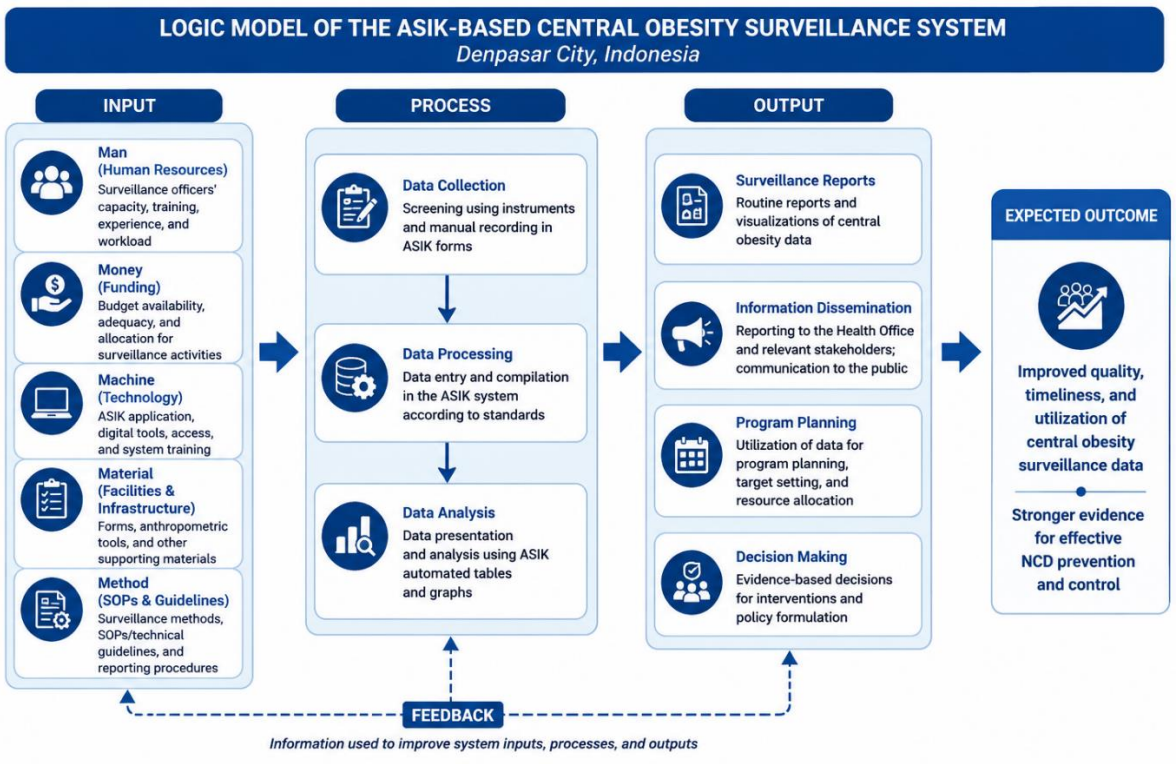
In-depth interviews were conducted with selected surveillance officers to obtain more detailed information regarding operational challenges, implementation barriers, reporting processes, and data utilization within the surveillance system. Document review was performed on surveillance reports, recording forms, and program documents related to the implementation of the ASIK-based surveillance system.

Quantitative data were analyzed descriptively using frequency distributions and percentage scores for each indicator and attribute. System performance was categorized as good (≥80%), adequate (60-79%), or poor (<60%). Qualitative data from interviews were analyzed using thematic analysis to identify recurring themes and support quantitative findings. Data triangulation was conducted by comparing questionnaire results, interview findings, and program documents to enhance the validity of the evaluation.

Table 1. Components Evaluated

Assessment Aspects	Indicators Assessed
Input	
Man (Human Resources)	Characteristics of surveillance officers including name, sex, age, education level, length of service, number of personnel, position, experience in managing the program, training attended, and future training needs.
Money (Funding)	Funding for screening activities, including sources of funding, adequacy of funds, and types of activities financed.
Machine (Technology)	Availability and utilization of digital tools in surveillance implementation, including ease of use, accessibility, and application training.
Material (Facilities and Infrastructure)	Non-digital resources such as record books, forms, and their completeness and ease of use by program officers.
Method	Implementation methods including active surveillance, availability of standard operating procedures (SOPs) or technical guidelines, and use of online reporting systems.
Proses	
Data Collection	Data collection methods were conducted in accordance with Ministry of Health Regulation No. 45 of 2014 on Health Surveillance Implementation, involving examination of targets using instruments as interview aids.
Data Processing	The process of data entry and compilation of obesity data collected from primary health centers. This evaluation refers to health data processing standards to produce specific, accurate, and timely information.
Data Analysis	Capacity and availability of procedures for presenting and analyzing data.

Output	
Information Dissemination	The format and flow of surveillance reporting to the Health Office, as well as data continuity across related institutions. The evaluation also assesses the extent to which surveillance information is disseminated to the public or other stakeholders to enhance response and intervention.



Figur 1. Logic Model of the ASIK-Based Central Obesity Surveillance System Evaluation in Denpasar City

Figure 1 illustrates the logic model framework used in this study. The framework describes the linkage between input, process, and output components of the ASIK-based central obesity surveillance system and serves as the basis for evaluating system performance.

Results

1. Analysis of the Implementation of the Central Obesity NCD Surveillance System Based on the Logic Model

a. Input Evaluation

1) Man (Human Resources)

Table 2. Distribution of Characteristics of NCD Surveillance Officers at the Denpasar City Health Office

Variable	Frequency (n=12)	Percentage (%)
Sex		
Male	1	8.3
Female	11	91.7
Age (years)		
26-30 Years	2	16.7
31-35 Years	5	41.7
36-40 Years	2	16.7
41-45 Years	2	16.7
46-50 Years	1	8.3
Education Level		
Diploma (D-III)	3	25
Bachelor (D-IV/S1)	6	50
Professional Degree	3	25
Professional Background		
Nurse	10	83.3
Nutritionist	1	8.3
Public Health	1	8.3
Length of Service (years)		
1-5 Years	4	33.3
6-10 Years	5	41.7
> 10 Years	3	25
Workload		
1 Program	8	66.7
2 Programs	2	16.7
≥ 3 Programs	2	16.7
Training History		
Ever attended training	12	100
Never attended training	0	0

The human resource component was generally adequate in terms of educational background, professional competence, and work experience. Most respondents were aged 31-35 years (41.7%), held a bachelor's degree (50%), and had 6-10 years of work experience (41.7%), indicating sufficient capacity to support surveillance activities. Most respondents were nurses (83.3%), while the remaining respondents were nutritionists and public health personnel, reflecting the multidisciplinary nature of NCD surveillance implementation. However, the performance of this component was only partially optimal. A considerable proportion of officers were responsible for multiple programs, with 33.4%

handling two or more programs, which may reduce focus and consistency in surveillance implementation.

Although all respondents (100%) had participated in training, the capacity was not fully adequate, as most training was general and did not specifically address technical needs, particularly related to ASIK data entry and data validation processes.

2) Money (Funding)

The funding component was generally adequate, with the primary source derived from Health Operational Assistance (BOK) funds, which support NCD screening activities both within and outside health facilities. However, specific gaps were identified in operational aspects, including transportation for field activities, advanced technical training, and incentives for supporting personnel. These limitations indicate that while funding is available, its allocation has not fully supported operational needs.

3) Machine (Technology)

The technology component was not optimal. Although all respondents utilized the ASIK application for reporting, none were provided with official devices, resulting in reliance on personal mobile phones. Limited technical training and frequent application-related problems, including login failures, system errors, and occasional data loss, were commonly reported. These technical constraints often delayed data entry and reduced overall system reliability.

4) Material (Facilities and Infrastructure)

The material component was partially adequate. Basic materials, including ASIK forms and anthropometric tools, were available across all health centers. However, inconsistencies in the quality and condition of measurement tools, as well as the absence of routine calibration, were reported. These issues may affect measurement accuracy and, consequently, data validity. Limitations in document storage systems were also identified.

5) Method

The method component was not fully standardized. Although all health centers reported having SOPs or technical guidelines, variations in content and format were observed. Furthermore, integration between SOPs and the ASIK digital system was limited, leading to confusion among staff when aligning manual procedures with digital reporting workflows. This indicates gaps in standardization and implementation consistency.

b. Process Evaluation

1) Data Collection

The data collection process was not optimal. Data were collected through screening activities and initially recorded manually using ASIK forms. However, most respondents reported that data entry into ASIK was not conducted in real-time, but after activities were completed. In addition,

duplication of recording was identified due to the lack of integration between ASIK and E-Puskesmas systems.

2) Data Processing

The data processing component was partially adequate. Data processing was conducted automatically within the ASIK system after entry. Nevertheless, data verification prior to submission was not consistently performed, indicating weak quality control mechanisms.

3) Data Analysis

The data analysis component was not optimal. Analysis was limited to automatically generated tables and graphs provided by the ASIK system. No further interpretation, trend analysis, or comparison across health centers or time periods was routinely conducted, indicating limited analytical utilization of data.

c. Output Evaluation

The output component was not functioning optimally. Surveillance data were available in the form of reports and visualizations; however, their use remained limited to routine administrative reporting. Data were not systematically utilized for program planning, evaluation, or decision-making. Dissemination was also limited, as findings were primarily reported to the Health Office without broader communication to stakeholders or the community.

In addition, feedback mechanisms were largely administrative and not analytical, with no tailored recommendations or in-depth evaluation provided to health centers. This indicates that the surveillance system output remains passive and has not been transformed into actionable information.

2. Analysis of the Implementation of the Central Obesity NCD Surveillance System Based on Surveillance Attributes

To provide a more objective assessment, each surveillance attribute was scored based on Likert-scale responses (1-4) and converted into percentage scores. The score for each attribute was calculated as the average of all item scores within the attribute. Performance was categorized as good (≥80%), adequate (60-79%), and poor (<60%).

Table 3. Scores of Surveillance System Attributes Based on Likert Scale Assessment

No	Surveillance Attribute	Number of Items	Score (%)	Category
1	Simplicity	5	83.3	Good
2	Flexibility	4	100.0	Good
3	Data Quality	6	16.7	Poor
4	Acceptability	4	91.7	Good
5	Sensitivity	2	50.0	Poor
6	Positive Predictive Value	2	75.0	Adequate
7	Representativeness	3	25.0	Poor
8	Stability	3	8.4	Poor
9	Timeliness	3	50.0	Poor

The evaluation of surveillance system attributes revealed varying levels of performance across different dimensions (Table 3). Overall, the system performed well in simplicity (83.3%), flexibility (100%), and acceptability (91.7%), indicating that the system is generally easy to use, adaptable to changes, and well accepted by health personnel.

In terms of simplicity, most respondents reported that the surveillance procedures were easy to understand and implement. However, some operational challenges remained, particularly due to the coexistence of manual and digital systems, as well as technical issues such as delayed data entry and system errors.

The system also demonstrated high flexibility, as respondents indicated that it could accommodate changes in reporting formats and targets. Nevertheless, this flexibility was constrained by the lack of integration with other health information systems, particularly E-Puskesmas, which limited data exchange and interoperability.

Acceptability was also high, with the majority of respondents actively participating in reporting activities. Despite this, limited feedback from the Health Office was identified as a potential barrier to sustaining long-term engagement and continuous system improvement.

In contrast, several key attributes showed poor performance. Data quality had a very low score (16.7%), reflecting substantial issues related to data completeness, consistency, and data management practices. Delayed data entry and the absence of routine validation mechanisms further contributed to poor data quality.

Sensitivity was also low (50.0%), indicating that the system has limited ability to detect all relevant cases and trends in central obesity. This limitation was partly due to the exclusion of data from private healthcare facilities, reducing system coverage.

The positive predictive value was categorized as adequate (75.0%), suggesting that the screening methods used, such as waist circumference measurement, were generally appropriate in identifying true cases, although further confirmation was still required.

Representativeness was low (25.0%), indicating that the system does not adequately capture variations across population groups and geographic areas, thereby limiting its ability to reflect the true distribution of central obesity.

Stability was identified as the weakest attribute (8.4%), with frequent technical issues such as system errors, login failures, and data loss significantly affecting system reliability and user confidence.

Timeliness was also suboptimal (50.0%), as reporting was often delayed due to high workload and technical constraints, despite routine data collection being conducted.

Overall, these findings indicate that while the system performs well in terms of usability and user engagement, its core surveillance functions, particularly data quality, stability, representativeness, and timeliness, remain inadequate and require substantial improvement.

Discussion

1. Implementation of the Central Obesity NCD Surveillance System Based on the Logic Model

This study demonstrates that although the ASIK-based central obesity surveillance system is operational in Denpasar City, its performance remains suboptimal across input, process, and output components, indicating a clear gap between system availability and effective system functioning.

From the input perspective, human resources were generally adequate in terms of educational background and experience. However, the presence of dual or multiple program responsibilities significantly reduces the effectiveness of surveillance activities. This finding aligns with previous studies indicating that excessive workload in public health settings negatively affects data quality and reporting consistency.

Interestingly, this study also highlights a contradiction with expectations of digital health systems. While digitalization is typically associated with improved efficiency, the coexistence of manual and digital reporting in the ASIK system has instead increased workload due to duplication. This finding suggests that digital transformation without full system integration may lead to inefficiencies rather than improvements.

Although all staff had participated in training, the limited technical focus of these trainings reveals a mismatch between capacity-building efforts and operational needs. According to the World Health Organization (WHO, 2018), effective surveillance systems require competency-based training tailored to specific system functions. The lack of targeted training in this study likely contributes to ongoing issues in data entry accuracy and validation.

From a financial perspective, although funding was generally perceived as sufficient, gaps in operational support, particularly for transportation, technical training, and incentives, indicate that resource allocation has not been fully aligned with field-level needs. This finding is consistent with Richter et al. (2022), who argue that the effectiveness of funding depends not only on availability but also on its strategic allocation. In this case, funding appears adequate in quantity but limited in its functional impact.

Regarding technology, the ASIK system represents a significant step toward digital surveillance. However, frequent technical issues, including system instability, data loss, and login failures, substantially reduce its effectiveness. This finding is in contrast with well-functioning digital surveillance systems, where stability and infrastructure readiness are critical success factors (Shalsabilla, 2024). As noted by Kirk et al. (2021), unreliable systems can reduce user trust and compliance, ultimately affecting data completeness and timeliness. The reliance on personal devices further reflects limited institutional support.

In terms of materials and infrastructure, inconsistencies in measurement tools and the absence of routine calibration raise concerns about data validity. This issue is particularly important in central obesity surveillance, where measurement accuracy directly influences case classification. Previous

study by Ozonze et al. (2023) and Machmud et al. (2025) have shown that measurement errors can introduce systematic bias, potentially affecting the estimation of disease burden.

From a methodological perspective, although SOPs were available, their variation across health centers and limited integration with digital workflows indicate weak standardization. This finding contrasts with best practices in surveillance systems, which emphasize the importance of standardized procedures to ensure data comparability across locations and time (Aritonang, 2024; Suryawan & Maradona, 2024). The lack of alignment between manual SOPs and digital systems further contributes to operational fragmentation.

At the process level, the study identifies several critical inefficiencies. Delayed data entry and duplication of reporting reflect the lack of integration between ASIK and E-Puskesmas systems. While previous studies (Olakotan, 2025) highlight the importance of system integration in improving efficiency, this study demonstrates that its absence increases workload and introduces potential inconsistencies in data.

Furthermore, the absence of routine data verification indicates a significant weakness in quality assurance. As emphasized by Syed et al. (2023), automation without validation mechanisms may amplify data errors rather than reduce them. Limited data analysis at the health center level further indicates that the surveillance system has not fully utilized its analytical potential.

From the output perspective, the most critical limitation lies in the minimal utilization of surveillance data. Although data are routinely collected and reported, they are not effectively used for program planning, evaluation, or policy-making. This finding highlights a fundamental disconnect between data production and data use.

Consistent with Rahajeng & Wahidin, (2020), surveillance systems should transform data into actionable insights; however, the current system remains largely administrative. The absence of systematic dissemination and meaningful feedback mechanisms further limits the impact of surveillance outputs, representing a missed opportunity for strengthening NCD control.

2. Analysis Based on Surveillance Attributes

The evaluation of surveillance attributes, as quantified through Likert-based scoring, indicates an overall mixed performance profile, with strengths in usability-related attributes and critical weaknesses in core surveillance functions.

Simplicity (83.3%) and flexibility (100%) were categorized as good, indicating that the system is generally easy to understand and adaptable. In terms of simplicity, the system is relatively easy to understand and implement; however, the coexistence of manual and digital systems introduces operational complexity, reducing efficiency despite its overall ease of use. This finding supports previous studies suggesting that hybrid systems tend to be less efficient than fully integrated digital systems (Mboera et al., 2021).

The system also demonstrated high flexibility, suggesting that it can adapt to changes in reporting formats and requirements. However, this adaptability remains largely structural rather than functional, as it is not supported by integration with other health information systems. As a result, it does not translate into improved efficiency or data flow, limiting system effectiveness.

In contrast, core performance attributes showed substantially lower scores. Data quality was particularly poor (16.7%), reflecting significant issues in data completeness, consistency, and validation. This finding reinforces previous evidence that digital systems without strong quality control mechanisms remain vulnerable to reliability issues (Sari et al., 2022; Paivaa et al., 2025).

Despite these limitations, acceptability remained high (91.7%), indicating strong engagement and participation from health workers. This is an important strength for system sustainability; however, limited feedback mechanisms may weaken long-term motivation and performance, as feedback plays a key role in maintaining engagement (Ali et al., 2025).

Sensitivity (50.0%) was suboptimal, indicating that the system has a limited ability to detect all relevant cases and trends in central obesity. The positive predictive value was categorized as adequate (75.0%), suggesting that the screening methods used are generally appropriate for identifying true cases, although confirmatory procedures are still required.

Representativeness (25.0%) was low, indicating that the system does not adequately capture variations across population groups and geographic areas. Together with low sensitivity, this suggests that the system may underestimate the true burden of central obesity, particularly due to incomplete data coverage and the exclusion of private healthcare facilities (Albali, 2023; Yu, 2024).

Stability was identified as the weakest attribute (8.4%), indicating frequent technical disruptions such as system errors, login failures, and data loss, which undermine system reliability and user confidence. This finding is consistent with Kalil & Abdulle (2021), who emphasize that system stability is a fundamental requirement for effective surveillance systems.

Timeliness (50.0%) was also suboptimal, reflecting delays in data entry and reporting due to workload and technical constraints. As timely data are essential for effective public health response, these delays reduce the responsiveness of the surveillance system (Jaya et al., 2023; Nurhasanah et al., 2025).

Overall, these findings highlight a critical imbalance: while the system performs well in terms of usability and user engagement, its core functions, particularly data quality, stability, representativeness, sensitivity, and timeliness, remain inadequate. This imbalance suggests that improvements should prioritize strengthening system integration, data quality assurance mechanisms, and technical infrastructure rather than focusing solely on user adoption. Strengthening surveillance systems therefore requires not only improving system usability but also ensuring data reliability, integration, and utilization for decision-making.

Conclusions

The ASIK-based central obesity surveillance system in Denpasar City is operational but not yet optimal. Key constraints include dual workloads, limited technical capacity, and insufficient operational support at the input level. At the process level, the system remains a non-integrated manual-digital hybrid, leading to delayed data entry, duplication, unstable internet access during reporting, and weak data verification. At the output level, data use is still limited to routine reporting and has not been fully utilized for planning or decision-making. Most surveillance attributes such as simplicity, flexibility, and acceptability are relatively good, while data quality, sensitivity, representativeness, stability, and timeliness remain weak.

In conclusion, system performance is limited by integration gaps and technical constraints. Future improvement should focus on strengthening system integration, providing official devices and stable internet support, enhancing training for officers, and improving data quality assurance and utilization to support evidence-based decision-making.

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