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Original Research Article

ASSESSING THE ROBUSTNESS OF A HYPERTENSION SURVEILLANCE SYSTEM: A CASE STUDY IN THE WORKING AREA OF THE DENPASAR CITY HEALTH OFFICE, 2025

Ni Luh Rahayu Widaryati[1)]*, Putu Ayu Swandewi Astuti [2)], Putu Dwi Adi[3)]
[1)] Master of Public Health Program, Faculty of Medicine, Udayana University
[2)] Faculty of Medicine, Udayana University
[3)] Bali Provincial Public Health Office
*Corresponding Author, E-mail: rahayuinda66@gmail.com

ABSTRACT

Introduction. Hypertension is widely recognized as a silent killer and risk factors of stroke and cardiovascular disease. Within Denpasar City, the prevalence of hypertension remains notably elevated. Surveillance systems constitute an indispensable instrument for the ongoing monitoring and control of hypertension. The present study sought to evaluate the hypertension surveillance system operating within the jurisdiction of the Denpasar City Health Office during 2025. **Method.** A qualitative case study design was used. Data collected through in-depth interviews conducted with non-communicable disease program officers at the Denpasar City Health Office and at four community health centres *(Puskesmas)* selected via simple random sampling. The data analysed with descriptive analysis. **Result & Analysis.** The result shows that the hypertension surveillance system was operational yet fell short of optimal performance. Principal constraints were identified in the areas of limited human resource capacity, excessive dual workloads among frontline staff, and fragmented reporting mechanisms. The ASIK application was frequently subject to technical disruptions, lacked integration with the existing E-Puskesmas system and depended on staff's personal devices. Furthermore, only a subset of community health volunteers demonstrated the capability to perform independent data input. The system performed adequately in acceptability and representativeness; however, significant deficiencies were observed in the domains of simplicity, timeliness, and stability. **Conlusion.** Strengthening is needed in human resource development, digital system integration, provision of adequate supporting infrastructure, and structured training programs for community health volunteers to improve system effectiveness and sustainability.

Keywords: ***Denpasar City, Hypertension, Logic Model, Surveillance Attributes, Surveillance System***

INTRODUCTION

Hypertension, widely referred to in clinical and public health discourse as a silent killer, constitutes one of the foremost drivers of non-communicable diseases (NCDs), most notably coronary heart disease and stroke. These conditions have ascended to become the leading causes of mortality worldwide, disproportionately affecting low and middle-income countries, including Indonesia. A particularly concerning characteristic of hypertension is the absence of recognizable symptoms in the majority of affected individuals, rendering a large segment of the population unaware of their condition and, consequently, untreated.

At the global level, an estimated 1.13 billion individuals are living with hypertension, with approximately two-thirds of this population residing in low- and middle-income countries. Despite the scale of the burden, fewer than 20% of affected individuals achieve adequate blood pressure control. This situation positions hypertension as the single largest attributable cause of premature death globally. In recognition of this public health emergency, the World Health Organization established a target of reducing the global prevalence of hypertension by 25% by the year 2025 (Kemenkes, 2019; WHO, 2025).

Within Indonesia, national data from the 2018 Basic Health Research Survey by Riskesdas (2019) documented a statistically significant rise in hypertension prevalence, from 25.8% in 2013 to 34.1% in 2018. Given the country's population of approximately 260 million, this trajectory presents a formidable public health challenge. The situation is further compounded by persistent gaps in detection and treatment: only approximately one quarter of all cases are identified, and among those diagnosed, a mere 0.7% reportedly adhere to antihypertensive pharmacotherapy on a regular basis (Riskesdas, 2019).

More recent surveillance data from the 2023 Indonesian Health Survey *(SKI)* conduct by BKPK Kemenkes (2024) indicate that hypertension prevalence in Bali Province remains substantially elevated. Among the population aged 15 years and above, only 9.5% reported having received a physician-confirmed diagnosis; however, direct blood pressure measurement revealed a prevalence of 31.1% within this age group. A comparable discrepancy was observed among individuals aged 18 years and above, where the physician-diagnosed rate stood at 10.0%, in contrast to a measured prevalence of 32.3%. This substantial divergence between self-reported diagnosis and objectively measured prevalence is strongly indicative of widespread undetected hypertension within the community.

At the national policy level, Indonesian Minister of Health Regulation No. 45 of 2014 on the Implementation of Health Surveillance mandates that all health institutions, from the ministerial level down to primary healthcare facilities, establish and maintain health surveillance systems (Kementerian Kesehatan, 2014). This obligation explicitly encompasses surveillance activities directed at NCD risk factors (Kementerian Kesehatan, 2024).

The operational effectiveness of any surveillance system is fundamentally contingent upon the quality of the data it generates. Accurate and reliable information serves as the cornerstone of evidence-based health policy formulation. Periodic evaluation of surveillance systems is therefore essential to confirm that

collected data faithfully represent field conditions and remain fit for purpose in epidemiological analysis and broader public health research (WHO, 2025).

In light of the high proportion of undetected hypertension cases and the attendant long-term risk of escalating cardiovascular disease burden, it is of critical importance to appraise the extent to which the existing hypertension surveillance system has been implemented effectively. Denpasar City, in particular, continues to face considerable challenges in the management and control of non-communicable diseases. A comprehensive assessment of hypertension surveillance implementation in this setting is therefore necessary to generate a thorough and contextually grounded understanding of current system performance and to identify actionable areas for improvement.

METHOD AND ANALYSIS

This study employed a qualitative research design with an evaluation research approach, utilizing a case study framework. The evaluation was conducted to appraise the implementation of the hypertension surveillance system within the working area of the Denpasar City Health Office during 2025, with reference to the logic model. framework encompassing input, process, and output dimensions, as well as established surveillance attributes. Data collection was carried out between April and June 2025. Primary data were obtained through in-depth interviews with all surveillance officers operating at the sub-district level across Denpasar City. Assessment of the evaluated dimensions was guided by a structured questionnaire instrument, and the resulting data were analysed using descriptive analysis.

The study subjects for data collection comprised the NCD program officer at the Denpasar City Health Office and the NCD program officers at community health centres *(Puskesmas)* across the four sub-districts of Denpasar City. One *Puskesmas* per sub-district was selected as a data collection site through simple random sampling, yielding four participating facilities: *Puskesmas* Denpasar Utara I, *Puskesmas* Denpasar Barat II, *Puskesmas* Denpasar Selatan III, and *Puskesmas* Denpasar Selatan IV. Informants were identified through purposive selection, based on two eligibility criteria: direct responsibility for the implementation of hypertension surveillance activities, and active involvement in the processes of hypertension data recording and reporting.

RESULTS

1. Input

Input refers to the resources mobilized to support the operational functioning of the hypertension surveillance system and constitutes the foundational determinant of program performance. Within the context of Denpasar City, the input dimension encompasses five core components, collectively referred to as the 5M framework: Man (human resources), Money (financing), Method (standard operating procedures), Material (physical supplies and equipment), and Machine (information and reporting technology).

1.1 Man (Human Resources)

With respect to human resources, a majority of community health centres reported that staffing allocated for hypertension and NCD surveillance

management was insufficient, with typically only one officer assigned to oversee these responsibilities. Informants attributed this deficiency to the increasing volume of online reporting obligations across multiple digital platforms and the imposition of dual or multiple concurrent job functions on frontline staff. Notwithstanding these constraints, *Puskesmas* officers had received relevant capacity-building interventions, including training in the Pandu PTM framework, NCD surveillance, and the Training of Trainer (ToT) P2PTM program conducted in 2023, as well as orientation sessions on the ASIK application delivered via online meetings. These training activities align with the provisions of Law No. 13 of 2003 on Manpower, which defines training as a comprehensive set of activities intended to provide, acquire, enhance, and develop occupational competencies, productivity, discipline, and work ethic in accordance with specified skill levels and job qualifications (Indonesia, 2003).

1.2 Money (Financing)

In terms of financial resources, funding for the surveillance program was drawn from two principal sources: regional government budget allocations *(Anggaran Pendapatan dan Belanja Daerah/APBD),* which supported facility-based services at community health centres and their subsidiary units, and Operational Health Cost funds *(Biaya Operasional Kesehatan/BOK)*, which financed outreach activities including community health campaigns, home visits, and integrated health posts *(posyandu).* All informants confirmed the availability of budgetary support from either the APBD or national program mechanisms; however, the scope and magnitude of funding were reported as limited. While officers generally assessed the available funds as adequate for routine operations, localized shortfalls were identified in several operational areas, most notably field transportation, continuing education for program staff, and financial incentives for community health volunteers.

1.3 Method (Standard Operating Procedures)

All officers confirmed the existence of standard operational references and regulatory guidelines governing surveillance practice. These included the Minimum Service Standards (*Standar Pelayanan Minimal/SPM)*, the Strategic Plan *(Renstra)*, and several ministerial instruments, namely Minister of Health Regulation No. 45 of 2014 on the Implementation of Health Surveillance, Minister of Health Regulation No. 71 of 2015 on NCD Management, Minister of Health Decree No. 1479/Menkes/SK/X/2003 on Integrated Surveillance of Communicable and Non-Communicable Diseases, and the 2024 Guidelines for Hypertension Control at Primary Health Care Facilities. These reference materials were produced and officially distributed by the Ministry of Health. This finding is consistent with previous research conducted by (Alendra et al., 2024) who found that the implementation of hypertension programs at *Puskesmas* level was constrained by insufficient human resources, limited funding, and inadequate infrastructure, all of which directly affected the quality of program delivery.

1.4 Material (Physical Resources and Supplies)

The availability of physical infrastructure and medical equipment required for program implementation was found to be adequate. Diagnostic equipment in use included sphygmomanometers, electrocardiogram (ECG) devices, and stethoscopes. Antihypertensive medications had been distributed to health facilities by the Denpasar City Health Office. These findings are consistent with (McVey et al., 2021) who assessed the readiness of *Puskesmas* in delivering cardiovascular disease services and found that while basic equipment such as sphygmomanometers was widely available, gaps in diagnostic capacity and essential medical supplies remained critical barriers to optimal hypertension program delivery, underscoring the indispensable role of physical resources in NCD program implementation.

1.5 Machine (Information Systems and Reporting Technology)

Evaluation findings revealed that all officers utilized a combination of digital and manual tools for hypertension data recording and reporting. The primary platforms in use were the ASIK application, printed ASIK forms, Google Spreadsheets, WhatsApp, and Microsoft Excel. While this combination of tools reflects an effort to maintain data continuity, the reliance on multiple unintegrated platforms also introduced significant operational redundancies, as discussed in greater detail in the process evaluation section below.

2. Process

2.1 Early Detection and Case Recording

Case detection and recording activities were conducted across both facility-based and community-based settings. Facility-based activities encompassed examinations performed at community health centres and their subsidiary health posts, while community-based activities included home visits, community health campaigns, and *posyandu*. Screening procedures incorporated measurement of blood pressure, height, body weight, and abdominal circumference, among other parameters. Data recording was performed both manually, using printed ASIK forms, and electronically, through the ASIK application. Community health volunteers and *Puskesmas* officers shared responsibility for initial data recording, after which data were further processed by the designated NCD program officer. Case confirmation for hypertension was conducted by physicians and other health professionals through clinical history-taking, symptom assessment, and physical examination. In the *posyandu* setting, when a volunteer identified a case meeting the diagnostic threshold of systolic blood pressure of 140 mmHg or above and/or diastolic blood pressure of 90 mmHg or above, the individual was immediately referred to the nearest *Puskesmas* for further evaluation and confirmation. With respect to referral networks and partnerships, all participating *Puskesmas* reported established collaborative arrangements with private clinics, independent medical practitioners, and independent midwifery practices for case detection, with identified cases

subsequently reported to the respective *Puskesmas*.

2.2 Data Reporting

Hypertension data reporting was carried out through two parallel channels: a manual pathway utilizing printed ASIK forms and Microsoft Excel, and an electronic pathway through the ASIK application and the E-Puskesmas (E-PUS) system. Evaluation findings indicated that the majority of officers did not perform real-time data entry into the ASIK application during ongoing activities; rather, data input was typically deferred until after the conclusion of each activity session. This practice consistently introduced reporting delays, particularly during periods of high activity volume, indicating that the system had not achieved optimal operational performance. A further systemic inefficiency was identified in the form of duplicate data entry during the screening process. Patients presenting directly at a *Puskesmas* had their data recorded and entered into the E-Puskesmas system, after which the same data were separately transcribed onto printed ASIK forms and re-entered into the ASIK application. The absence of data integration or electronic bridging between the E-PUS and ASIK platforms necessitated this repetitive process, which not only amplified the workload of program officers but also introduced a significant risk of data discrepancies. This finding aligns with (Aisyah et al., 2025) who reported that Indonesian *Puskesmas* operate an average of 30 non-integrated health information systems, compelling health personnel to input data repeatedly across multiple platforms, which inevitably leads to duplication in data entry and undermines overall system efficiency.

2.3 Data Processing and Validation

Data processing and validation encompassed a sequence of operations including data encoding, transformation, and stratification according to the epidemiological dimensions of person, place, and time. Analytical and interpretive functions were performed by the NCD program officer using univariate and descriptive statistical methods. Processed data were subsequently presented in infographic formats, including tables and graphs, disaggregated by sex, geographic location, and time period.

2.4 Dissemination and Feedback

Information dissemination and feedback mechanisms operated through several established channels. All *Puskesmas* confirmed that hypertension-related information had been communicated through inter-program and cross-sectoral coordination meetings, as well as through their respective social media platforms. Concerning feedback from the Denpasar City Health Office, all *Puskesmas* officers reported that the Health Office maintained an active feedback loop, providing reminders and updated guidance regarding delayed submissions, data entry processes, and the most recent directives pertaining to surveillance implementation. Structured coordination meetings were held at regular intervals of three to six months, supplemented by periodic field monitoring activities.

3. Output

Assessment of the output dimension of the hypertension surveillance system indicated that the information produced by the system was incorporated into the district-level Health Profile document, published annually by the Denpasar City

Health Office. The outputs of the surveillance system served a purpose extending beyond statistical documentation; the data were broadly utilized to support cross-program and cross-sectoral activities, inform local government performance assessments, and provide a substantive reference base for health research. These findings affirm that the quality and availability of surveillance outputs carry strategic significance in supporting evidence-based policy decision-making at the local level.

4. Surveillance Attributes

4.1 Simplicity

Regarding simplicity, the majority of officers reported that the overall reporting pathway was sufficiently clear; however, the process of data entry into the ASIK application was characterized as technically demanding and time-consuming, requiring approximately five to ten minutes per patient. This placed an additional burden on both volunteers and officers, particularly when processing large volumes of data. A significant limitation was also identified in relation to the technical capacity of community health volunteers to perform independent data entry into the ASIK platform. Interview findings revealed that many volunteers continued to rely on *Puskesmas* officers' accounts to access the application, with some utilizing officers' personal credentials. A substantial proportion of volunteers had not received adequate technical training and frequently required assistance from program officers or student interns. In certain community-level settings, no trained volunteers were available to conduct data entry, resulting in delays in the reporting process. These findings collectively suggest that the system had not yet achieved full simplicity or accessibility for implementers at the community level.

4.2 Flexibility

With respect to flexibility, the ASIK reporting system demonstrated a reasonable capacity to accommodate diverse input formats originating from varied health service settings, including integrated health posts, private clinics, and community health centres. Officers confirmed that the system was adaptable to the range of reporting configurations encountered across these different service points.

4.3 Acceptability

In terms of acceptability, defined as the level of participation among surveillance officers in implementing the surveillance system, observational evidence drawn from monthly hypertension reports submitted by *Puskesmas* to the Denpasar City Health Office confirmed that all participating facilities had submitted monthly reports on a consistent basis, indicating an acceptable level of system engagement and compliance.

4.4 Sensitivity

Regarding sensitivity, all officers reported that when a blood pressure measurement of 140 mmHg systolic and/or 90 mmHg diastolic or above was recorded during screening, a confirmation protocol was applied. This protocol involved up to three repeated measurements, supplemented by clinical history-taking and symptom assessment, before a definitive determination of hypertension status was made. This procedural approach reflects adherence to established diagnostic criteria

and supports the reliability of case ascertainment within the system.

4.5 Representativeness

With regard to representativeness, the ASIK application demonstrated a reasonable capacity to characterize the distribution of hypertension cases according to the standard epidemiological dimensions of person, place, and time. However, several constraints limited the comprehensiveness of this representation. Although the ASIK platform is designed to support real-time data entry, the system was frequently subject to technical errors and access delays, prompting officers to defer data input and resort to contingency tools such as Microsoft Excel and Google Spreadsheets. Furthermore, no mechanism existed for the integration of data from non-*Puskesmas* facilities, including hospitals and private clinics, into the primary recording systems (E-PUS and ASIK). As a consequence, screening findings from external facilities were not automatically incorporated into the surveillance data, reducing the completeness and coherence of reported information. These limitations contributed to recurrent delays in meeting prescribed reporting deadlines.

4.6 Data Quality

Data quality was assessed as moderately satisfactory, insofar as clinical diagnoses were supported by systematic history-taking and physical examination. However, the overall quality and completeness of recorded data remained suboptimal due to recurrent technical failures within the ASIK application, including instances in which previously entered data were lost following system errors. Internal validation of inputted data was also found to be inconsistent. Several *Puskesmas* reported that data verification procedures were not uniformly applied prior to submission to the Health Office, introducing a risk of compromised data integrity at the point of reporting.

4.7 Stability

The stability of the ASIK system was assessed as inadequate. The platform experienced recurrent technical disruptions, including scheduled maintenance periods, slow access speeds, and unintended loss of inputted data. These recurring failures compelled program officers to maintain parallel records using alternative platforms, most notably Google Spreadsheets, as backup systems. The consistent reliance on secondary contingency tools is indicative of the primary system's insufficient operational reliability and underscores the urgent need for infrastructure improvement to ensure uninterrupted surveillance data continuity.

CONCLUSION

The findings of this study indicate that the overall quality of the hypertension surveillance system operating within the jurisdiction of the Denpasar City Health Office, as assessed through the logic model framework encompassing input, process, and output dimensions and the prescribed surveillance attributes, has not yet reached a satisfactory level of performance. Principal deficiencies were identified across several interconnected areas. Human resource capacity remained inadequate, with officers routinely assigned multiple concurrent responsibilities that produced excessive workloads and impaired their capacity to perform timely and accurate data entry. The reporting system lacked simplicity, as the simultaneous use of

multiple unintegrated applications generated redundant workflows. The absence of electronic bridging between the ASIK application and the E-Puskesmas system compelled officers to perform duplicate data entry, further straining operational efficiency. The ASIK platform itself demonstrated poor system stability, with frequent technical errors resulting in the unintended loss of previously inputted data. Data entry activities continued to rely on officers' personal mobile devices and private internet data packages, constituting an unsustainable operational dependency. Furthermore, not all community health volunteers across the working areas of the participating *Puskesmas* possessed the technical competency to independently perform data entry within the ASIK application.

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