

Strengthening Maternal and Child Health Information Systems Management Policies: Study in Maluku Province

Asep Kusnali^{1*}, Tety Rachmawati¹, Karlina Karlina², Jenny Veronika Samosir¹, Primasari Primasari¹, Istiana Hermawati³, Haerawati Idris⁴

1. Research Center for Public Health and Nutrition, National Research and Innovation Agency, Indonesia

2. Health Development Policy Agency, Ministry of Health, Indonesia

3. Department of Village Community, Sekolah Tinggi Pembangunan Masyarakat Desa APMD Yogyakarta, Indonesia

4. Department of Health Policy and Administration, Faculty of Public Health, Universitas Sriwijaya, Indonesia

*corresponding author e-mail: asep059@brin.go.id

Article Info

Keywords:

Health information system;
Health metrics network;
Management policy;
Maternal and child health

JEL Classification:

I180, K230

DOI:

10.33830/jom.v20i1.6821.2024

Article History

Received : December 4, 2023

Accepted : June 29, 2024

Publish : June 30, 2024

Abstract

Purpose – The importance of maternal and child health data in enhancing health services has the problem of underutilization of collected data. It points out the challenges in using this information to make informed policy, program design, and resource allocation decisions. This study examines the challenges in utilizing maternal and child health data for policymaking in Maluku Province.

Methodology – We apply a research qualitative approach using the WHO Health Metrics Network to assess the capacity of the health information system in Ambon and Buru.

Findings – The research found that 70% of health data was underutilized due to data accuracy and integration issues. Based on detailed capacity assessments, a tailored health information system management framework was developed. Key findings include policy gaps and actionable recommendations to enhance data use in decision-making, aiming to improve health service delivery and outcomes.

Originality – The study focuses on the unique challenges of maternal and child health data utilization in Maluku Province, Indonesia. The research addresses specific gaps in policy and strategy, human resource governance, and data integration by developing a health information system management framework and conducting capacity assessments.

1. Introduction

Efforts to capture, store, transmit, and manage health data are crucial for functioning health-related activities and organizations. A robust Health Information System (HIS) can support these needs but requires strong policies to ensure proper and sustainable operation. In developing countries, maternal and child health remains a significant concern, with high rates of morbidity, mortality, and stunting (Khan et al., 2022). Using high-quality, timely, accurate, complete, comprehensive, and reliable data can strengthen the health system in multiple ways. It includes supporting good governance, providing efficient and effective services, ensuring service quality and availability, improving service accessibility, reducing disease risk, and ensuring the

sustainability of national health service programs (Anasel & Kacholi, 2023; Nasoha, 2017). All these efforts aim to improve population health, particularly maternal and child health.

Therefore, a strong HIS is essential for tracking national health progress and achieving Sustainable Development Goals (SDGs). Effective policy design to support HIS resource distribution and decision-making in the health sector requires timely information from routine health information systems. It helps track the quality of healthcare service delivery and other support systems such as equipment, supplies, budgets, infrastructure, and human resources (Barro et al., 2020; Leon et al., 2020). However, in some developing countries, routine health information systems implementation faces significant challenges (Aqil et al., 2009). Issues such as obstacles in health data recording (Ngusie et al., 2022) and limited use of information (Lopes et al., 2020) have led to low-quality data and unusable information (Nsubuga et al., 2006).

In Indonesia, policies to strengthen the health information system include Government Regulation No. 46 of 2014 on Health Information Systems. This policy aims to create an interconnected mechanism between health facilities, local governments, and national governments. The digital transformation of the health sector, highlighted in the National Medium-Term Development Plan (RPJMN) for 2020-2024, emphasizes the need to strengthen routine data on maternal and child health programs. Maternal and child health is a priority in developing human resources for Superior Indonesia, as these indicators are very sensitive to improvements in health services and serve as key success indicators for health sector development (Danefi & Susanti, 2023).

Currently, maternal and child health data are primarily obtained through surveys, which can delay decision-making for government programs. Additionally, routine maternal and child health data are not optimally integrated into the development planning system in Indonesia. The lack of integration is a significant reason for this. Assessment by the Ministry of Health (Table 1) shows that data and resource management components have the lowest value compared to other components, highlighting a significant area for improvement.

Data management involves the procedures for collecting, storing, processing, and compiling data (World Health Organization, 2008). Countries should have a centralized data depository to consolidate all health information, facilitating cross-referencing, standard adherence, and reducing redundant data collection. It also helps address data inconsistencies and facilitates data reconciliation across different systems.

Table 1. HIS Capacity

Components of HIS	Year (%)			
	2007 ^a	2014 ^b	2016 ^c	2018 ^c
Resources	47	54,10	58	50
Indicators	61	67,20	76	68
Data Sources	51	59,90	69	61
Data Management	35	32,60	56	45
Data Quality	55	69,80	72	72
Use and dissemination of data	57	74,20	84	78

Source: processed data

Previous studies have identified barriers to using routine information for maternal and child health programs in evidence-based policy decisions. These include a lack of demand for evidence, limited capacity to use evidence, challenges in routine data management, and capacity constraints among policymakers (Inguane et al., 2020). However, few studies have explored these issues in

the context of Maluku. This study aims to provide policy recommendations for local governments to enhance available data for policymaking and to understand why routine maternal and child health information is rarely used in evidence-based policy decisions.

The significant contribution of this study to management knowledge is developing a health information system management framework tailored for routine data recording systems in maternal and child health programs. This framework is based on capacity assessments of regional health information systems and evaluated against current national policies. By identifying the gaps in policy and strategy, human resource governance, data integration, and the use of data for decision-making, the study provides valuable insights and recommendations for local governments to enhance the utilization of available data for policymaking. It contributes to improved management practices and more effective health service delivery, particularly in developing regions like Maluku Province, particularly in maternal and child health.

2. Research Methods

This research uses qualitative approaches and is carried out using the method of assessing the capacity of the health information system through the Health Metrics Network (HMN) version 4.00 (World Health Organization, 2008). The components and standards of the health information system within the framework of the HMN consist of six components and provide normative standards for each (Table 2).

The assessment process was built by achieving consensus among various key stakeholders at the technical level of the District Health Office. Specifically, it involved 12 program holders from multiple departments, including planning, public health, health services, and disease prevention and control. Additionally, representatives from the Central Statistics Agency, the Population and Civil Registry Service, the Forging Empowerment and Family Planning Service, and the Communication and Informatics Service were included. These stakeholders were selected due to their crucial health data management and policymaking roles. Their expertise and responsibilities in their respective fields ensured a comprehensive health information system evaluation and facilitated the integration of diverse perspectives into the consensus-building process. Each assessment item is given a score of highly adequate or ≥ 75 , adequate between 50-74, present but not adequate in the range of 25-49, and inadequate or < 25 . HMN results are analyzed descriptively analytically.

Table 2. Components of Health Information System Capacity Assessment

Component	Valuation
Resources	Policies and strategies Governance, Human Resources, Budgeting, and HIS infrastructure
Indicators	Minimal indicators and operational definition Development of health indicators
Data sources	Population-based data sources Institution-based data sources or routine data
Data management	Integration from multiple data sources Data analysis and visualization to generate information
Data quality	Data collection methods, period, and data consistency Data representation of population and disaggregation of information
Use and dissemination of data	Use of data for decision-making, resource allocation, and planning Dissemination of information and advocacy

Source: processed data

After collecting the data, it was analyzed using sociological and legal analysis methods. The research was conducted in the Maluku Provinces, where some regencies have a high rate of maternal and infant mortality, exceeding 12 deaths per year (Ministry of Health Republic of Indonesia, 2020). As a result, Ambon and Buru were selected.

3. Results and Discussions

HIS Capacity in Maternal and Child Health Program

Assessing the capacity of health information systems in maternal and child health programs reveals both achievements and shortcomings. For improved consistency, several components have been combined to enhance clarity. As shown in Figure 1, Ambon and Buru differ in their performance across various categories, including resources, indicators, data sources, data management, data quality, and the use and dissemination of data. This comparison highlights the strengths and areas needing improvement in each region's health information system capacity.

Findings from key informants, observations, group discussions, and assessments conducted are incorporated and supplemented to reflect the status of HMN assessments. The resource evaluation showed a modest variation in achievements between the research sites. Ambon has adequate achievements (55%) compared to Buru (present but not adequate at 33%). The indicator is a component with a high score in each region. Ambon and Buru have adequate at 67%. Meanwhile, the assessment of the data source of each region has adequate achievements, namely 72% in Ambon and 63% in Buru. Even if inadequate, the assessment of data management in Ambon and Buru reaches 13%. In terms of data quality, the average is relatively high, but the evaluation of the dissemination and data usage in Ambon (78%) and Buru (70%) is still adequate. The percentage differences are descriptively significant, particularly for resource evaluation and data quality. Ambon's higher scores in resource evaluation and data quality suggest it performs better in these areas than Buru.

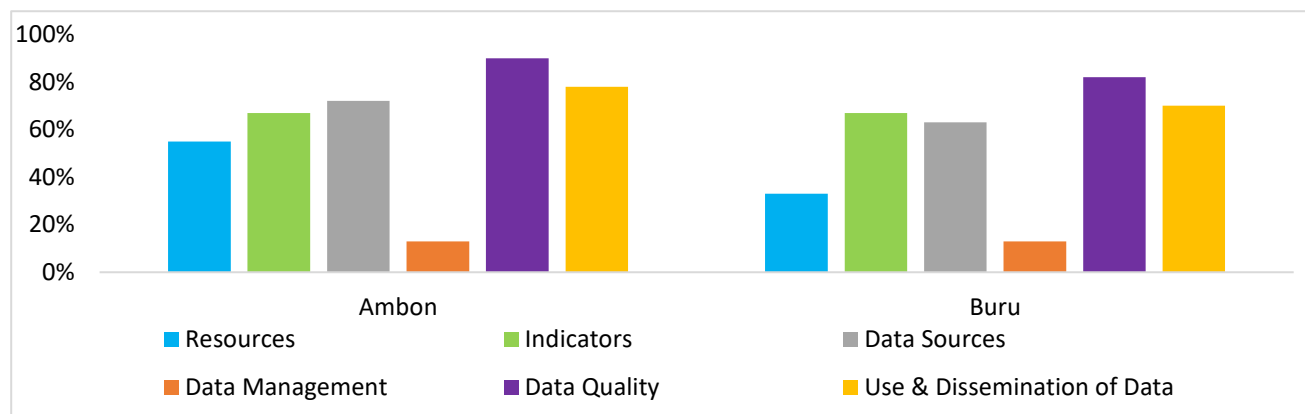


Figure 1. HIS Capacity Assessment of Maternal and Child Health Program

HIS in Maternal and Child Health Program based on HMN Scenario

Table 3 explains in more detail the assessment results of each HMN component so that the results scenario based on the gold standard of the HMN framework will be seen in the next discussion and evaluated based on the health information system policy regulated in HIS Regulation. The utilization of resources in the maternal and child health information system has shown how key units and institutions function and interact. Conducting institutional analysis can prove valuable in recognizing limitations that undermine policies or hinder the execution of crucial strategies aimed at developing the information system (Maulidina et al., 2021). Buru is one region

with a considerable gap in the implementation of a maternal and child health information system. It is evidenced by the results of the assessment of the resource component, which is still inadequate. Many studies have found that weaknesses in governance and budgeting policies (Tamfon et al., 2020), human resources (Meghani et al., 2021), and infrastructure (Nugroho et al., 2021) can lead to weak implementation of health information systems in decision-making.

The indicator component assessment results show that minimal maternal and child health indicators have been determined. The average ratings in Ambon and Buru are adequate for the scenario of minimal indicators and operational definition, as well as the development of health indicators. Health indicators, especially morbidity and mortality, are needed to monitor the provision of health services and detect the quality of services in population studies in cohort interventions (Birhanu et al., 2021).

Table 3. HIS Capacity Assessment Results for Maternal and Child Health Program

Component	Valuation	Perception	
		Ambon	Buru
Resources	Policies and strategies	++	-
	HR Governance, and Budgeting	+	+
	Infrastructure	++	+
Indicators	Minimal indicators and operational definition	++	++
	Development of health indicators	++	++
Data sources	Population-based data sources	++	+
	Institution-based data sources or routine data	+++	++
Data management	Integration from multiple data sources	-	-
	Data analysis and visualization to generate information	+	-
Infant mortality	Data collection methods, period, and data consistency	++	++
	Data representation of population and disaggregation of information	+++	++
Maternal Mortality	Data collection methods, period, and data consistency	++	+++
	Data representation of population and disaggregation of information	+++	++
Childbirth in health care facilities	Data collection methods, period, and data consistency	+++	++
	Data representation of population and disaggregation of information	+++	++
Data Quality	Antenatal Care Visits	++	++
		Data representation of population and disaggregation of information	+++
Neonatal Visit	Data collection methods, period, and data consistency	++	++
	Data representation of population and disaggregation of information	+++	+++
Puerperal Visits	Data collection methods, period, and data consistency	++	++
	Data representation of population and disaggregation of information	+++	+++
Use and dissemination of data	Use of data for decision making, resource allocation, and planning	++	+
	Dissemination of information and advocacy	+++	++

Information: (-) = inadequate; (+) = present but not adequate; (++) = Adequate; (+++) = Highly adequate

Source: processed data

The assessment of data sources shows a weakness in the population-based health data source in Buru (present but not adequate) because the research area does not have the ability and practicality to conduct population-based health surveys. The optimal choice will depend upon a range of factors, including epidemiology, specific characteristics of the measurement instrument,

cost and capacity considerations, and program needs. In addition, each source may generate data on various indicators (World Health Organization, 2008).

Data management is closely related to health information system policies, strengthening data sources and cooperation and coordination (Stanimirović, 2015). The assessment results showed that both Ambon and Buru are in an inadequate situation in terms of integration from multiple data sources and data analysis activities. For this reason, special attention is needed in data collection, storage, processing, and compilation. The aim is to carefully collect data from various sources – both within the health system and outside – and to ensure its quality by sanitizing and checking before disseminating the information to the wider public (World Health Organization, 2008).

The assessment results of using data for decision-making, resource allocation, and planning are still weaknesses in Buru because the information is not always generated for policymakers and decision-makers in an understandable format. Information is of much greater value, especially when combined with other information and evaluated about health system problems. At this stage, information becomes evidence that decision-makers can use. This evidence synthesis becomes more powerful when formatted for presentation, communication, or dissemination to decision-makers in a form that transforms their understanding of health problems and needs (World Health Organization, 2008). Policies related to the assessment results of this component are strengthening the management of health data and information as well as cooperation and coordination across programs and sectors (Meghani et al., 2021).

Maternal and Child Health Information System Framework

The study results showed considerable gaps in policy and strategy issues, human resource governance, integration of various data sources, and the use of data for decision-making, resource allocation, and planning, so the discussion in this paper will focus on strengthening the four sub-components. The Health Information System is one of the activities in the priority project of strengthening health governance, financing, research, and development to integrate the health information system as stated in the RPJMN for 2020-2024 and the Ministry of Health Strategic Plan for 2020-2024. Issue strategic digital utilization in the health sector, which is the basis of the target, is around 2,560 (25.3%) Community Health centers and 244 (8.96%) hospitals still do not have internet access (Kementeriaan Komunikasi dan Informatika, 2020).

The health information system policy in HIS Regulation has guaranteed the availability, quality, and access to accountable health information by involving the participation of the community, including professional organizations, to realize the implementation of a health information system that can be utilized through strengthening cooperation, coordination, integration, and synchronization in supporting the implementation of sustainable health development (Koesanto et al., 2021).

A reference to health information system policy and planning is needed as a foundation, direction, and goal in developing and strengthening health information systems. Some of the supportive policies in Figure 2 consist of Ministry of Health Regulation Number 1171/Menkes/PER/VI/2011 concerning Hospital Information Systems (MoH Regulation No. 1171/2011), Ministry of Health Regulation Number 82 of 2013 concerning Hospital Management Information Systems (MoH Regulation No. 82/2013), Ministry of Health Regulation Number 92 of 2014 concerning The Implementation of Data Communication in Integrated Health Information Systems (MoH Regulation No. 92/2014), Ministry of Health Regulation Number 46 of 2017 concerning The National E-Health Strategy (MoH Regulation No. 46/2017), Ministry of Health Regulation Number 31 of 2019 concerning Community Health Center Information System (MoH Regulation No. 31/2019) and Ministry of Health Regulation Number 18 of 2022 concerning The

Implementation of One Data in the Health Sector through the Health Information System (MoH Regulation No. 18/2022).

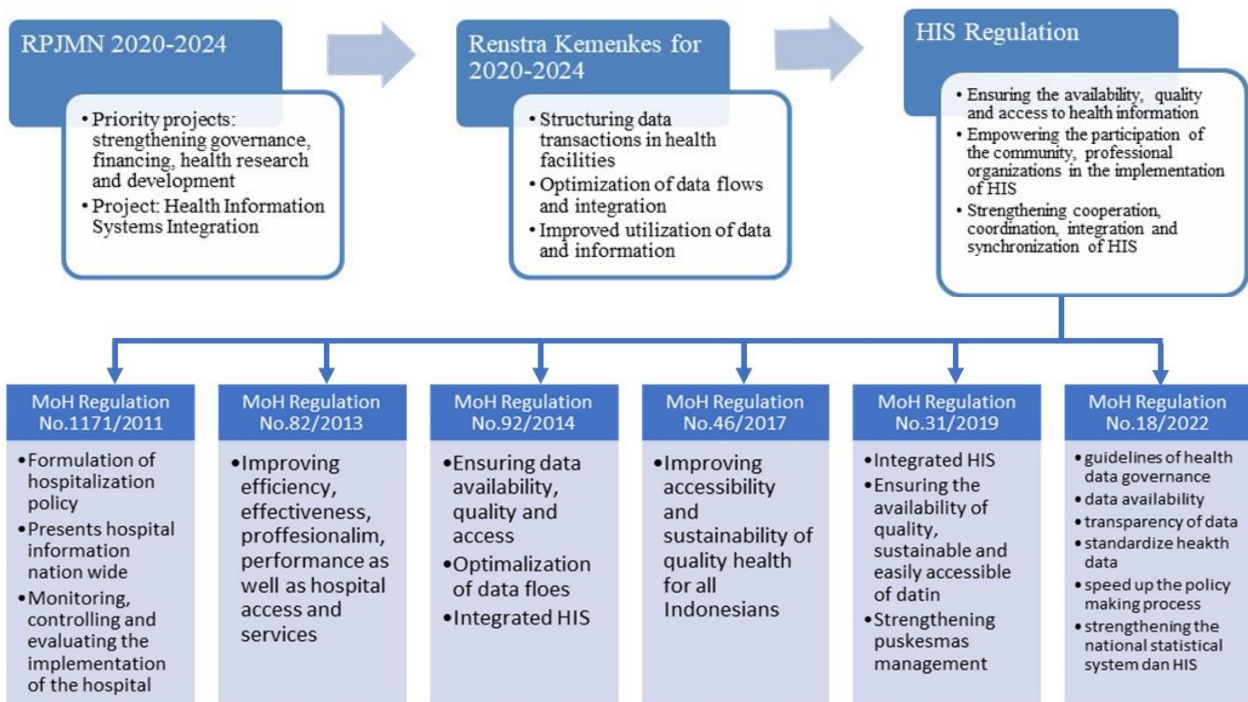


Figure 2. Health information system policy framework

Experience from other countries explains that evidence-based health information system policies and strategies must be developed to achieve substantial progress through effective resource mobilization, effort coordination, and interventions alignment. Several countries have formed national committees or task forces consisting of critical stakeholders of health information systems in the health sector to improve leadership, coordination, and harmonization efforts (Kumar et al., 2018).

In the case of Indonesia, based on the research location, it is evident that no institution regulates health data management regularly to minimize differences in data discrepancies between data sources at central and regional levels. Institutionally, it still depends on the readiness of resources and innovation in the areas so that efforts to integrate with policies at the center experience obstacles. This paper is limited to two strategic issues in data management regarding human resources and standards and interoperability, which are part of the national health electronic strategy.

MoH Regulation No. 31/2019 explains that the Community Health Center is a health facility responsible for organizing a health information system in its work area (Article 3). Nonetheless, the performance of managing routine health data records depends on roles, responsibilities, and mandates between management arrangements at central, regional, and other government agencies, the private health sector, and partners (Leon et al., 2020). What needs to be realized now is enforcing health information system regulations (World Health Organization, 2007a), which begins with developing an action plan for the next few years regarding a routine health data recording system for maternal and child health programs.

Routine data management arrangements for maternal and child health programs are inseparable from the quality and quantity of health human resources (Iswari et al., 2019). However, some core competencies, such as epidemiology, biostatistics, demography, and information

systems specialization, are still lacking. Even in some health centers, there is only one person, and no one is responsible for data collection and reporting to the health office (Kusnali et al., 2020). A strategic role that can affect data quality in first-level health facilities is surveillance officers (Thomas et al., 2021). Regulation of the Minister of Health Number 97 of 2014 concerning Health Services for the Period Before Pregnancy, Pregnancy, Childbirth, and Postpartum Period, Implementation of Contraceptive Services, as well as Sexual Health Services (MoH Regulation No. 97/2014) states that the task of maternal and child health surveillance includes recording and reporting, monitoring the local area, perinatal maternal audits and follow-up responses (Article 31 paragraph (2)) so that the role of digital resources in the health sector cannot stand alone without health workers who carry out health surveillance.

Skilled and well-trained human resources in health information and technology are central to ensuring that health information systems operate efficiently, safely, and sustainably (Anasel & Kacholi, 2023; Sahusilawane, 2016). They are responsible for designing, developing, and managing information systems that can accurately collect, store, and analyze health data (Zoulias et al., 2023). In addition, they also play a role in securing sensitive patient data, maintaining privacy, and complying with regulations related to data protection (Hsu & Pan, 2013). Competent human resources in managing health information systems will ensure easy access for medical personnel, make the right decisions, and integrate information that facilitates better and more effective health services for the community (Waters et al., 2013). Thus, in the era of sustainability, investment in the development of human resources that have a deep understanding of technology and governance of health information systems will positively impact achieving goals in providing of quality health services (Tamfon et al., 2020).

Another strategic issue is that Indonesia has adopted an integration strategy in the health information system. However, the health system ecosystem's very complex condition of is one of the obstacles (Kusnali et al., 2020). As of 2021, Indonesia has 3,042 hospitals, 10,292 health centers, 7,614 registered clinics, and various other health facilities that have utilized information and communication technology but are not yet connected (Kementerian Kesehatan RI, 2022). Various regulations have been made to accommodate the role of HIS in the national health system, both directly and indirectly. However, these regulations need to be described in more detail in the guidelines and standard operating procedures of the various types of HIS used in health organizations.

MoH Regulation No. 46/2017 states that the standards and operability of electronic health have been implemented in the form of creating a health data dictionary, collaboration in the preparation of SNI for health informatics, adoption of ISO related to electronic health, agreement on the use of a population identification number, and creating a health information exchange used for integration and interoperability services system. Even the hospital information system (SIMRS) stipulates that SIMRS must be integrated into programs in the Government or local government and is part of the Health Information System (Windari et al., 2023). This integration is carried out through data communication capabilities (interoperability) (Article 5 MoH Regulation No. 82/2013). Likewise, applications in the community health center information system must be connected between programs and integrated with the national health information system (Article 30, paragraph 5 MoH Regulation No. 31/2019).

The ability of HIS interoperability has been regulated in the MoH Regulation No. 92/2014. Furthermore, in the implementation of data in the health sector through MoH Regulation No. 18/2022, data interoperability is one of the rules that must be met by Health Data Producers (Article 3, paragraph 2). Thus, the interoperability of data and HIS is necessary for realizing an integrated HIS between the Government and local government (Sifaunajah et al., 2022). Based on

the results of the capacity assessment of HIS for maternal and child health programs in Ambon and Buru, it has been proven that this integration concept has not been implemented properly. Hence, the capacity of the data management component is lower than the other components (Kusnali et al., 2020). This condition can lead to insecure availability, quality, and access to priority health data and other data content, and the flow of health data from districts/cities and provinces to the Ministry of Health or vice versa is not optimal.

In general, several countries have standardized and integrated regional health information system programs into the national health information system (Klaib & Nuser, 2019; Kumar et al., 2018). The focus on the capabilities of integration strategies in different countries has highlighted challenges, including contextual factors relating to politics, institutional arrangements, resource constraints (poor infrastructure, limited human resources with low skills, and limited financial resources), heterogeneity of interests among donors, decision-makers and health reformers, and the diversity of reporting systems of each program (Kikkas et al., 2019). Sudan is one of the countries that has implemented the Integrated Disease Surveillance and Response record, which focuses on 17 priority diseases. Nevertheless, none of these records was integrated into the national-level health information system (World Health Organization, 2007b). Therefore, Sudan recognizes the importance of the integration strategy as a critical solution to reduce the burden of data resolution and reporting, as well as encourage data production and the effective and efficient utilization and dissemination of information.

4. Conclusions

This study enhances maternal and child health information systems by focusing on Maluku Province, an underrepresented region in health data research. It presents a tailored management framework based on capacity assessments, addressing data accuracy, completeness, and integration gaps. Ambon's higher resource evaluation and data quality than Buru highlights targeted improvement areas. The study suggests that local governments can integrate routine health data into decision-making, leading to informed policies and better health outcomes. Recommendations include regular capacity assessments, training health workers, improving technological infrastructure, and enhancing collaboration among health agencies. This framework extends health information systems theory, emphasizing context-specific approaches and stakeholder collaboration, supporting SDGs for maternal and child health.

References

- Anasel, M. G., & Kacholi, G. (2023). Health Information Systems. In *Leadership and Governance in Primary Healthcare: An Exemplar for Practice in Resource Limited Settings* (Issue 4, pp. 55–64). <https://doi.org/10.1201/9781003346821-5>
- Aqil, A., Lippeveld, T., & Hozumi, D. (2009). PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems. *Health Policy and Planning, 24*, 217–228.
- Barro, S. G., Dicko, A., de Lame, P. A., & Staccini, P. (2020). Health Metrics Network (HMN-WHO), a tool to assess the quality of the information system in Burkina hospitals. *Studies in Health Technology and Informatics, 270*, 602–606. <https://doi.org/10.3233/SHTI200231>
- Birhanu, F. Z., Tsehay, A. S., & Bimerew, D. A. (2021). Heterogeneous effects of improving technical efficiency on household multidimensional poverty: evidence from rural Ethiopia. *Heliyon, 7*(12). <https://doi.org/10.1016/j.heliyon.2021.e08613>
- Danefi, T., & Susanti, S. (2023). Analysis of Maternal Health in Local Area Monitoring-Maternal

- and Child Health (LAM-MCH) Indicators in Pagerageung Health Center. *Kian Journal*, 2(1), 7–14. <https://doi.org/10.56359/kian.v2i1.231>
- Hsu, W. S., & Pan, J. I. (2013). The secure authorization model for healthcare information system. *Journal of Medical Systems*, 37(5). <https://doi.org/10.1007/s10916-013-9974-z>
- Inguane, C., Sawadogo-Lewis, T., Chaquise, E., Roberton, T., Ngale, K., Fernandes, Q., Dinis, A., Augusto, O., Covele, A., Hicks, L., Gremu, A., & Sherr, K. (2020). Challenges and facilitators to evidence-based decision-making for maternal and child health in Mozambique: District, municipal and national case studies. *BMC Health Services Research*, 20(1), 1–10. <https://doi.org/10.1186/s12913-020-05408-x>
- Iswari, L., Fudholi, D. H., & Aditya, S. K. (2019). Dashboarding the maternal and child health profiles for health supporting system. *IOP Conference Series: Materials Science and Engineering*, 482(1). <https://doi.org/10.1088/1757-899X/482/1/012013>
- Kementerian Kesehatan RI. (2022). *Profil Kesehatan Indonesia 2021* (F. Sibuea, B. Hardhana, & W. Widiyanti (Eds.)). Kementerian Kesehatan RI.
- Kementerian Komunikasi dan Informatika. (2020, December 29). *BAKTI Tuntaskan Penyediaan Akses Internet Bagi 3.126 Puskesmas dan Rumah Sakit*. https://www.kominfo.go.id/index.php/content/detail/31757/bakti-tuntaskan-penyediaan-akses-internet-bagi-3126-puskesmas-dan-rumah-sakit/0/sorotan_media
- Khan, M., Khurshid, M., Vatsa, M., Singh, R., Duggal, M., & Singh, K. (2022). On AI Approaches for Promoting Maternal and Neonatal Health in Low Resource Settings: A Review. *Frontiers in Public Health*, 10(September), 1–23. <https://doi.org/10.3389/fpubh.2022.880034>
- Kikkas, E. M., Sillakivi, T., Suumann, J., Kirsimägi, Ü., Tikk, T., & Värk, P. R. (2019). Five-Year Outcome of Laparoscopic Sleeve Gastrectomy, Resolution of Comorbidities, and Risk for Cumulative Nutritional Deficiencies. *Scandinavian Journal of Surgery*, 108(1), 10–16. <https://doi.org/10.1177/1457496918783723>
- Klaib, A. F., & Nuser, M. S. (2019). Evaluating EHR and health care in Jordan according to the international health metrics network (HMN) framework and standards: A case study of hakeem. *IEEE Access*, 7, 51457–51465. <https://doi.org/10.1109/ACCESS.2019.2911684>
- Koesanto, S. M. A. A., Husnatarina, F., Rahmaddian, R., & Madya, F. (2021). Information Technology Adoption by Internal Auditors in Public Sector: Antecedents and Consequences. *Jurnal Organisasi Dan Manajemen*, 17(2 SE-Articles), 217–233. <https://doi.org/10.33830/jom.v17i2.1290.2021>
- Kumar, M., Gotz, D., Nutley, T., & Smith, J. B. (2018). Research gaps in routine health information system design barriers to data quality and use in low- and middle-income countries: A literature review. *International Journal of Health Planning and Management*, 33(1), e1–e9. <https://doi.org/10.1002/hpm.2447>
- Kusnali, A., Rachmawati, T., Handayani, L., Rustika, Widyasari, R., Ardani, I., Handayani, S., Nugroho, A. P., Samosir, J. V., Latifah, C., Primasari, Effendi, D. E., Agustina, Z. A., & Machfutra, E. D. (2020). *Model Penguatan Sistem Pencatatan Data Rutin Program Kesehatan (Kesehatan Ibu dan Anak)*.
- Leon, N., Balakrishna, Y., Hohlfeld, A., Odendaal, W., Schmidt, B., Zweigenthal, V., Watkins, J. A., & Daniels, K. (2020). Routine Health Information System (RHIS) Improvements for Strengthened Health System Management (Review). In *Cochrane Database of Systematic Reviews* (Issue 8). <https://doi.org/10.1002/14651858.CD012012.pub2.www.cochranelibrary.com>
- Lopes, F. R. L., Monteiro, K. S., & Santos, S. (2020). How data provided by the Brazilian information system of primary care have been used by researchers. *Health Informatics Journal*, 26(3), 1617–1630. <https://doi.org/10.1177/1460458219882273>
- Maulidina, A., Hidayah, Z., & Maharani, A. (2021). Examining the Link Between Information Technology Utilization, Work-Family Conflict, Commitment and Employee Performance. *Jurnal Organisasi Dan Manajemen*, 17(2 SE-Articles), 192–202.

<https://doi.org/10.33830/jom.v17i2.1792.2021>

- Meghani, A., Rodríguez, D. C., Bilal, H., Tripathi, A. B., Namasivayam, V., Prakash, R., Peters, D. H., & Bennett, S. (2021). Examining policy intentions and actual implementation practices: How organizational factors influence health management information systems in Uttar Pradesh, India. *Social Science and Medicine*, 286(July), 114291. <https://doi.org/10.1016/j.socscimed.2021.114291>
- Ministry of Health Republic of Indonesia. (2020). *Indonesia Health Profile 2019*.
- Nasoha, M. (2017). Pengaruh Partisipasi Pengguna Terhadap Kesuksesan Suatu Sistem Informasi. *Jurnal Organisasi Dan Manajemen*, 11(1 SE-Articles), 26–33. <https://doi.org/10.33830/jom.v11i1.28.2015>
- Ngusie, H. S., Ahmed, M. H., Kasaye, M. D., & Kanfe, S. G. (2022). Utilisation of health management information and its determinant factors among health professionals working at public health facilities in North Wollo Zone, Northeast Ethiopia: a cross-sectional study. *BMJ Open*, 12(4), 1–10. <https://doi.org/10.1136/bmjopen-2021-052479>
- Nsubuga, P., White, M., Thacker, S., Anderson, M., Blount, S., Broom, C., Chiller, T., Espitia, V., Imtiaz, R., Sosin, D., Stroup, D., Tauxe, R., Vijayaraghavan, M., & Trostle, M. (2006). Public health surveillance: a tool for targeting and monitoring interventions. In D. Jamison, J. Breman, A. Measham, G. Alleyne, M. Claeson, D. Evans, P. Jha, A. Mills, & P. Musgrove (Eds.), *Disease Control Priorities in Developing Countries*. The World Bank.
- Nugroho, A. P., Effendi, D., Agustina, Z. A., Kusnali, A., & Maimunah, S. (2021). Challenges in Maternal and Child Health Routine Data Administration in Indonesia: A Qualitative Study. *Indian Journal of Forensic Medicine & Toxicology*, 15(4), 752–760. <https://doi.org/10.37506/ijfmt.v15i4.16795>
- Sahusilawane, W. (2016). Pengaruh Pelatihan dan Kejelasan Tujuan dalam Penggunaan Sistem Informasi Keuangan Daerah. *Jurnal Organisasi Dan Manajemen*, 12(2 SE-Articles), 113–120. <https://doi.org/10.33830/jom.v12i2.57.2016>
- Sifaunajah, A., Hariono, T., Widya, M. A. A., Airlangga, P., Sujono, & Sufaidah, S. (2022). Model Implementation of Application Programming Interface for E-Government Data Integration. *2022 Seventh International Conference on Informatics and Computing (ICIC)*, 1–6. <https://doi.org/10.1109/ICIC56845.2022.10006904>.
- Stanimirović, D. (2015). Modelling the health information system in Slovenia - Operative, construction and implementation aspects. *International Journal of Engineering Business Management*, 7. <https://doi.org/10.5772/60992>
- Tamfon, B. B., Bilounga Ndongo, C., Bataliack, S. M., Ngoufack, M. N., & Nguefack-Tsague, G. (2020). Routine health information system in the health facilities in Yaoundé–Cameroon: assessing the gaps for strengthening. *BMC Medical Informatics and Decision Making*, 20(1), 1–11. <https://doi.org/10.1186/s12911-020-01351-3>
- Thomas, J. C., Doherty, K., Watson-Grant, S., & Kumar, M. (2021). Advances in monitoring and evaluation in low- and middle-income countries. *Evaluation and Program Planning*, 89(July), 101994. <https://doi.org/10.1016/j.evalprogplan.2021.101994>
- Waters, K. P., Zuber, A., Willy, R. M., Kiriinya, R. N., Waudu, A. N., Oluoch, T., Kimani, F. M., & Riley, P. L. (2013). Kenya's Health Workforce Information System: A model of impact on strategic human resources policy, planning and management. *International Journal of Medical Informatics*, 82(9), 895–902. <https://doi.org/10.1016/j.ijmedinf.2013.06.004>
- Windari, A., Kismartini, K., Luqman, Y., & Wijanarko, B. (2023). Organizational Effect on the Implementation of “SIMRS” (Hospital Management Information Systems) in Hospital: A Systematic Review. *Journal of Health Policy and Management*, 8(1), 13–22. <https://doi.org/10.26911/thejhpm.2023.08.01.02>
- World Health Organization. (2007a). *Assessment of the Ethiopian national health information system report*. World Health Organization. http://www.who.int/healthinfo/%0Acountry_monitoring_evaluation/documentation/en/

- World Health Organization. (2007b). *Sudan Health information system; review and assessment*. http://www.who.int/healthinfo/country_monitoring_evaluation/documentation/en/
- World Health Organization. (2008). *Assessing the National Health Information System: An Assessment Tool (Version 4.00)*. World Health Organization. <https://doi.org/10.3917/g.099.0097>
- Zoulias, E., Mantas, J., Ognjanovic, I., Sendelj, R., Lakovic, L., Kara, P. A., Bokor, L., & Reich, C. (2023). Health Informatics Training Programs to Strengthen Health Workforce in Montenegro. *Studies in Health Technology and Informatics*, 305, 596–599. <https://doi.org/10.3233/SHTI230567>