International Journal of Public Health Science (IJPHS)
Vol. 14, No. 4, December 2025, pp. 1765~1778
ISSN: 2252-8806, DOI: 10.11591/ijphs.v14i4.26820

Optimization of maternal healthcare at the village level in reducing maternal mortality in Bali, Indonesia

Panca Dwi Prabawa[1,2], I Ketut Widnyana[2], Ni Putu Pandawani[2], Wayan Maba[2]
[1]BPS-Satistics Bali Province, Denpasar, Indonesia
[2]Postgraduate Program in Regional and Rural Planning, Mahasaraswati Denpasar University, Denpasar, Indonesia

Article Info

Article history:

Received Jul 25, 2025
Revised Sep 11, 2025
Accepted Nov 3, 2025

Keywords:

Analytic hierarchy process
Healthcare accessibility
Healthcare quality
SERVQUAL model
Village level

ABSTRACT

Although maternal mortality rates in Bali have declined, the achievement remains below the government's target, highlighting the need to strengthen the role of villages as the frontline of development. This study aims to identify alternative strategies to accelerate maternal mortality reduction by examining the supply of maternal healthcare services and the demand reflected in women's utilization of these services at the village level. Using the analytic hierarchy process (AHP) to map accessibility across villages and SERVQUAL model to evaluate women's perceptions of maternal healthcare services provided through integrated services post *(posyandu)* and village health post (*poskesdes*), the study reveals significant disparities in accessibility across villages, particularly in Tabanan, Bangli, and Karangasem Regencies. While overall perceptions of healthcare quality are positive, the largest and most significant service quality gaps occur in tangibility and responsiveness. Based on these findings, the study recommends prioritizing villages with limited access to maternal healthcare services by ensuring health coverage for pregnant women from low-income households and guaranteeing the availability of midwives in villages through incentive schemes, while adopting community-based approaches to effectively reach migrant populations and improve their utilization of maternal healthcare services.

Corresponding Author:

Panca Dwi Prabawa
BPS-Statistics Bali Province
Puputan (Renon) Street No. 1, Denpasar, Bali-80226, Indonesia
Email: pancadwiprabawa@gmail.com

1. INTRODUCTION

Women during pregnancy and childbirth face specific health risks, which, if not appropriately addressed, can lead to the worst-case scenario of maternal mortality. Maternal mortality is globally recognized as one key indicator of health and socio-economic development [1]. Maternal mortality reflects the overall status of women, their access to maternal healthcare, and the healthcare system's response to their needs. Reducing maternal mortality is a priority agenda outlined in the Sustainable Development Goals (SDGs)'s third goal, "Ensure Healthy Lives and Promote Well-Being for All at All Ages." According to target 3.1 of the third goal, it is agreed that "by 2030, the global maternal mortality rate should be reduced to less than 70 per 100,000 live births" [2].

Based on the results of the 2020 Indonesian Population Census, the maternal mortality ratio (MMR) in Bali is 85 per 100,000 live births. However, Bali's MMR must still be prioritized to meet the target outlined in the Bali Regional Development Plan for 2024-2026: to reduce MMR to 65 per 100,000 live births by 2026 or

meet the SDGs target by 2030 (see Figure 1). It still needs to be a priority to reduce the MMR in Bali, at least to achieve the target. Hence, various strategic and collaborative actions is necessary to enhance maternal health.

To ensure the achievement of the MMR target in Bali, attention must be given to women who are at high risk. Risks during pregnancy and childbirth can be prevented when women receive the necessary maternal healthcare. According to [3], there are three delays closely related to maternal mortality events: the delay in deciding to seek maternal healthcare, the delay in accessing maternal healthcare facilities, and the delay in receiving adequate maternal healthcare. Access to healthcare is not only measured by distance but also by the quality of that healthcare [4]. In other words, unequal access to maternal healthcare contributes to maternal mortality, making the equal distribution of maternal healthcare essential to prevent maternal mortality, especially for those at high risk.

To accelerate the reduction of maternal mortality and improve the health status of women, the Indonesian government has focused on health programs starting at the village level. By empowering villages as the lowest level of government representation that directly interacts with the community, health initiatives can prevent maternal mortality risks even from the pre-pregnancy period [5]. However, some health initiatives at the village level, particularly in rural areas, are not yet optimal in fulfilling their preventive and curative roles due to a lack of health workers and inadequate healthcare facilities.

Research by Titaley *et al.* [6] indicates that cost and distance are primary factors influencing women's decision to access maternal healthcare. Additionally, this decision cannot be separated from personal preferences. The behavior of utilizing healthcare is influenced not only by motivation but also by adequate knowledge, the presence of barriers, and how this behavior is perceived as important and becomes a habit [7]. Karkee *et al.* [8] emphasize the importance of studying women's awareness of maternal healthcare and their perceptions of its quality in increasing utilization. Therefore, while addressing issues related to adequate availability of maternal healthcare is a priority, there also needs to be a focus on the necessity of utilizing maternal healthcare, particularly in enhancing knowledge and awareness of women and the broader community.

Reducing maternal mortality is a priority. Strategies for reducing maternal mortality need to be examined both from the perspective of providing adequate maternal healthcare and utilizing maternal healthcare. Considering the potential differences in MMR across regions and villages, which are crucial for development, it is interesting to analyze the accessibility and quality of maternal healthcare across villages in Bali further. This study aims to comprehensively investigate maternal healthcare services at the village level in Bali. Three primary objectives guide the research: first, to map and analyze the inter-village disparities in access to maternal healthcare; second, to assess the quality of village-level maternal healthcare services by examining the perceptions and expectations of users; and third, to develop evidence-informed strategic recommendations for enhancing both the accessibility and quality of maternal healthcare delivery at the village level. Ultimately, this research seeks to provide a nuanced understanding of the current maternal healthcare landscape and contribute actionable insights to assist policymakers and healthcare providers in addressing geographical inequities and improving maternal health outcomes across Bali.

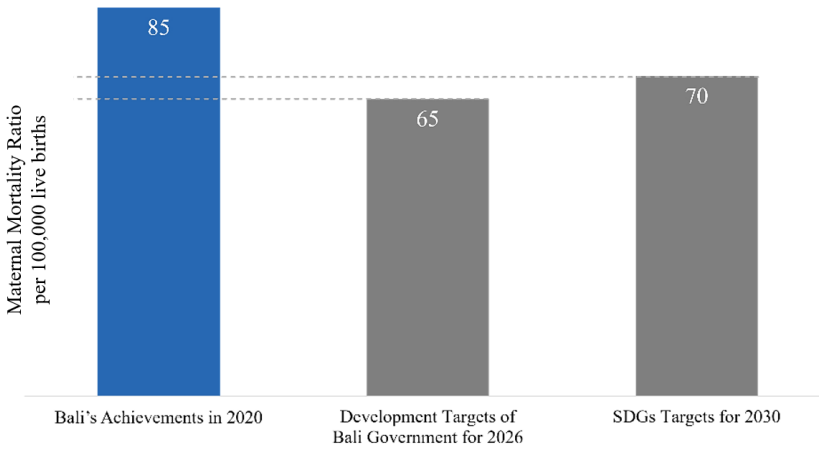

Figure 1. Maternal mortality ratio achievement and targets in Bali

2. LITERATURE REVIEW

2.1. Access to healthcare and maternal mortality

The condition of maternal mortality reflects not only the women's health status during pregnancy and childbirth but also access to and quality of healthcare, behaviors in utilizing healthcare, as well as the socio-economic status of women, households, and communities in the area [4]. Socio-economic status influences the incidence of maternal mortality but only explains a slight difference across provinces in Indonesia. Access to maternal healthcare is the leading cause of disparities in MMR [9] and should be considered in efforts to reduce maternal mortality [10]. Easily accessible and quality healthcare during pregnancy and childbirth reduces the risk of maternal mortality and morbidity [11].

According to Thaddeus and Maine [3], the condition of healthcare facilities being far away and limited has the potential to delay women from reaching them and obtaining adequate healthcare. Delays in reaching health facilities are primarily caused by long distances resulting from the uneven distribution of locations, particularly the tendency for facilities to be concentrated in urban areas [12], [13]. On the other hand, delays in receiving adequate healthcare are mainly caused by limited resources at health facilities, which are unable to handle complex pregnancy and childbirth complications. In addition to long distances and limited services, conditions in rural areas are exacerbated by a lack of awareness of maternal health, leading to delays in deciding to seek healthcare.

2.2. Women's perception of healthcare quality

The quality of healthcare is a crucial consideration when deciding whether to seek care. Findings by [3] show that when women have access to healthcare facilities, their perception of healthcare quality tends to be prioritized over distance. This condition cannot be separated from the women's assessments based on their experiences or the information they receive. Thus, women's decisions to utilize maternal healthcare are connected to healthcare quality. This can be understood as women are more likely to have a high intention to return if they feel satisfied with the quality they received [14]. Therefore, assessing women's perceptions can serve as an evaluation for healthcare providers to improve and enhance the quality of their healthcare [15].

According to Donabedian [16], healthcare quality can be assessed through a model consisting of three interconnected categories: structure, process, and outcome. The Donabedian model is one of the recommended models for assessing healthcare quality, as recommended by [17], and serves as a systematic and flexible guideline for evaluating healthcare quality. In the context of health, according to the Donabedian model, outcomes encompass not only improvements in physical health conditions but also subjective aspects, such as patients' perceptions and experiences. Therefore, women's satisfaction with healthcare and their desire to return are important factors in evaluating healthcare quality. A positive perception indicates that healthcare meets their expectations. Women's perceptions of healthcare quality will affect healthcare utilization in the future and indirectly influence the reduction of maternal mortality.

2.3. The role of villages in improving maternal health

Maternal health initiatives aim to maintain women's health so they can give birth to healthy and quality generations while reducing maternal mortality. To help accelerate the achievement of optimal maternal health, community involvement is necessary, tailored to the specific conditions and needs of the local population. One way to empower the community is through active participation in community-based health initiatives (UKBM), which serve as a platform for villagers' empowerment established based on their needs, managed by, for, and with them, prioritizing a promotive and preventive approach (Regulation of the Ministry of Health of the Republic of Indonesia Number 21 of 2021).

Villages play a crucial role in providing healthcare, which can be facilitated through the management of UKBM. The implementation of UKBM in the village supports enhancing maternal health during pre-pregnancy, pregnancy, childbirth, and postpartum periods through integrated services post (*posyandu*) and village health post (*poskesdes*). At the village level, there is also a village-based midwife (*bidan desa*) program, which aims to ensure every village has a midwife assigned to practice midwifery as part of the network connected to the community health center *(puskesmas*).

On the other hand, the Indonesian government has committed to initiating development at the village level. According to Law of the Republic of Indonesia Number 6 of 2014, villages are recognized as having the authority to organize their governance and implement initiatives for village development, community development, and community empowerment based on their initiatives and local customs. This recognition of authority is accompanied by providing financial resources to villages through the village fund (*dana desa*) policy. With *dana desa*, the implementation of development can be more aligned with the specific needs of each village. One of the priority uses of the *dana desa* is education and training for maternal health as part of health promotion and the healthy living community movement (Regulation of the Ministry of Village, Development of Disadvantaged Regions, and Transmigration of the Republic of Indonesia Number 7 of 2023).

3. METHOD

3.1. Operational framework

This study is a field-based quantitative investigation employing a cross-sectional, observational design. Primary data were collected directly in the field and supplemented with secondary sources to support a comprehensive analysis. Conducted as an exploratory inquiry, the research aims to generate new insights into a relatively underexplored phenomenon. The findings are expected to enrich the existing literature and to inform future scholarly discourse and research.

This research examines the in-depth relationship between maternal mortality and healthcare from two sides: supply and demand. Theoretical and empirical studies indicate that maternal mortality is intricately linked to the framework of healthcare services. Specifically, access to quality maternal healthcare during the antenatal, intrapartum, and postpartum periods is a critical preventive factor against maternal mortality [9], [18], [19], [20]. From the supply side, the research emphasizes the accessibility of maternal healthcare. Meanwhile, from the demand side, it considers women's perceptions of maternal healthcare quality, which serves as the basis for their decision to utilize. Given the important role of villages in health development, this study looks at accessibility from a village perspective and women's perception of community-based health initiatives at the village level. Socio-economic and cultural factors are not specifically examined in this study, which is a limitation, as these factors indirectly impact maternal mortality [4], [9] and have a relatively limited influence on healthcare utilization [21]. The conceptual framework linking these factors to maternal mortality is illustrated in Figure 2.

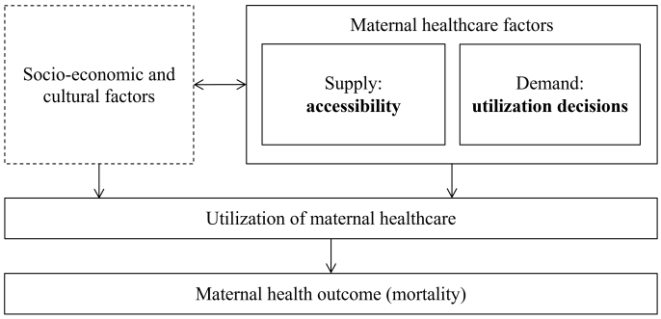

Figure 2. Conceptual framework linking maternal healthcare utilization to maternal mortality

3.2. Research design

The scope of this research is the villages in Bali Province. Accessibility reflects how women in villages can access maternal healthcare. Meanwhile, quality reflects how community-based maternal health initiatives—*posyandu* and *poskesdes*—are utilized in the villages. Thus, there are two areas of analytical objects: the village as a territorial unit and the women living within it. This research encompasses all 717 villages in Bali [22].

This research conducts two integrated analyses. To describe the accessibility level of maternal healthcare, the research applies the analytic hierarchy process (AHP) method. AHP determines priority criteria through questionnaire interviews with stakeholders and uses them to create a thematic map using secondary data available at the village level. To measure the quality of *posyandu/poskesdes*, this research employs the SERVQUAL model through self-enumerated questionnaires completed by women as service users. The results from both analyses are subsequently analyzed in depth using a TOWS matrix to formulate strategies for improving the accessibility and quality of maternal healthcare.

To analyze maternal healthcare accessibility, 14 selected respondents represent the triple helix collaboration between the government (health department at the provincial level and regency/municipality level), academics, and the community (Indonesian Midwives Association, Indonesian Planned Parenthood Association). The criteria selection to determine priority is based on variables derived from the Village Potential Data (Podes) data and is relevant to maternal mortality incidents related to a study by [23], which summarizes the territorial factors influencing maternal mortality from various previous studies. This data source was selected because Podes is conducted as a census covering all administrative areas at the village level, to provide data on the existence and development of village potential, including aspects of social, economic, infrastructure, and public facilities. According to [24], the AHP method is used to structure the territorial variables into a hierarchy (see Figure 3) and then analyze them to determine priority.

To analyze maternal healthcare quality, a total of 149 sample respondents, married women aged 15–49 years, were selected and proportionally distributed across all districts in Bali to assess the quality of

services at *posyandu/poskesdes* using a self-administered questionnaire. The samples were collected using a non-probability sampling technique with the quota sampling method. This approach was selected because the study explores respondents' perspectives in a preliminary context, rather than aiming to estimate or generalize the population. The sample size was determined using Cochran's formula [25] for finite populations and proportionally distributed across all districts in Bali Province according to the number of women of reproductive age.

The questionnaire was developed based on the SERVQUAL model, integrated with the Donabedian model [26]. The Donabedian model provides a framework for evaluating service quality through its components, while the SERVQUAL model examines patients' perceptions and expectations. Respondents were asked to rate each statement on a scale from 1 (strongly disagree) to 7 (strongly agree) for each statement, both based on the healthcare that has been received (perception) and the healthcare that should be received (expectation), where values from 2 to 6 are not assigned specific labels [27]. The questionnaire has undergone prior validity and reliability testing to ensure that it is fit for use. The complete list of questionnaire statements is presented in Table 1.

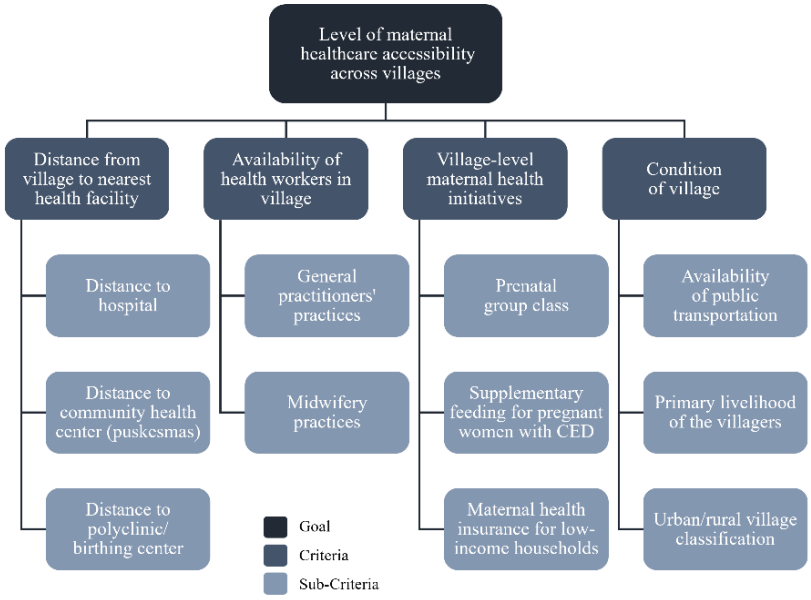

Figure 3. Hierarchical structure of maternal healthcare accessibility

Table 1. Explanation of perception-based assessment variables on the quality of village-level maternal healthcare

Dimensions	Explanations	Questionnaire item descriptions
Tangible	Respondents evaluated the physical conditions, facilities, and availability of health workers prior to receiving healthcare	1. Having complete facilities and services 2. The available medical equipment is clean and safe to use 3. The health information provided is straightforward to understand 4. There are sufficient health workers
Assurance	Respondents assessed the background and professional attitude of health workers, as well as their initial impressions of the service process	5. Health workers are professionals in their field 6. The healthcare provided are safe and reliable 7. The healthcare process is straightforward to understand 8. The healthcare is provided on time
Reliability	Respondents evaluated the health workers' ability to provide care and support during the service process	9. Health workers have good health knowledge 10. Health workers have adequate experience 11. Health workers provide services correctly and accurately 12. Health workers can communicate well and politely
Responsiveness	Respondents assessed the responsiveness of health workers to their needs during the service process	13. Health workers deliver services promptly 14. Health workers show concern to help 15. Health workers will not neglect even when they seem busy
Empathy	Respondents evaluated whether health workers demonstrated empathy toward their feelings during the service process	16. Health workers deliver services promptly 17. Health workers empathize with complaints and expressions 18. Health workers strive to provide solutions
Medical output	Evaluation of respondents based on the impact of the services received and their overall satisfaction with the care they have received	19. Health complaints improve and can be handled well 20. Satisfaction with the healthcare provided

Statistical tests were conducted to assess the significance of the quality gap score, quantifying the discrepancy between patient expectations and perceptions of maternal healthcare quality at the village level, using a paired sample t-test. A larger positive gap indicates that perceived quality is substantially lower than expected, implying that the healthcare received fails to meet patients' expectations. Therefore, aspects demonstrating the most significant gaps should be prioritized for improvement to enhance overall service quality. Additionally, tests were performed to examine the significance of the relationship between perceived healthcare quality and output of the healthcare received (medical output) using the Pearson correlation test, identifying which aspects of maternal healthcare quality are most closely associated with maternal health outcomes and patient satisfaction.

4. RESULTS AND DISCUSSION

4.1. Accessibility level of maternal healthcare at the village level

Among the eleven criteria, maternal health insurance for low-income households received the highest score, indicating it is the top priority in assessing the accessibility of maternal healthcare in Bali. Providing health insurance not only increases the utilization of healthcare facilities but also improves the quality of care provided [28]. Health insurance reduces the financial burden of accessing healthcare, particularly for individuals with limited incomes [29], [30]. In addition, it encourages healthcare facilities to implement specific minimum service standards, which in turn enhances service utilization. A study by [31] found that maternal health insurance ownership positively influences the use of maternal healthcare. However, some villages may not provide maternal health insurance for low-income households because they are already covered under the National Health Insurance–Healthy Indonesia Card (JKN-KIS) program.

The second priority variable is the availability of midwifery practice in the village. Midwives play a vital role in maternal healthcare, particularly in providing antenatal care, first aid, and early detection of complications during pregnancy, childbirth, and the postpartum period. Furthermore, midwives authorized to practice independently are graduates of professional education programs, equipping them with more advanced competencies (Law of the Republic of Indonesia Number 4 of 2019). Achieving universal coverage of midwifery services has the potential to prevent up to 67 percent of maternal mortality in low- and middle-income countries [32] and is also associated with reduced referral rates and fewer cases requiring complex interventions [33]. However, this must be supported by compliance with competency standards and the availability of an enabling practice environment. Additionally, midwives are often the preferred providers of maternal healthcare across socio-economic groups due to their accessibility in terms of distance and affordability [34].

The implementation of prenatal group classes and supplementary feeding programs for pregnant women with chronic energy deficiency (CED) is among the criteria with relatively high priority in improving maternal health. Participation in prenatal group classes is positively associated with increased utilization of adequate antenatal care and delivery assistance by trained health professionals at healthcare facilities [35]. Meanwhile, supplementary feeding programs contribute to improved nutritional intake and reduced morbidity among pregnant women, thereby lowering the risk of complications during pregnancy and childbirth [36]-[38]. These findings highlight that maternal health initiatives at the village level represent a key priority in enhancing access to maternal healthcare.

Based on the priority scores shown in Figure 4, the accessibility level of maternal healthcare can be calculated for each village. A higher accessibility score indicates that maternal healthcare is more accessible in each area. Most villages in Bali Province exhibit relatively high accessibility. This is illustrated by the thematic map in Figure 5, which shows that 21.3% of villages fall into the category with the highest accessibility level (indicated in blue). These villages are predominantly located in the southern part of Bali, particularly in Gianyar Regency, and around the capitals of Jembrana and Buleleng Regencies. In contrast, only 10.6% of villages are classified as having the lowest accessibility level (indicated in red), primarily found in Bangli, Tabanan, and Karangasem Regencies. Villages in this lowest-accessibility group are typically characterized by the absence of midwifery services and the lack of maternal health insurance for low-income households.

The accessibility of maternal healthcare across villages is negatively correlated with maternal mortality. As illustrated in Figure 6, villages with lower levels of accessibility, such as those in Bangli, Tabanan, and Karangasem Regencies, tend to have higher MMR. In contrast, areas with higher accessibility, such as Denpasar City, Badung Regency, and Gianyar Regency, generally exhibit lower MMR. The concept of accessibility extends beyond geographic distance; it also encompasses the ease with which pregnant women can obtain adequate and timely healthcare [4]. Improved access enables pregnant women to receive appropriate care throughout pregnancy, reduces the risk of complications, and ultimately contributes to lower MMR.

Villages requiring priority attention for improving maternal healthcare accessibility have been further identified. As shown in Figure 7, several areas exhibit relatively low accessibility levels despite having high population densities. These villages are in Tabanan Regency (Kerambitan, Kediri, and Marga Districts), Bangli Regency (Susut, Bangli, and Tembuku Districts), and Karangasem Regency (Sidemen District). This suggests a high potential need for maternal healthcare in these areas, given the large number of female residents, yet significant barriers remain in accessing maternal healthcare. Efforts to improve accessibility should be directed toward villages with low accessibility levels; however, priority should be given to those with higher population densities, as interventions in these areas are likely to have a greater impact on reducing maternal mortality.

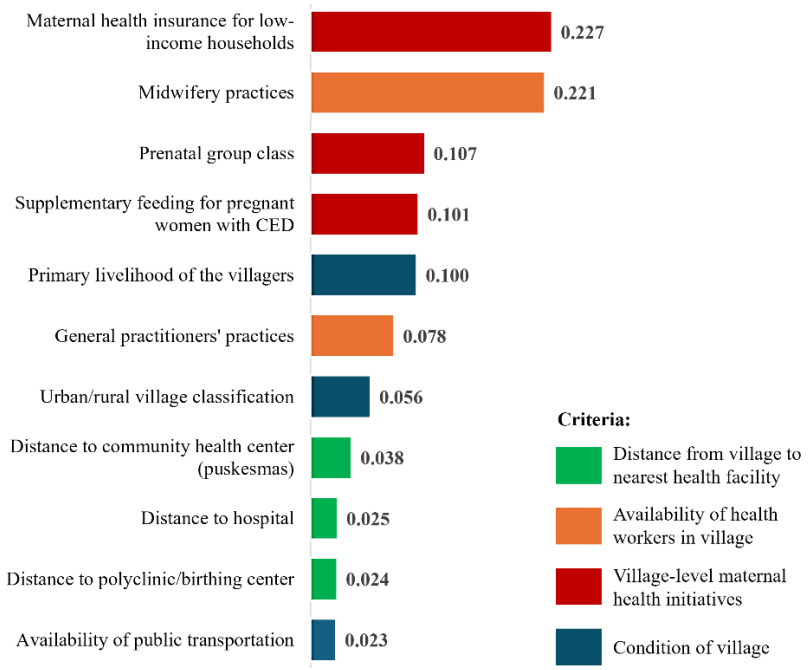

Figure 4. Priority scores of accessibility criteria for maternal healthcare across villages

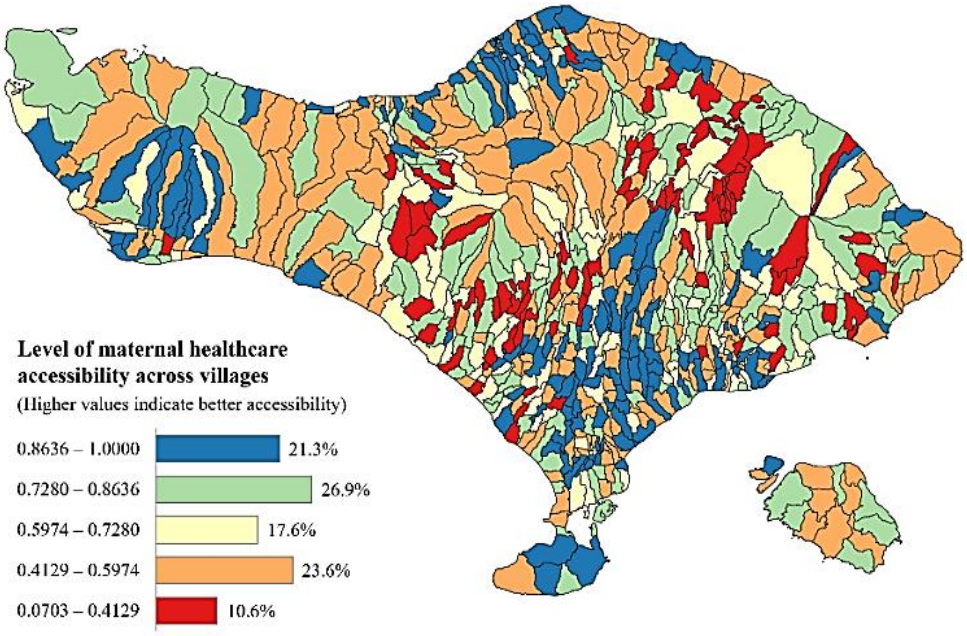

Figure 5. Village-level spatial distribution of maternal healthcare accessibility in Bali

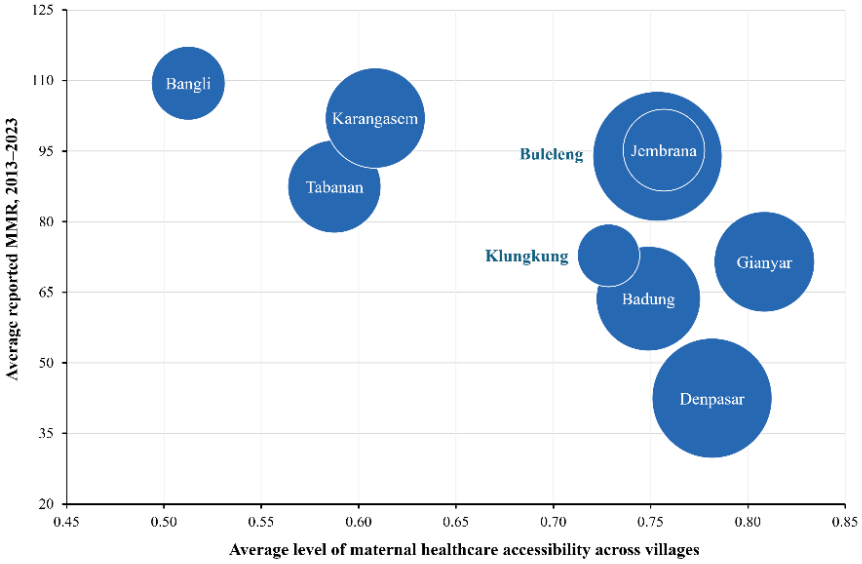

Figure 6. Scatter diagram of average village-level maternal healthcare accessibility and average reported MMR by regency/municipality in Bali

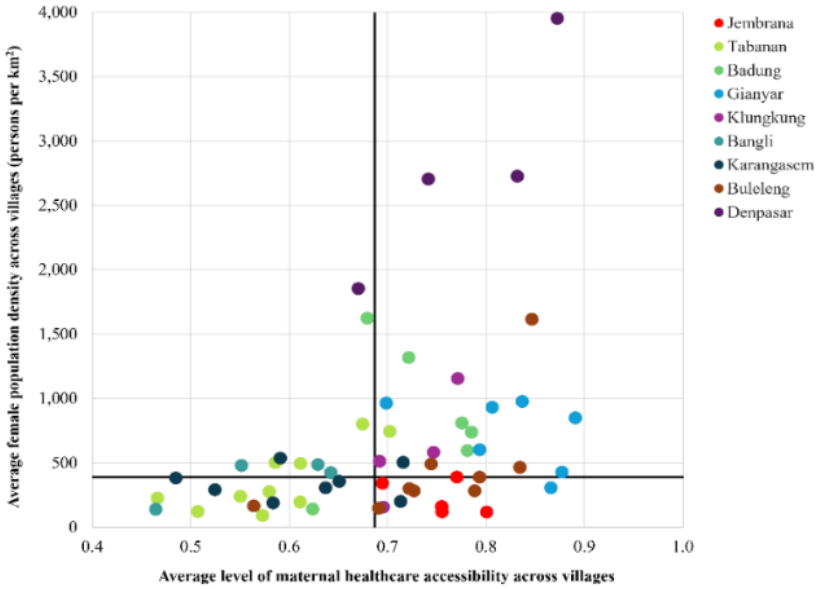

Figure 7. Quadrant chart of average maternal healthcare accessibility and average female population density at the village-level by subdistrict in Bali

4.2. Women's perception of maternal healthcare quality at the village level

Overall, the quality of services at *posyandu/poskesdes* in Bali is relatively good, as shown in Table 2. On a scale of 1 to 7, the average perception score reported by respondents was 6.160. However, the corresponding expectation score was higher, at 6.808, indicating a potential for improved maternal healthcare quality at the village level *(posyandu/poskesdes)*. The statistical tests comparing perception and expectation scores (average gap quality score) reveal a significant difference, underscoring the gap between the maternal healthcare quality women currently receive and what they expect.

Table 2. Average *posyandu/poskesdes* quality score based on women's perceptions

SERVQUAL dimensions	Average score of quality perception	Average score of quality expectation	The average gap quality score of expectation-perception
Tangible	6.020	6.790	0.770*
Assurance	6.208	6.817	0.609*
Reliability	6.262	6.810	0.549*
Responsiveness	6.132	6.799	0.667*
Empathy	6.177	6.823	0.647*
Overall	6.160	6.808	0.648*

*Gap quality score of expectation-perception significant at 1% level (paired t-test)

The most significant gap is observed in the tangible dimension (indicated by the largest gap quality score in Table 2, indicating that women face limitations in the physical aspects of maternal healthcare. The indicator with the widest gap relates to facilities and infrastructure, as well as the availability of health workers. This suggests that inadequate infrastructure and a shortage of health workers are the main barriers to meeting women's expectations. The second largest gap appears in the responsiveness dimension, indicating that health workers have not fully met expectations regarding readiness and speed in addressing women's needs. The most critical indicator within this dimension concerns the ability of health workers to provide services promptly and attentively, even when operating under high workloads. This highlights how limited staffing and excessive workloads can delay responses to women's needs, reducing their perception of service quality. Human resources and infrastructure shortages can create discomfort for users when accessing healthcare [39]. Moreover, high workloads among community health workers can negatively affect their productivity [40].

In addition to examining the quality gaps, this study also analyzes the relationship between each maternal healthcare quality dimension and medical output regarding improvements in women's health conditions and satisfaction with the services received. As shown in Table 3, the assurance and empathy dimensions exhibit the strongest associations with medical output, indicated by the largest Pearson correlation coefficient in Table 3. This suggests that women's trust and confidence in services are positively linked to better health outcomes. Conversely, although the tangible and responsiveness dimensions display larger quality gaps, their relationship with medical output is relatively weaker. In other words, even when facilities, infrastructure, and the responsiveness of health workers are perceived as inadequate, women tend to place greater value on how well they are supported and treated with empathy during service delivery. This supports the perspective that healthcare quality is shaped not only by physical components but also by users' psychological and emotional experiences [41]. These findings reinforce that *posyandu/poskesdes* are performing relatively well, contributing to improved health outcomes. Nevertheless, the substantial gaps in the tangible and responsiveness dimensions remain critical areas for improvement.

Table 3. Pearson correlation between SERVQUAl dimensions and medical output in assessing *posyandu/poskesdes* quality

SERVQUAL dimensions	Pearson correlation coefficient	
	Between quality perception and *medical output*	Between the gap quality of expectation-perception and *medical output*
Tangible	0.664*	-0.547*
Assurance	0.682*	-0.595*
Reliability	0.636*	-0.540*
Responsiveness	0.649*	-0.570*
Empathy	0.673*	-0.603*

*Pearson correlation coefficient significant at 1% level (t-test)

4.3. Improving the accessibility and quality of maternal healthcare at the village level

Based on the analysis of maternal healthcare accessibility and quality at the village level in Bali, this section formulates strategies using a TOWS matrix, which categorizes strategic options by combining internal factors (strengths and weaknesses) with external factors (opportunities and threats) [42], [43]. Regarding internal factors, maternal healthcare in Bali demonstrates a strong foundation in accessibility and service quality. Accessibility mapping indicates that distance and transportation are low-priority barriers. Perception assessments show narrow quality gaps in the assurance and empathy dimensions, suggesting that health workers at *posyandu/poskesdes* are competent and communicative. However, gaps persist in in-service distribution, particularly in providing maternal health insurance for low-income households and the

availability of midwife practices in certain villages. Moreover, significant quality gaps in the tangible and responsiveness dimensions reflect limitations in infrastructure, staffing, and high workloads, which collectively affect overall service delivery.

Regarding external factors, service quality assessments indicate that women's satisfaction with maternal healthcare is relatively high, reflecting strong trust in local healthcare facilities. However, migrants often encounter administrative barriers and have limited awareness of maternal health, resulting in underutilization of available services. This is consistent with [44] findings, which report low public awareness of civil registration, primarily due to limited understanding and socioeconomic challenges. BPS-Statistics Bali Province (2023) notes that many migrants have low education levels, work in the informal sector, and live in inadequate housing conditions. Additionally, promotional and preventive healthcare at the village level largely depends on midwives under *puskesmas* coordination rather than on village-led initiatives, partly due to limited awareness about health-oriented development among village officials [45], [46].

Based on the SWOT analysis, a TOWS matrix was constructed. As shown in Table 4, each combination of internal and external factors generates implementable strategies. In the Strengths–Opportunities (SO) strategy, the availability of competent health workers and high maternal awareness are key assets. To expand service coverage and effectiveness, digital health consultations (telemedicine) can be developed to overcome geographic and personnel limitations, while also increasing women's awareness of pregnancy check-ups and childbirth preparedness [47], [48].

In the weakness–opportunity (WO) strategy, efforts should focus on expanding maternal health insurance for low-income households and ensuring the availability of qualified midwives, particularly in remote villages [49]. This can be achieved by refining maternal health insurance to be more inclusive and targeted and incentivizing midwives to work in underserved areas. Health insurance schemes should consider accessibility, resource availability, accurate targeting, and effective communication [50]. Incentive programs for midwives should address monetary and non-monetary factors, including access to training, skill development, career advancement, and adequate living conditions for them and their families [51], [52].

Table 4. TOWS matrix of strategies to improve accessibility and quality of maternal healthcare at village level

Internal factors / External factors	Strengths (S)	Weaknesses (W)
Opportunities (O)	SO strategies: - Optimize maternal health promotion through communication, information, and education initiatives. - Develop telemedicine for pregnant women to improve access and awareness.	WO strategies: - Refine maternal health insurance schemes to be more inclusive and targeted, considering socio-economic conditions and healthcare accessibility. - Implement incentive mechanisms to encourage midwives to serve in underserved areas.
Threats(T)	ST strategies: - Strengthen community-based health promotion targeting migrant populations - Promote the active involvement of health workers in village development planning.	WT strategies: - Systematically redistribute health workers based on levels of accessibility and service burden - Improve administrative compliance mechanisms for migrant populations to enhance healthcare access.

On the other hand, strategies addressing external threats focus on increasing the utilization of maternal healthcare, particularly among migrant populations. In the strength–threat (ST) strategy, a community-based approach is essential to mobilize migrants toward improved health behaviors and participation in outreach programs [53]. To ensure maternal health becomes a priority in village development, healthcare providers should actively participate in village planning processes. According to [54], responsive village officials, combined with active community involvement and decision-making capacity, positively influence the effectiveness of development programs funded by the village fund.

In the weakness–threat (WT) strategy, the redistribution of health workers should be implemented more systematically to ensure service availability in villages with low accessibility. Additionally, policies related to migrant registration and administrative compliance should be made more flexible and inclusive to facilitate equitable access to maternal healthcare, particularly during emergencies [55]. Highlight that improving health protection for migrant populations and reducing barriers to civil registration not only enhances maternal and infant health outcomes but also strengthens the government's capacity to monitor population health more accurately and effectively.

5. CONCLUSION

This study identified disparities in maternal healthcare accessibility across Bali, with villages of high population density but low access, particularly in Tabanan, Bangli, and Karangasem, requiring targeted interventions. Insurance coverage for low-income households and the presence of midwives were the most critical factors, while service quality showed gaps in infrastructure and responsiveness despite generally positive perceptions; assurance and empathy dimensions were most strongly linked to positive outcomes. Policy implications emphasize coordinated provincial and local action, prioritizing resource allocation to underserved villages, strengthening midwife deployment, expanding inclusive insurance schemes, addressing migrant barriers, and integrating telemedicine to enhance literacy and continuity of care, all through community-based approaches and collaborative governance to ensure sustainable impact.

This study has several limitations that should inform future research. Maternal mortality is influenced by multiple factors, including the socio-economic characteristics of mothers and their families, living conditions, and healthcare facilities. However, the present study focuses on the accessibility and quality of maternal healthcare and does not account for individual socio-economic variables. Furthermore, healthcare quality assessment is confined to community-based health initiatives at the village level; evaluating primary-level facilities and higher-level referral centers is necessary to obtain a more comprehensive picture of service quality. Finally, accessibility analyses would benefit from incorporating the capacity of villages to understand, manage, and autonomously support maternal health issues, since this capacity affects the readiness of villages to sustain maternal healthcare. Addressing these gaps would strengthen the understanding of maternal outcomes' drivers and guide more targeted interventions.

FUNDING INFORMATION

Authors state no funding involved.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Panca Dwi Prabawa	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓
I Ketut Widnyana	✓	✓				✓				✓		✓		
Ni Putu Pandawani	✓			✓		✓				✓		✓		
Wayan Maba	✓					✓				✓		✓		

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

This study complied with all relevant national regulations and institutional policies, in line with the principles of the Helsinki Declaration, and received approval from the authors' institutional review board or equivalent ethics committee.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [PDP]. The data, which contains information that could compromise the privacy of research participants, is not publicly available due to certain restrictions.

REFERENCES

[1] J. R. Wilmoth *et al.*, "A new method for deriving global estimates of maternal mortality," *Statistics, Politics, and Policy*, vol. 3, no. 2, Jan. 2012, doi: 10.1515/2151-7509.1038.

[2] Ministry of National Development Planning of the Republic of Indonesia, *Indicator Metadata of Sustainable Development Goals (SDGs) Indonesia: Pillars of Social Development*, (in Bahasa: *Metadata Indikator Tujuan Pembangunan Berkelanjutan (SDGs) Indonesia: Pilar-pilar Pembangunan Sosial*), 2nd ed. Jakarta, 2020.

[3] S. Thaddeus and D. Maine, "Too far to walk: Maternal mortality in context," *Social Science and Medicine*, vol. 38, no. 8, pp. 1091–1110, Apr. 1994, doi: 10.1016/0277-9536(94)90226-7.

[4] J. McCarthy and D. Maine, "A framework for analyzing the determinants of maternal mortality," *Studies in Family Planning*, vol. 23, no. 1, p. 23, Jan. 1992, doi: 10.2307/1966825.

[5] *Reducing Maternal and Neonatal Mortality in Indonesia*. Washington, D.C.: National Academies Press, 2013. doi: 10.17226/18437.

[6] C. R. Titaley, C. L. Hunter, M. J. Dibley, and P. Heywood, "Why do some women still prefer traditional birth attendants and home delivery?: a qualitative study on delivery care services in West Java Province, Indonesia," *BMC Pregnancy and Childbirth*, vol. 10, no. 43, Dec. 2010, doi: 10.1186/1471-2393-10-43.

[7] Montaño Daniel E. and Kasprzyk Danuta, *Theory of reasoned action, theory of planned behavior, and the integrated behavioral model*, vol. 70, no. 4. 2015.

[8] R. Karkee, A. Lee, and C. Binns, "Why women do not utilize maternity services in Nepal: a literature review," *WHO South-East Asia Journal of Public Health*, vol. 2, no. 3, p. 135, 2013, doi: 10.4103/2224-3151.206759.

[9] L. Cameron, D. Contreras Suarez, and K. Cornwell, "Understanding the determinants of maternal mortality: An observational study using the Indonesian Population Census," *PLOS ONE*, vol. 14, no. 6, p. e0217386, Jun. 2019, doi: 10.1371/journal.pone.0217386.

[10] Ministry of Health of the Republic of Indonesia and UNFPA, *Review of maternal mortality in five region in Indonesia*. Jakarta, 2012.

[11] World Health Organization, "Maternal, newborn, child, adolescent health and ageing and quality of care indicator metadata toolkit," *Geneva*, 2024. Oct. 07, 2024

[12] S. El Gelany, M. G. Mansour, and M. M. Hassan, "The three delays of maternal mortality in a public-sector tertiary teaching hospital: is there a paradigm shift?," *Gynecology and Obstetrics Research-Open Journal*, vol. 2, no. 2, pp. 52–56, Jul. 2015, doi: 10.17140/GOROJ-2-112.

[13] A. Geleto, C. Chojenta, A. Musa, and D. Loxton, "Barriers to access and utilization of emergency obstetric care at health facilities in sub-Saharan Africa: a systematic review of literature," *Systematic Reviews*, vol. 7, no. 1, p. 183, Dec. 2018, doi: 10.1186/s13643-018-0842-2.

[14] B. Tedja, M. Al Musadieq, A. Kusumawati, and E.Yulianto, "Systematic literature review using PRISMA: exploring the influence of service quality and perceived value on satisfaction and intention to continue relationship," *Future Business Journal*, vol. 10, no. 39, 2024, doi: 10.1186/s43093-024-00326-.

[15] M. Mekie *et al.*, "Perceived quality of maternal care and its barriers based on women's perspective in hospitals of Northwest Ethiopia: a qualitative study," Frontiers Medicine, vol. 11, 2024, doi: 10.3389/fmed.2024.1387710.

[16] A. Donabedian, "The quality of care," *JAMA*, vol. 260, no. 12, p. 1743, Sep. 1988, doi: 10.1001/jama.1988.03410120089033.

[17] World Health Organization (WHO), *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities*, WHO, 2016. [Online]. Available: https://iris.who.int/bitstream/handle/10665/249155/9789241511216-eng.pdf (accessed Oct. 7, 2024).

[18] F. Salehi and L. Ahmadian, "The application of geographic information systems (GIS) in identifying the priority areas for maternal care and services," *BMC Health Services Research*, vol. 17, no. 1, p. 482, Dec. 2017, doi: 10.1186/s12913-017-2423-9.

[19] T. Win, P. Vapattanawong, and P. Vong-ek, "Three delays related to maternal mortality in Myanmar: a case study from maternal death review, 2013," *Journal of Health Research*, vol. 29, no. 3, pp. 179–187, 2015.

[20] M. A. Mahmood *et al.*, "Health system and quality of care factors contributing to maternal deaths in East Java, Indonesia," *PLOS ONE*, vol. 16, no. 2, p. e0247911, Feb. 2021, doi: 10.1371/journal.pone.0247911.

[21] J. Mulyanto, A. E. Kunst, and D. S. Kringos, "Geographical inequalities in healthcare utilisation and the contribution of compositional factors: A multilevel analysis of 497 districts in Indonesia," *Health & Place*, vol. 60, p. 102236, Nov. 2019, doi: 10.1016/j.healthplace.2019.102236.

[22] BPS-Statistics Bali Province, *Village Potential Statistics of Bali Province 2024*. Denpasar: BPS-Statistics Bali Province, 2024.

[23] L. Ahmadian, F. Salehi, and K. Bahaadinbeigy, "Application of geographic information systems in maternal health: a scoping review," *Eastern Mediterranean Health Journal*, vol. 26, no. 11, pp. 1403–1414, Nov. 2020, doi: 10.26719/emhj.20.095.

[24] T. L. Saaty and L. G. Vargas, *Models, Methods, Concepts & applications of the analytic hierarchy process*, vol. 175. Boston, MA: Springer US, 2012. doi: 10.1007/978-1-4614-3597-6.

[25] W. G. Cochran, *Sampling techniques*. New York: NY : Wiley, 1997.

[26] C.-C. Chen, C.-T. Hsiao, D.-S. Chang, and W.-C. Lai, "The delivery model of perceived medical service quality based on donabedian's framework," *Journal for Healthcare Quality*, vol. 46, no. 3, 2024, doi: 10.1097/JHQ.0000000000000420.

[27] A. Parasuraman, Parsu, A. Zaithaml, Valarie, and L. Berry, L, "SERVQUAL : a multiple-item scale for measuring consumer perceptions of service quality," *Journal of Retailing*, vol. 64, no. January, pp. 12–35, 2008.

[28] A. B. Comfort, L. A. Peterson, and L. E. Hatt, "Effect of health insurance on the use and provision of maternal health services and maternal and neonatal health outcomes: A systematic review," *Journal of Health, Population and Nutrition*, vol. 31, no. 4 SUPPL.2, 2013.

[29] M. I. Brooks, H. Thabrany, M. P. Fox, V. J. Wirtz, F. G. Feeley, and L. L. Sabin, "Health facility and skilled birth deliveries among poor women with Jamkesmas health insurance in Indonesia: a mixed-methods study," *BMC Health Services Research*, vol. 17, no. 1, p. 105, Dec. 2017, doi: 10.1186/s12913-017-2028-3.

[30] V. Widyaningsih, Khotijah, and Balgis, "Expanding the scope beyond mortality: burden and missed opportunities in maternal morbidity in Indonesia," *Global Health Action*, vol. 10, no. 1, Jan. 2017, doi: 10.1080/16549716.2017.1339534.

[31] N. K. Aryastami and R. Mubasyiroh, "Optimal utilization of maternal health service in Indonesia: a cross-sectional study of Riskesdas 2018," *BMJ Open*, vol. 13, no. 9, p. e067959, Sep. 2023, doi: 10.1136/bmjopen-2022-067959.

[32] A. Nove *et al.*, "Potential impact of midwives in preventing and reducing maternal and neonatal mortality and stillbirths: a Lives Saved Tool modelling study," *The Lancet Global Health*, vol. 9, no. 1, pp. e24–e32, Jan. 2021, doi: 10.1016/S2214-109X(20)30397-1.

[33] S. Wenang, O. Emilia, A. Wahyuni, A. Afdal, and J. Haier, "Obstetrics care in Indonesia: Determinants of maternal mortality and stillbirth rates," *PLOS ONE*, vol. 19, no. 7, p. e0303590, Jul. 2024, doi: 10.1371/journal.pone.0303590.
[34] A. Paramita, P. Andarwati, N. Izza, L. Kristiana, H. Maryani, and D. H. Tjandrarini, "Pregnant women's preference for antenatal care (Anc) provider: lessons learned to support maternal mortality rate reduction strategies," *Southeast Asian Journal of Tropical Medicine and Public Health*, vol. 53, no. Suppl 2, pp. 254–272, 2022.
[35] K. Azhar, I. Dharmayanti, D. H. Tjandrarini, and P. S. Hidayangsih, "The influence of pregnancy classes on the use of maternal health services in Indonesia," *BMC Public Health*, vol. 20, no. 1, p. 372, Dec. 2020, doi: 10.1186/s12889-020-08492-0.
[36] S. Diana, C. U. Wahyuni, and B. Prasetyo, "Maternal complications and risk factors for mortality," *Journal of Public Health Research*, vol. 9, no. 2, p. 1842, Jul. 2020, doi: 10.4081/jphr.2020.1842.
[37] R. Seviana Putri, D. Aulia, K. Dwi Wahyuningtyas, E. Frederika Puruhito, and S. Hansa Kamal, "Effectiveness of supplementary feeding in pregnant women with chronic energy deficiency : a systematic article review," *International Journal of Research Publications*, vol. 115, no. 1, pp. 122–129, Dec. 2022, doi: 10.47119/IJRP10011511220224285.
[38] H. Sampeangin, V. Hadju, S. Sirajuddin, A. I. A. Thahir, and A. R. Thaha, "The effect of supplementary feeding program for chronic energy deficiency pregnant women on Hb concentration MUAC, and gestational weight gain in Indonesia," *Indian Journal of Public Health Research & Development*, vol. 9, no. 8, p. 306, 2018, doi: 10.5958/0976-5506.2018.00738.6.
[39] A. Sriatmi and Y. Fatmasari, "The community satisfaction and participation of the health planning process in primary health care," *Jurnal Kesehatan Masyarakat*, vol. 14, no. 2, pp. 279–288, Nov. 2018, doi: 10.15294/kemas.v14i2.11717.
[40] T. Astale, T. Abebe, and G. Mitike, "Workload and emerging challenges of community health workers in low- and middle-income countries: A mixed-methods systematic review," *Plos One*, vol. 18, no. 3, Mar. 2023, doi: 10.1371/journal.pone.0282717.
[41] L. Fan *et al.*, "Patients' perceptions of service quality in China: An investigation using the SERVQUAL model," *PLOS ONE*, vol. 12, no. 12, p. e0190123, Dec. 2017, doi: 10.1371/journal.pone.0190123.
[42] H. Weihrich, "The TOWS matrix—A tool for situational analysis," *Long Range Planning*, vol. 15, no. 2, pp. 54–66, Apr. 1982, doi: 10.1016/0024-6301(82)90120-0.
[43] Fred R. David, F. R. David, and M. E. David, *Strategic management: a competitive advantage approach, concepts and cases - pearson (eTextBook)*, 16th ed. England: Pearson Education Limited, 2017.
[44] BPS, A. B. Aji and K. D. Chandra Sari, "Juridical analysis of village government authority in managing village funds for health in Banyumas Regency," (In Bahasa: *Analisis yuridis kewenangan pemerintah desa dalam pengelolaan dana desa untuk kesehatan di Kabupaten Banyumas*), *Jurnal Hukum Ius Quia Iustum*, vol. 28, no. 3, Sep. 2021, doi: 10.20885/iustum.vol28.iss3.art7.*Towards inclusivity: Development of civil registration in Indonesia 2019–2023*. Jakarta: BPS-Statistics Indonesia, 2024.
[45] V. Yulian, L. McGowan, and T. Stacey, "Desa SIAGA, a community participation model for maternal and neonatal health in Indonesia, barriers and facilitators to implementation: findings from a comparative case study design.," BMC Pregnancy Childbirth, vol. 25, 2025, doi: 10.1186/s12884-025-08320-6.
[46] J. Indra and K. Khoirunurrofik, "Understanding the role of village fund and administrative capacity in stunting reduction: Empirical evidence from Indonesia," *PLOS ONE*, vol. 17, no. 1, p. e0262743, Jan. 2022, doi: 10.1371/journal.pone.0262743.
[47] Bonifasius, I. P. G. Kayika, O. Abdul madjid, J. M. Seno Adjie, and H. I. Marceliano Rumopa, "Effectiveness of the telemedicine approach on maternal health practices among pregnant women in rural areas," *Indonesian Journal of Obstetrics and Gynecology*, pp. 179–185, Jul. 2024, doi: 10.32771/inajog.v12i3.2100.
[48] P. Haryanti, S. L. Pandugaran, M. Aljaberi, R. Poddar, and M. Nisha, "Telehealth improves pregnancy health care: Literature review," *Malaysian Journal of Medicine and Health Sciences*, vol. 19, no. s9, pp. 280–288, Aug. 2023, doi: 10.47836/mjmhs.19.s9.38.
[49] M. A. Mahmood *et al.*, "Root-cause analysis of persistently high maternal mortality in a rural district of Indonesia: Role of clinical care quality and health services organizational factors," *BioMed Research International*, vol. 2018, no. 3673265, pp. 1–11, 2018, doi: 10.1155/2018/3673265.
[50] A. Kuwawenaruwa, G. Mtei, J. Baraka, and K. Tani, "Implementing demand side targeting mechanisms for maternal and child health-experiences from national health insurance fund program in Rungwe District, Tanzania," *Globalization and Health*, vol. 12, no. 1, p. 41, Dec. 2016, doi: 10.1186/s12992-016-0180-x.
[51] I. Anderson, A. Meliala, P. Marzoeki, and E. Pambudi, *The production, transportation, and performance of physicians, nurses, and midwives in Indonesia : An Update*. Washington: World Bank Group, Washington, DC, 2014. doi: 10.1596/20729.
[52] T. Ensor, Z. Quayyum, M. Nadjib, and P. Sucahya, "Level and determinants of incentives for village midwives in Indonesia," *Health Policy and Planning*, vol. 24, no. 1, pp. 26–35, Nov. 2008, doi: 10.1093/heapol/czn040.
[53] Z. S. Lassi, R. Kumar, and Z. A. Bhutta, "Community-based care to improve maternal, newborn, and child health," *Disease Control Priorities, Third Edition (Volume 2): Reproductive, Maternal, Newborn, and Child Health*, pp. 263–284, 2016, doi: 10.1596/978-1-4648-0348-2_ch14.
[54] W. *et al.*, "Does rural development enable community empowerment? evidence from village fund in Indonesia," *Pakistan Journal of Life and Social Sciences (PJLSS)*, vol. 22, no. 1, pp. 6141–6153, 2024, doi: 10.57239/PJLSS-2024-22.1.00453.
[55] A. R. Cheong and M. A. K. Baltazar, "Too precarious to walk: an integrated 'three delays' framework for modeling barriers to maternal health care and birth registration among stateless persons and irregular migrants in Malaysia," *Genus*, vol. 77, no. 1, p. 18, Dec. 2021, doi: 10.1186/s41118-021-00129-3.

BIOGRAPHIES OF AUTHORS

Panca Dwi Prabawa is a statistician and demographic researcher at BPS–Statistics Bali Province, specializing in spatial analysis with a focus on rural and village development. Previously, he served as a technical staff member to the Chief Statistician of BPS-Statistics Indonesia, contributing to various initiatives on the advancement of official statistics and the utilization of big data at both national and Asia-Pacific regional levels. He is currently pursuing a master's degree in Regional and Rural Planning at Mahasaraswati Denpasar University. He can be contacted at email: pancadwiprabawa@gmail.com.

I Ketut Widnyana is a professor and lecturer in Postgraduate Program in Regional and Rural Planning at Mahasaraswati Denpasar University, Denpasar, Indonesia. He also serves as an expert and reviewer for community service programs at the Denpasar Polytechnic of Health and is a member of the Academic Scientific Research Development Team under the Ministry of Higher Education, Science, and Technology. He completed his doctoral program in Agricultural Sciences with a specialization in Bioresource Management at Udayana University. He has authored and co-authored numerous scientific articles, research papers, and books on agriculture, environmental management, and regional planning. He can be contacted at email: widnyanaketut@unmas.ac.id.

Ni Putu Pandawani is a professor and lecturer in the Postgraduate Program in Regional and Rural Planning at Mahasaraswati Denpasar University, Denpasar, Indonesia. She completed her doctoral degree in Agricultural Sciences with a specialization in Bioresource Management at Udayana University. She is actively involved in research and academic writing, contributing to various national and regional research grants as well as community service programs. The outcomes of her work have been published in nationally accredited journals and international publications. She can be contacted at email: pandawaniputu@unmas.ac.id.

Wayan Maba is a professor and lecturer in Postgraduate Program in Regional and Rural Planning, Mahasaraswati Denpasar University, Denpasar, Indonesia. He previously served as the head of the accreditation board in Bali Province and was also a member of the expert team for the National Professional Certification in Jakarta. He completed his doctoral program in educational research and evaluation at State University of Jakarta. He can be contacted at email: wayanmaba.unmas@gmail.com.