REVIEW

Bibliometric Analysis and ChatGPT-Assisted Identification of Key Strategies for Improving Primary Maternity Care Based on a Decade of Collective Research

Sidik Maulana [1],*, Muhammad Iqhrammullah [2],*, Rovy Pratama[3], Sydney Tjandra[4], Intan Chaharunia Mulya[5], Hartiah Haroen[6]

[1]Postgraduate Program of Nursing, Faculty of Nursing, Universitas Padjadjaran, Sumedang, Indonesia; [2]Postgraduate Program of Public Health, Universitas Muhammadiyah Aceh, Banda Aceh, Indonesia; [3]Department of Public Health, Faculty of Medicine, Universitas Syiah Kuala, Indonesia; [4]Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia; [5]Education Program in Reproduction & Development, Department of Obstetrics and Gynaecology, Monash University, Melbourne, Victoria, 3168, Australia; [6]Department of Community Health Nursing, Faculty of Nursing, Universitas Padjadjaran, Sumedang, Indonesia

*These authors contributed equally to this work

Correspondence: Sidik Maulana, Faculty of Nursing, Universitas Padjadjaran, Jl. Ir. Soekarno KM. 21, Jatinnagor, Sumedang, 45363, Indonesia, Tel +6289662392294, Email sidik17001@mail.unpad.ac.id; Rovy Pratama, Department of Public Health, Faculty of Medicine, Universitas Syiah Kuala, Jl. Teuku Nyak Arief No. 441, Kopelma Darussalam, Kec. Syiah Kuala, Kota Banda Aceh, Aceh, 23111, Indonesia, Email rovy.pratama@usk.ac.id

Abstract: Maternity care within primary health facility settings is critical for reducing maternal and neonatal mortality in Indonesia. The aim of this study was to analyze research trends over the past decade to identify key strategies for improving maternity care in primary health care facilities in Indonesia. A bibliometric analysis was conducted using data from the Scopus database to map the research landscape and identify latent research topics in maternal health care. The analysis included keyword co-occurrence and network visualization, with assistance from ChatGPT-4.0 for enhanced identification and categorization of keywords. The identified research trends were used as surrogate variables representing the main concerns among researchers, experts, and funders. These variables were used to build strategies, which were then analyzed using SWOT (Strengths, Weaknesses, Opportunities, and Threats) by reflecting on the Indonesian context. The results revealed that key topics in maternity care included midwifery roles, pandemic resilience, and telemedicine. Based on SWOT analysis, most of the constructed strategies were found to have high external opportunities but low internal capabilities, indicating the need to strengthen internal resources. In conclusion, Indonesia must enhance its internal capabilities, particularly human resources and infrastructure, to effectively utilize external opportunities and improve maternal health outcomes.

Keywords: antenatal care, bibliometric analysis, maternal health, primary health care, JKN program

Introduction

Epidemiological trends show that maternal health care in Indonesia faces significant challenges, with maternal mortality rates remaining high despite various interventions. In 2020, Indonesia had a maternal mortality ratio (MMR) of 189 maternal deaths per 100,000 live births, one of the highest in Southeast Asia.[1] Adolescent pregnancy significantly contributes to these figures, with adolescent birth rate in Indonesia reaching 36 per 1000 women.[2] To respond to the high MMRs, an international consensus has suggested family planning, rapid emergency obstetric treatment, competent care during pregnancy and childbirth, and urgent postnatal care as the core strategies.[3] The national family planning program in Indonesia is one of the successful programs that has achieved a significant reduction of total fertility rate from 5.0 to 2.3%.[4] Moreover, the contraceptive prevalence rate among married women increased from 8% in the early 1970s to 63%

in 2017.[4] The Jaminan Kesehatan Nasional (JKN) program that has been implemented over the past decade has contributed to the improved maternal health in Indonesia. The program has expanded health insurance coverage dramatically, increasing from 114 million participants in 2014 to over 271.2 million by 2024, covering 95.75% of the population.[5] Nonetheless, the utilization of maternal care services is still suboptimal due to the presence of limited access by some groups of communities.[6] Poor outcomes in maternity care remain prevalent following the inadequate access to skilled health providers, financial barriers, and socio-economic disparities.[7]

Maternal care ranges from antenatal care (ANC), skilled birth attendance, and up to postnatal care (PNC). In Indonesia, primary health care facilities, known as PUSKESMAS, play a crucial role in delivering these services, especially in rural and low-resource settings. The primary health care facilities provide routine ANC visits, immunizations, health education, counseling, skilled childbirth attendance, and essential PNC.[8] High-quality maternal care can significantly reduce maternal mortality and improve neonatal outcomes. A systematic review further suggested that the quality of infrastructure, availability of medical supplies, and the presence of trained healthcare personnel are critical factors influencing maternal health outcomes.[9] Nonetheless, the MMR remains high due to factors like hemorrhage, hypertension, sepsis, and adolescent pregnancy.[10,11]

Despite the steady improvement of maternal health in Indonesia, the problem persisted for decades.[1] In fact, improvements of the MMR in Indonesia are still significantly lagging behind the Sustainable Development Goals (SDG) target of reducing maternal deaths to fewer than 70 per 100,000 live births by 2030.[12] To achieve this target, public health researchers have extensively studied maternal care, resulting in a vast body of literature covering various aspects of maternal health. However, the large volume of these studies limits practitioners in synthesizing the key strategies effectively. The large number of studies on maternal health makes it challenging for practitioners to identify the best strategies, as they have to sort through many articles with different focuses. As previously argued, multidisciplinary approach to policymaking remains fragmented, with expert knowledge being discussed in isolated fields.[13]

Herein, a bibliometric analysis of keyword co-occurrence was performed using data from the Scopus database. The Scopus database was selected for metadata collection due to its extensive coverage of global and regional scientific publications, with consistently well-maintained data quality.[14] Bibliometric analysis is a powerful tool for mapping the research landscape and identifying trends, patterns, and gaps in a particular field. This analysis provides insights on the research progress in a particular field, as well as areas that require further investigation. For example, a study used this methodology to map green accounting in health sector.[15] Another study employed bibliometric analysis to identify research topics in polymer sciences that were prominent during the COVID-19 pandemic.[16] Research topics, herein, were identified within clusters generated from network visualization, with assistance from ChatGPT-4.0. The advanced natural language processing capabilities of ChatGPT enhanced the identification and categorization of keywords.

Methods
Study Design and Conceptual Framework
The main objectives of this study were twofold: to identify and formulate strategies to address the persistent issues related to primary maternity care services in the community. We employed a combinatorial approach using keyword co-occurrence network analysis and SWOT (strength, weakness, opportunity, and threat) analysis, with strictly supervised use of ChatGPT-4.0. The study was designed to diverge from traditional bibliometric studies, which typically summarize extensive data to depict trends and structural relationships within a field, as suggested in a published report.[17] The conceptual framework for this study integrates research trend analysis with strategic planning to address maternal health care challenges in Indonesia. Bibliometric analysis using network visualization of co-occurring keywords was employed to identify the latent issues. These latent issues served as surrogate variables, forming a data-driven basis for strategies to improve maternal health services in primary care. Further, SWOT analysis was performed on the identified key strategies to provide useful insights for their implementation. The conceptual framework used in this study is presented as a schematic diagram in Figure 1.

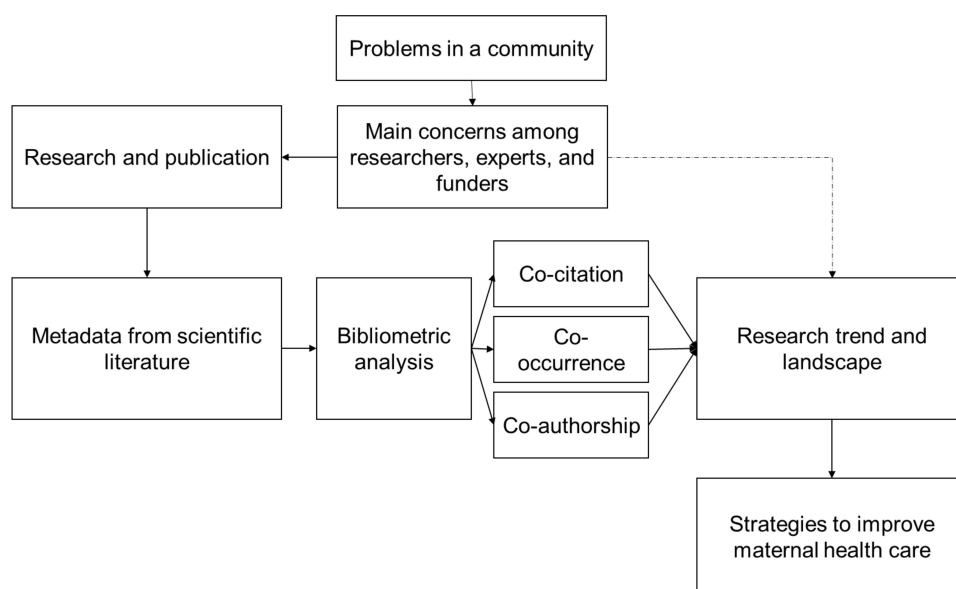**54** International Journal of Women's Health 2025:17

Figure 1 Conceptual framework of using bibliometric analysis to identify the stressing and persistent problems which are used as the basis for the development of strategies.

Search Strategy

The literature search was performed on Scopus database on 02 July 2024 using a previously designed keyword combination as follows: ("Maternal health" OR "Maternal care" OR "maternity care" OR "Antenatal care" OR "Prenatal care" OR "Pregnancy care" OR "Obstetric care" OR "Maternal mortality" OR "Maternal morbidity" OR "Reproductive health") AND (PUSKESMAS OR "Community health center*" OR "Primary healthcare" OR "primary health center*" OR "Healthcare delivery" OR "Public health facilit*" OR "community-based, care" OR "rural, health center"). To capture one-decade long research data, the search was limited for works published from January 2014 to July 2024. No limitations on document type, country, or subject area were applied. No specific inclusion or exclusion criteria were applied for research participants, study designs, or exposures other than those suggested by the search terms. The keyword combination inherently excluded studies involving animal subjects. The focus was directed toward human maternal health and care, particularly within the context of primary healthcare settings. The metadata from the identified records were downloaded as a .csv file for further use in network visualization.

Identification of Latent Research Topics

A bibliometric analysis was performed on the metadata of the identified records using desktop VOSviewer version 1.6.20. The .csv file was uploaded to the software for the co-occurrence analysis, which generated a network visualization of co-occurring keywords by determining the relationship between keywords. Total link strength (TLS) was computed in this analysis as a parameter of the relationship. To ensure the analysis reflected the study's objectives, only those suggested by authors (author keywords) were selected as the unit of analysis. The visualization was generated using the full counting method, with a minimum occurrence number of 5 as the threshold. The network of co-occurrence was normalized using association strength. No further selection by the author was performed on the visualized co-occurring keywords. The clustering was set at default, where the number of random starts and iterations were both set to 10. Thresholds chosen in the model were based on a consensus among the authors. This preference aimed to ensure clear and distinct keyword clusters for effective visualization. The approach followed the recommendations of previous studies.[18,19]

Keywords falling under the same cluster were indicated by the same color. The keywords from each cluster were then arranged to form research topics, facilitated by ChatGPT-4.0. Initially, a specific context for bibliometric analysis was set in the interaction session using the command: "I am performing bibliometric analysis on primary maternity care, please help". The command "define the research topic according to the keyword in each cluster…" was then used, followed by adding the clustered keywords. Thereafter, the ChatGPT-4.0 offered options for research topics. Each topic was then

critically reviewed by the author to ensure it accurately reflected the current research landscape and the practical needs of primary maternity care in Indonesia. In some cases, the author asked to consider the combination of the topics along with the pros and cons of the decision. This process was tightly supervised by the authors.

Strategies Determination and SWOT Analysis

After defining the research topics, the authors employed ChatGPT-4.0 to help generate the related strategies. The command "provide strategies to improve the primary maternity care based on the following research topic…" was used, followed by inputting the research topics. Initially, the artificial intelligence program was requested to record a number of scientific articles reporting the maternity care and health care system in Indonesia. Thereafter, ChatGPT was asked to provide initial strategy suggestions, which were then refined and contextualized by the author. The author removed the strategy if it was considered similar to previous ones.

To quantify the SWOT analysis, each identified point in strength, weakness, opportunity, or threat was graded between 0 and 2. The score of each point was then multiplied by the weight, ranged between 0 and 1 that was dependent on the level of importance. The X and Y coordinates (X, Y) was determined using the following equations:

$$X = Strength - Weakness \tag{1}$$

$$Y = Opportunity - Threat \tag{2}$$

The SWOT analysis was assisted by ChatGPT-4.0, with calculations inserted first and requested to be recorded. For each strength, weakness, opportunity, and threat, the author requested ChatGPT to provide at least 2 to 5 points that were most relevant for consideration. Authors actively assessed the correctness of the analysis. Instruction to reperform the analysis when ChatGPT had mistakenly mixed external factors in the strength or weakness domain was given through a command to exclude the external factor from either of the two domains. Instructions for reassessment was carried out if authors felt the score did not reflect to the conditions in Indonesia. In some instances, new articles were introduced or re-introduced to ChatGPT to ensure the analysis remained relevant to the conditions in Indonesia. Clarification was asked to ChatGPT if any discrepancies before and after the new instruction occurred. Using this information, authors exercised full discretion in accepting, rejecting, or modifying the analysis. To warrant the mathematical correctness, authors recalculated the score given by the ChatGPT through Excel.

Four-Quadrant Plot and Interpretation

The SWOT coordinates were plotted in a four-quadrant plot. Quadrant I (the upper right) indicates that the strategy has high priority and feasibility. Quadrant II (the upper left) suggests that the strategy has high priority, while suffering from low feasibility deriving from lack of internal strength and high internal weakness. When the strategy is located in quadrant III (lower left), it becomes the least favorable due to low priority and low feasibility. Strategies in quadrant IV (lower right) are low in terms of priority but high in feasibility deriving from the significant presence of threat.

Results

Characteristics of the Included Bibliometric Data

Metadata from a total of 1839 publications was identified from the Scopus database and used in the bibliometric analysis. Most of the included metadata were derived from original research articles (91.5%), followed by review articles (5.3%, Figure 2). Research on primary maternity care steadily has increased globally over the year, with last year accounting for 14.3% of the total included records (Figure 2). The distribution of the publications according to the country of the main author's affiliation is presented in Figure 3. Most publications were reported from Ethiopia (n=259, 14.1%), followed by India (n=217, 11.8%) and the United Kingdom (n=216, 11.7%). Indonesia is among the top 10 countries performing and publishing research on primary maternal care with a total of 133 documents (7.2%).
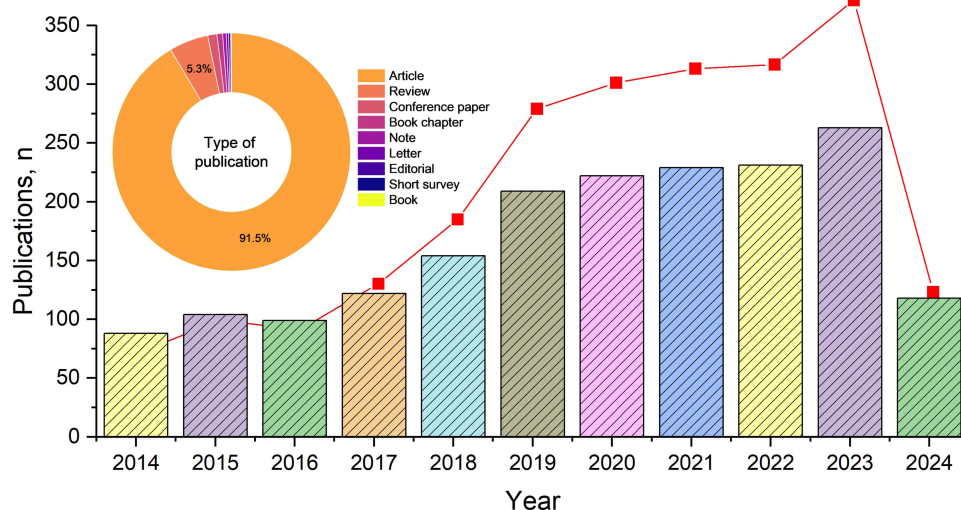
Figure 2 Distribution of the analyzed records by the type and year of publication.
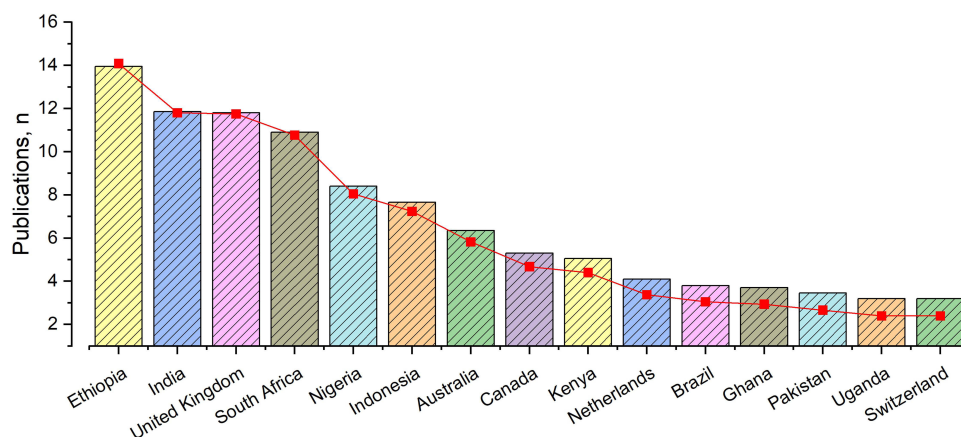

Figure 3 Distribution of the analyzed records by the country of the main author's affiliation.

Research Clusters and Identified Strategies

The visualization depicting the relationship between co-occurring keywords from publications that are relevant to primary maternity care is presented in Figure 4. Six clusters were generated, with a TLS of 1319 in each cluster, except for cluster 6 (TLS=628). Keywords in this analysis were mostly correlated with maternal health and pregnancy, as indicated by the high TLS values among others (TLS=214 and 151, respectively). Notably, keywords "midwives" and "COVID-19" (TLS=24 and 54, respectively) were among the latent research topics. The identified clusters have been summarized and presented in Table 1. From the six identified clusters, 29 strategies were formulated (Table 2).

Results from SWOT Analysis

SWOT analysis was performed for each formulated strategy, and the results are presented as coordinates in Table 3 and Figure 5. Providing supporting facilities and incentives for midwifery in rural areas was located in the first quadrant (+X, +Y). The strategies of providing continuous professional development opportunities for healthcare providers in obstetrics was also located in the first quadrant. Other strategies in this quadrant were "stakeholder engagement", "education to new mothers", "nutritional support", "infrastructure to support midwifery", "community outreach programs", and "maternal healthcare policies". Performing integrated services for primary maternity care, advocating contraception during health
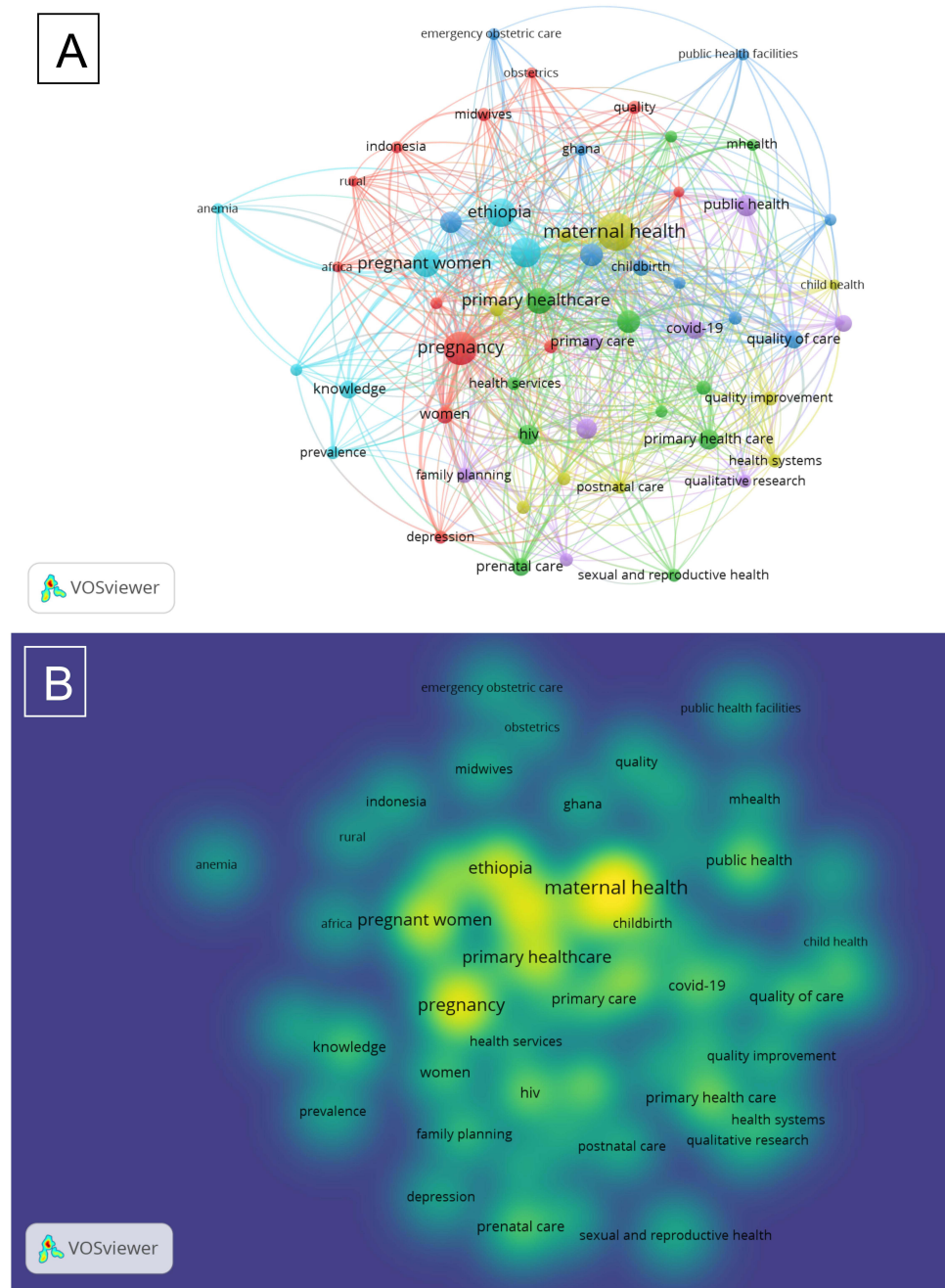
Figure 4 Co-occurrence network of keywords used in primary maternity care research (**A**) and its overlay presentation (**B**). The visualization was generated on VOSviewer with minimum occurrence n=15.

crises, and adopting a multidisciplinary approach are the least favorable strategies, as they were located in the third quadrant (-X, -Y). Predominantly, strategies identified in this study were located in the second quadrant (-X, +Y; n=10).

Discussion
Latent Topics in Primary Maternity Care Research

The study revealed several latent topics that predominated research on maternity care within primary healthcare settings. One of the foremost themes is the significant role of midwifery in providing maternal health services. Midwives play a crucial role in Indonesia's maternal health system, as they provide services for almost every stages of maternity.[20]

Table 1 Research Clusters Identified in the Network of the Co-Occurring Keywords in Primary Maternity Care Publications

Keyword	TLS	Keyword	TLS
Cluster 1	1319	**Cluster 3 (cont.)**	
Africa	22	Public health facilities	20
Antenatal	29	Quality of care	63
Depression	31	Uganda	29
Indonesia	21	Utilization	37
Maternal	31	**Cluster 4**	1319
Maternity care	26	Child health	29
Midwives	24	Health systems	43
Obstetrics	23	Healthcare delivery	24
Pregnancy	151	Kenya	23
Quality	23	Maternal health	214
Rural	27	Postnatal care	44
Women	48	Qualitative study	21
Cluster 2	1319	Quality improvement	35
Community health worker	29	Sub-Saharan Africa	44
Health services	30	**Cluster 5**	1319
HIV	56	Contraception	32
Maternal and child health care	27	COVID-19	54
mhealth	25	Family planning	39
Nigeria	84	Health policy	43
Prenatal care	47	Primary care	36
Primary health care	56	Public health	60
Primary health care	96	Qualitative research	30
Sexual and reproductive health	20	Reproductive health	42
South Africa	30	**Cluster 6**	628
Cluster 3	1319	Anemia	19
Childbirth	52	Antenatal care	174
Emergency obstetric care	24	Ethiopia	91
Ghana	37	Knowledge	33
India	76	Pregnant women	85
Maternal and newborn health	28	Prevalence	24
Maternal mortality	52	Risk factors	25

Table 2 Identified Topics Deriving from the Keywords Contained in Each Cluster

Topics (label)	Associated Keywords	Focus Description
Cluster 1		
Role of midwives and quality of antenatal care in rural areas (T1.1)	Antenatal, depression, maternal, midwives, quality, rural, women	Assessing the quality of antenatal care services in rural regions, focusing on the role of midwives, the prevalence of maternal depression, and overall maternal health outcomes.
Obstetric care and maternal outcomes (T1.2)	Maternity care, obstetrics, pregnancy, quality	Examining the provision of obstetric care, its impact on pregnancy outcomes, and the overall quality of maternity care services.

(*Continued*)

Table 2 (Continued).

Topics (label)	Associated Keywords	Focus Description
Cluster 2		
Role of community health workers in maternal and child health care (T2.1)	Community health worker, health services, maternal and child health care, prenatal care, primary health care	Evaluating the impact of community health workers on maternal and child health outcomes, with an emphasis on prenatal care and primary health care services.
Integration of mhealth in sexual and reproductive health services (T2.2)	mHealth, HIV, primary health care, sexual and reproductive health	Investigating the use of mobile health technologies in delivering sexual and reproductive health services, including managing HIV and other health conditions.
Cluster 3		
Utilization and quality of emergency obstetric care in public health facilities: Impact on maternal and newborn health outcomes (T3.1)	Childbirth, emergency obstetric care, maternal and newborn health, maternal mortality, public health facilities, quality of care, utilization	Assess the availability and effectiveness of emergency obstetric care services, investigate their contribution to reducing maternal mortality, explore factors influencing the utilization of public health facilities for childbirth, and evaluate the quality of care provided and its impact on maternal and newborn health outcomes.
Cluster 4		
Postnatal care and child health outcomes (T4.1)	Investigating the quality and delivery of postnatal care services and their impact on child health outcomes in different health systems.	Child health, postnatal care, healthcare delivery
Health system strengthening for maternal health (T4.2)	Health systems, maternal health, qualitative study, quality improvement	Examining initiatives aimed at improving health systems to enhance maternal health care delivery and conducting qualitative studies on quality improvement efforts.
Cluster 5		
Impact of covid-19 on family planning and contraception (T5.1)	Contraception, covid-19, family planning, public health	Assessing how the COVID-19 pandemic has affected access to family planning and contraception services, and evaluating public health responses.
Reproductive health policies in primary care (T5.2)	Health policy, primary care, qualitative research, reproductive health	Investigating the role of health policies in shaping reproductive health services within primary care settings and the outcomes of qualitative research in this area.
Cluster 6		
COVID	Anemia, antenatal care, knowledge, pregnant women, prevalence	Studying the prevalence of anemia among pregnant women, identifying risk factors, and evaluating knowledge and interventions related to antenatal care.
Addressing risk factors for pregnancy complications (T6.2)	Antenatal care, risk factors	Investigating various risk factors associated with pregnancy complications and strategies to mitigate these risks through antenatal care.

Another significant topic that emerged is the importance of resilience during pandemics in the healthcare system. The COVID-19 pandemic highlighted the vulnerabilities of healthcare systems worldwide, including their ability to maintain essential services during crises.[21] Developing strategies to ensure the continuity of maternal health services during pandemics is crucial. Telemedicine, as a latent topic, shows great promise in addressing this challenge.[22]

Table 3 Results from the SWOT Analysis on the Constructed Strategies

Strategies		S	W	O	T	SWOT coordinate	
						X	Y
T1.1							
Training and education for midwives	Training for midwives	3.55	−3.55	3.85	−2.8	0	1.05
Improve the infrastructure of rural healthcare facilities to support midwifery	Infrastructure to support midwifery	3.21	−2.82	3.39	−2.74	0.39	0.65
Community outreach programs to educate rural women about available antenatal care and services	Community outreach programs	3.16	−3.03	3.74	−2.95	0.13	0.79
Provide incentives to attract and retain midwives in rural areas.	Incentives for midwives	2.45	−3.21	4.11	−3.54	−0.76	0.57
Telemedicine to connect midwives in rural areas with specialists	Telemedicine with specialists	1.85	−4.29	4.36	−4.09	−2.44	0.27
T1.2							
Standardized protocols for obstetric care	Standardized protocols	4.98	−5.06	6.43	−5.09	−0.08	1.34
Continuous professional development opportunities for healthcare providers in obstetrics	Continuous skill development	4.99	−4.56	6.43	−4.18	0.43	2.25
Comprehensive education to expectant mothers for regular checkups and available obstetric care services	Healthcare promotion	3.21	−3.78	4.75	−2.98	−0.57	1.77
Establish robust monitoring and evaluation systems to track maternal outcomes	Monitoring and evaluation	3.06	−3.3	4.18	−3.95	−0.24	0.23
Allocation of resources to support obstetric care services.	Resource allocation	2.7	−6.3	6.8	−4.3	−3.6	2.5
T2.1							
Provide specialized training for community health workers (CHWs) in maternal and child health care.	Training for CHWs	6.5	−8.1	6.4	−4.3	−1.6	2.1
T2.2							
Ensure robust data security and privacy measures	Data security	2.5	−4.5	3.8	−3.3	−2	0.5
T3.1							
Strengthen referral systems to ensure timely access to emergency obstetric care.	Improving referral system	4.2	−7.8	2	1	−3.6	3
T4.1							
Develop comprehensive postnatal care programs that include follow-up visits and support for new mothers and their babies.	Comprehensive postnatal care	4.1	−4.2	4.4	−3.9	−0.1	0.5
Provide education and support to new mothers on infant care, breastfeeding, and recognizing signs of health issues.	Education to new mothers	3.3	−2.5	3.5	−2.5	0.8	1
Implement home visit programs by healthcare providers to ensure mothers and babies are receiving adequate postnatal care.	Home visit	4.5	−4.9	6.8	−5	−0.4	1.8
Integrate postnatal care services with other child health services to provide holistic care.	Integrated postnatal care	4.8	−7	6.3	−6.6	−2.2	−0.3
T4.2							
Develop and implement policies aimed at strengthening health systems for maternal health.	Maternal healthcare policies	4.9	−4	5	−4.9	0.9	0.1
Implement quality improvement initiatives to enhance the delivery of maternal health services.	Delivery quality improvement	6.5	−9	8.3	−6.2	−2.5	2.1
Engage stakeholders strengthening health systems for maternal health.	Stakeholder engagement	6	−4.5	3	1	1.5	3

(*Continued*)

61

Table 3 (Continued).

Strategies		S	W	O	T	SWOT coordinate	
						X	Y
T5.1							
Ensure continuity of family planning and contraception services during pandemics through telehealth and remote consultations.	Continuous contraception service in crises	4.84	−6.35	5.46	−4.98	−1.51	0.48
Strengthen supply chain management of contraceptives, especially during the pandemics.	Contraceptives supply in crises	6.1	−6.3	6.6	−4.4	−0.2	2.2
T5.2							
Advocate for policies that prioritize family planning and contraception services during health crises.	Contraception advocacy in crises	4.7	−5.2	3.4	−4	−0.5	−0.6
Collect and analyze data on service utilization during pandemics.	Service utility evaluation	3.8	−6.4	5	−4.9	−2.6	0.1
T6.1							
Implement routine screening programs for anemia during antenatal visits.	Routine screening for anemia	4	−4.4	5.1	−4.4	−0.4	0.7
Provide nutritional support and supplements to pregnant women at risk of anemia.	Nutritional support	4.3	−3.7	5.5	−4	0.6	1.5
T6.2							
Educate pregnant women on nutrition and risk factors for complications.	Education about pregnancy	7.2	−6.1	6.2	−6.2	1.1	0
Screening for and managing risk factors for pregnancy complications.	Screening of pregnancy complications	5.2	−5.5	6.6	−4.6	−0.3	2
Adopt a multidisciplinary approach involving obstetricians, nutritionists, and other specialists to manage risk factors effectively.	Multidisciplinary approach	3.76	−4.59	3.33	−4.08	−0.83	−0.75

Highly Prioritized Strategies to Improve Primary Maternity Care

Herein, we found nine strategies located in the priority quadrant (quadrant I). Ranked from highest to lowest, the strategies were: (1) Stakeholder engagement; (2) continuous skill development; (3) education to new mothers; (4) nutritional support; (5) infrastructure to support midwifery; (6) training for midwifery; (7) community outreach program; and (8) maternal healthcare policies.

Stakeholder engagement in strengthening maternity care was considered as the top priority. Studies on the local cultural practices and norms have been widely performed in Indonesia, which serves as the modality to form relationship with the community.[23,24] Moreover, engaging local community patrons has proven effective in promoting maternal health; for instance, religious leaders motivate maternal health practices through sermons, while community health workers ("cadre") conduct grassroots actions, such as distributing supplements and collecting data.[25] Stakeholder engagement is crucial for improving primary maternity care because their close proximity to communities can greatly enhance maternal care. T his close proximity may lead the community to view them as peers rather than "healthcare workers".[26] Most recently, Indonesia's health system transformation encompasses 25 competencies that are essential for community health workers to acquire.[27] Moreover, Minister of Health Regulation No. 21 of 2021 concerning the Implementation of Health Services for Prenatal, Pregnancy, Childbirth and Postnatal Periods, Contraception Services, and Sexual Health Services, also reflected how cooperation between parties is supported by regulations for maternal health improvement.[28]

Further, training and education programs for midwives were highlighted as a priority strategy. These programs should focus on enhancing midwives' skills and knowledge in areas such as antenatal care, maternal mental health, and emergency obstetric care. The quality of midwifery education in Indonesia has been questioned, with studies highlighting
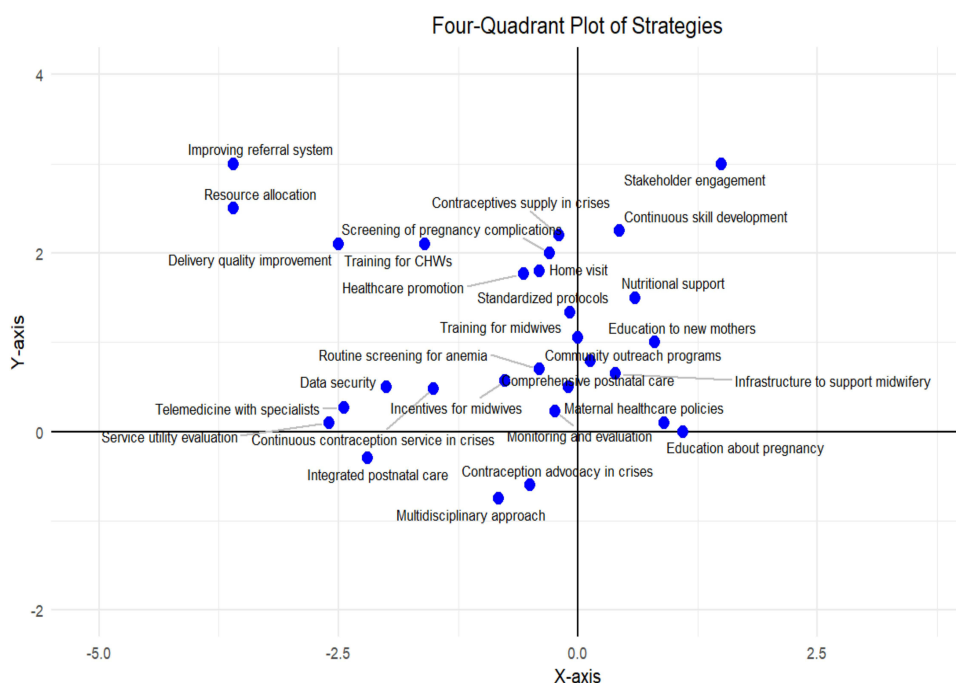
Four-Quadrant Plot of Strategies

Figure 5 Quadrant plot of the strategies formulated based on metadata of primary maternity care-related publications as analyzed by SWOT.

the need for strengthening clinical experiences during the educational program.[29] Professional development programs should not only target midwives but also be extended to other healthcare workers (HCWs) in obstetrics. Providing opportunities to learn and develop professional skills for HCWs is the priority strategy because of the supportive policies (Indonesian government plans to provide scholarship for healthcare workers), existing training infrastructure, and being high demand for skills.[30]

Elevating the skills of obstetric HCWs is crucial as it directly impacts patient outcomes, coping mechanisms, and the overall maternity care experience.[31] Routine training enhances HCWs' decision-making abilities and response time in managing complicated obstetric cases.[31] High-quality care resulting from such training can ultimately reduce maternal-neonatal morbidity and mortality. A systematic review in 2019 concluded that short-duration training significantly improves the clinical practices of healthcare workers in emergency maternity care.[32] The Central Board of Indonesian Midwives Association has organized pivotal training programs for midwives, covering several key themes: (1) Basic obstetric and neonatal life support, (2) Contraceptive care, (3) Antenatal care, and (4) Updates in midwifery practices.[33] However, the success of these programs relies on clear training objectives, financial resources, effective training methods, and high enthusiasm among HCWs.[34] Additionally, challenges such as geographical barriers and retention issues need to be addressed to effectively implement these strategies.

The vast geographic expanse of Indonesia necessitates improvements in infrastructure to support the performance of HCWs. Fundamental aspects of maternity care infrastructure include medical equipment, technology, and the design of healthcare facilities.[35] However, upgrading these infrastructures can be challenging due to budget constraints. Overcoming these financial barriers may be possible through strong government commitment to economic growth in rural areas, the establishment of private-public partnership, and high-demand from local communities. In maternity care, primary health care is expected to provide basic screening and maternity care to reduce the need for hospital referrals for advanced maternity care. To support this goal, the Indonesian government has initiated a program to enhance maternity care infrastructure in rural areas by distributing ultrasonography (USG) equipment to primary health care centers. This program includes additional training for general practitioners based on the USG curriculum.[36]

Supporting new mothers, including through providing education and nutritional support is the priority strategy because of the equally strong internal and external factors. Existing government initiatives and the feasible use of

cultural approach support the realization of the strategy. Moreover, primary healthcare in Indonesia has been supported by a well-established network of community health centers (PUSKESMAS). The development of educational materials through a variety of digital platforms and increased awareness of maternal health additionally offers the opportunity to execute the strategy. Regarding the nutritional support, the current Indonesian government has highlighted this as their top strategy to combat malnutrition among pregnant women and children. This serves as both strength (internal commitment and regulation) and opportunities (increased awareness and partnerships) to run the strategy. The aforementioned external and internal factors similarly conclude the community outreach program as the priority strategy. It is top priority to conduct a community outreach program targeting women in rural communities regarding the awareness about the available maternal and child care services, including risk factor screening. The campaign can improve maternal health outcomes by raising the awareness and encourage screening of risk factors.[37] The community outreach program is essential because Indonesia experiences a lack of facility utility due to the health insurance coverage and accessibility.[38] Moreover, distance to the healthcare facilities remains the biggest challenge for the facility utilization rates.[39]

What to Focus on?

The findings from the present study suggest that most of the strategies fall into quadrant II of the SWOT matrix, indicating that these strategies have high potential but require significant internal strengthening. This suggests that if Indonesia does not significantly improve its internal capabilities, particularly in human resources, it will miss significant opportunities to address pressing issues identified over the past decade. To capitalize on these strategies, Indonesia should focus on enhancing internal strengths by investing in training and education for healthcare providers, improving healthcare infrastructure, promoting the adoption of telemedicine, developing supportive policies, and fostering collaboration among stakeholders. Internal strengthening refers to a more aggressive allocation of fundamental improvements in human resources, economic resources, and governance structures specifically directed toward maternal care in Indonesia. This aligns with findings from a previous study, which highlighted the shortage of qualified human resources, limited standardized guidelines, and inadequate facilities and budgets.[40]

Strengths and Limitations

The strength of this study is the utilization of metadata from over 1800 studies and a robust bibliometric analysis. Further, the identification of research clusters and formulation of strategies was assisted by an artificial intelligence program under active supervision and iterative feedback from the author. This collaboration between human expertise and artificial intelligence provided a detailed and systematic organization of information, reducing potential biases by incorporating diverse analytical perspectives. However, the study has limitations, such as the use of a single database in extracting the metadata, which may have excluded relevant studies not indexed in Scopus or those that were not published. The search strategy was not as refined as those typically employed in systematic reviews, which could affect the representativeness of the data.

Conclusion

The study on maternity care in primary healthcare settings highlighted several latent topics, including the pivotal role of midwives, the impact of telemedicine, standardized protocols, continuous professional development, and comprehensive postnatal care. The study identified various strategies to enhance maternity care, such as follows: (1) training and education for midwives, (2) improving rural healthcare infrastructure, (3) community outreach programs, (4) providing incentives for midwives, (5) using telemedicine, (6) developing standardized protocols, (7) offering continuous professional development, (8) comprehensive education for expectant mothers, (9) establishing robust monitoring and evaluation systems, and (10) ensuring adequate resource allocation. Based on the SWOT analysis, prioritized strategies include continuous professional development, quality improvement initiatives, strengthening referral systems, stakeholder engagement, and specialized training for community health workers. These findings suggest the need for Indonesia to focus on strengthening internal capacities, particularly in human resources, to fully capitalize on the opportunities identified in the present study.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Khairani S, Hidayat M, Abdullah A. Analysis of determinants of disparity in maternal mortality rates between provinces in Indonesia. *Int J Med Health Res*. 2024;10(1):43–51.
2. Chotimah K, Suza DE, Efendi F, Hadisuyatmana S, Astutik E, Susanti IA. Determinants of adolescent first births in Indonesia. *Syst Rev Pharm*. 2020;11(5):1.
3. Trost SL, Beauregard JL, Smoots AN, et al. Preventing pregnancy-related mental health deaths: insights from 14 US maternal mortality review committees, 2008–17: study examines maternal mortality and mental health. *Health Affairs*. 2021;40(10):1551–1559. doi:10.1377/hlthaff.2021.00615
4. Mahmud A, Ekoriano M, Titisari AS, Wijayanti UT, Sitorus MA, Rahmadhony A. Determinants of modern contraceptives use in Indonesia: a spatial analysis. *Syst Rev Pharm*. 2021;12(3):769–777.
5. Nurcihikita T. The analysis of the implementation of the national health insurance fraud prevention program. *J Health Manag Admin Pub Health Poli*. 2024;2(1):52–63.
6. Gayatri RV, Hsu YY, Damato EG. Utilization of maternal healthcare services among adolescent mothers in Indonesia. Healthcare (Basel). *MDPI*. 2023;11(5);678 doi:10.3390/healthcare11050678.
7. Laksono AD, Wulandari RD, Rohmah N, Rukmini R, Tumaji T. Regional disparities in hospital utilisation in Indonesia: a cross-sectional analysis data from the 2018 Indonesian basic health survey. *BMJ open*. 2023;13(1):e064532. doi:10.1136/bmjopen-2022-064532
8. Windayanti H, Masruroh M. Characteristics of pregnant women related to pregnant women's knowledge about antenatal care (ANC). *JKM*. 2022;8(4):709–716. doi:10.33024/jkm.v8i4.7888
9. Herwansyah H, Czabanowska K, Kalaitzi S, Schröder-Bäck P. The utilization of maternal health services at primary healthcare setting in Southeast Asian countries: a systematic review of the literature. *Sex Reprod Healthcare*. 2022;32:100726. doi:10.1016/j.srhc.2022.100726
10. Symonds NE, Vidler M, Wiens MO, et al. Risk factors for postpartum maternal mortality and hospital readmission in low-and middle-income countries: a systematic review. *BMC Pregnancy Childbirth*. 2023;23(1):303. doi:10.1186/s12884-023-05459-y
11. Bauserman M, Thorsten VR, Nolen TL, et al. Maternal mortality in six low and lower-middle income countries from 2010 to 2018: risk factors and trends. *Reproductive Health*. 2020;17:1–10. doi:10.1186/s12978-019-0847-x
12. Kurjak A, Stanojević M, Dudenhausen J. Why maternal mortality in the world remains tragedy in low-income countries and shame for high-income ones: will sustainable development goals (SDG) help? *J Perinat Med*. 2023;51(2):170–181. doi:10.1515/jpm-2022-0061
13. Christensen J. Expert knowledge and policymaking: a multi-disciplinary research agenda. *Policy & Politics*. 2021;49(3):455–471.
14. Baas J, Schotten M, Plume A, Côté G, Karimi R. Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quant Sci Stud*. 2020;1(1):377–386. doi:10.1162/qss_a_00019
15. Koçyiğit SÇ, Çilhoroz İA, Çelik G, Günenç EÖ. Bibliometric mapping of studies on green accounting in health. *J Mehmet Akif Ersoy Univ Econ Admin Scie Facul*. 2023;10(2):1627–1645.
16. Chiari W, Damayanti R, Harapan H, et al. Trend of polymer research related to COVID-19 pandemic: bibliometric analysis. *Polymers*. 2022;14(16):3297. doi:10.3390/polym14163297
17. Passas I. Bibliometric analysis: the main steps. *Encyclopedia*. 2024;4(2):1014–1025.
18. Iqhrammullah M, Refin RY, Rasmi RI, et al. Cancer in Indonesia: a bibliometric surveillance. *Narra X*. 2023;1(2):1.
19. Ginting B, Chiari W, Duta TF, et al. COVID-19 pandemic sheds a new research spotlight on antiviral potential of essential oils–A bibliometric study. *Heliyon*. 2023;9(7). doi:10.1016/j.heliyon.2023.e17703
20. Fitriana F, Ningtyas WS, Dewi ER. Providing mental healthcare for postpartum women in Indonesia: a qualitative phenomenological study. *Br J Midwifery*. 2022;30(12):692–699. doi:10.12968/bjom.2022.30.12.692
21. Haldane V, De Foo C, Abdalla SM, et al. Health systems resilience in managing the COVID-19 pandemic: lessons from 28 countries. *Nature Med*. 2021;27(6):964–980. doi:10.1038/s41591-021-01381-y
22. Wijaya JH, Octavius GS, Hwei LRY. A literature review of telemedicine in Indonesia: past, present, and future prospective. *J Administrasi Kesehatan Indonesia*. 2022;10(2):261–272. doi:10.20473/jaki.v10i2.2022.261-272
23. Aryastami NK, Mubasyiroh R. Traditional practices influencing the use of maternal health care services in Indonesia. *PLoS One*. 2021;16(9):e0257032. doi:10.1371/journal.pone.0257032
24. Damayanti NA, Wulandari RD, Ridlo IA. Maternal health care utilization behavior, local wisdom, and associated factors among women in urban and rural areas, Indonesia. *Int J Womens Health*. 2023;15:665–677. doi:10.2147/IJWH.S379749
25. Suryawati C, Nugraha P, Fatmasari EYFEY, Kusumastuti W. Role of stakeholders in increasing maternal participation in maternal health program in the Coastal Area of Bonang Sub-District, Demak Regency. *Southeast Asian J Trop Med Public Health*. 2022;53(Suppl 2):876–894.
26. Randell M, Li M, Rachmi CN, et al. 'Of' the community but not 'of' the health system: translating community health workers' knowledge into credible advice in Aceh, Indonesia. *Dis Health Sys*. 2024;3(1):5. doi:10.1007/s44250-024-00069-7
27. Health Ministry of Indonesia. Transformasi kesehatan Indonesia[Health transformation in Indonesia]. Available from: https://www.kemkes.go.id/id/layanan/transformasi-kesehatan-indonesia. Accessed August 18, 2024.
28. Health Ministry of Indonesia. Regulation of the minister of health number 21 of 2021 concerning the provision of health services for the pre-pregnancy period, pregnancy period, childbirth, and post-childbirth period, contraceptive services, and sexual health services. Available from: https://peraturan.go.id/id/permenkes-no-21-tahun-2021. Accessed August 18, 2024.
29. Adnani QES, Gilkison A, McAra-Couper J. Strengthening midwifery education through clinical experience: findings from a qualitative study in Indonesia. *Women Birth*. 2022;35(1):87–95. doi:10.1016/j.wombi.2021.03.002
30. Health Ministry of Indonesia. Act No. 17 Year 2023 regarding Health. Available from: https://farmalkes.kemkes.go.id/unduh/uu-17-2023/. Accessed August 8, 2024.

31. Ahmed W, Saber N, Bauomey E, El Sayed N, Omar A. The effect of a two-day training and refresher program on the basic emergency obstetric and newborn care knowledge and skills of health workers in Legazpi City, Albay. *Acta Medica Philippina*. 2021;10(28):10–20. doi:10.47895/amp. vi0.3151

32. Ameh CA, Mdegela M, White S, van den Broek N. The effectiveness of training in emergency obstetric care: a systematic literature review. *Health Policy Plann*. 2019;34(4):257–270. doi:10.1093/heapol/czz028

33. Indonesian Midwives Association. Surat keputusan ketua umum pengurus pusat Ikatan Bidan Indonesia nomor: 253-1/SKEP/PPIBI/I/2023 tentang lembaga diklat profesi ikatan bidan Indonesia (LDP IBI)[Decree of the Chairperson of the Central Executive Board of the Indonesian Midwives Association Number: 253-1/SKEP/PPIBI/I/2023 regarding the Professional Training Institute of the Indonesian Midwives Association (LDP IBI)]. Available from: https://siaksi.kemkes.go.id/dokfolder/institusi/KK233-2023-09-191695111505_Upload_SK_penetapan_LDP_FINAL_pdf.pdf. Accessed August 20, 2024.

34. Ahmed W, Saber N, Bauomey E, El Sayed N, Omar A. Maternity care providers' labour language & communication skills and its effects on maternal outcome: an intervention study. *Assiut Scient Nur J*. 2022;10(28):10–20. doi:10.21608/asnj.2022.107798.1269

35. Luxon L. Infrastructure - The key to healthcare improvement. *Future Hosp J*. 2015;2(1):4–7. doi:10.7861/futurehosp.2-1-4

36. Health Ministry of Indonesia. Kurikulum pelatihan pelayanan ANC dan penggunaan USG dasar obstetri terbatas melalui *blended learning*. Available from: https://siakpel.kemkes.go.id/upload/akreditasi_kurikulum/kurikulum-1-34323535-3236-4231-b537-373738363934.pdf. Accessed August 8, 2024.

37. Silvana R, Pratiwi R, Rinaldzi A. Upaya menurunkan morbiditas dan mortalitas ibu hamil melalui penyuluhan dan skrining risiko kehamilan di kelurahan tuan kentang palembang[Intervention to Reduce Morbidity and Mortality Among Pregnant Women Through Counseling and Pregnancy Risk Screening in Tuan Kentang Subdistrict, Palembang.]. *J Pengabdi Masyarakat*. 2020;1(2):101–107.

38. Tandy DY, Megatsari H, Laksono AD, Ibad M. Ecological analysis of maternity care in Indonesia in 2018. *Indian J Med Forensic Med Toxicol*. 2021;15(2):2261–2267. doi:10.37506/ijfmt.v15i2.14708

39. Puspitasari DA, Bulan SO. *The Effect of Accessibility and Availability of Health Infrastructure on Maternal Healthcare Utilization in Indonesia to Achieve Sustainable Development Goals*. IOP Publishing; 2021:012110.

40. Handayani D, Junadi P, Achadi A. The readiness of resources the implementation of maternal health services indicators for the minimum services standards in depok West Java Indonesia. *Indian J Public Health Res Dev*. 2019;10(5):1363. doi:10.5958/0976-5506.2019.01120.3