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Role of the Midwife in The Use of Ultrasonography (USG) Equipment in Antenatal Care (ANC) Service: A Scoping Review

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A B S T R A C T

Ultrasonography (USG) is one of the technological tools in the health sector, especially midwifery. Midwives are recommended to be able to use technology in the field of midwifery to reduce maternal and child mortality, especially in Indonesia. The aim of this literature study is to determine the role of midwives in the use of ultrasonography (USG) equipment in Antenatal Care (ANC) services. The method used in this literature study is scoping review, the literature search in this study uses 3 health journal databases (PubMed, ProQuest, SciencDirect). For the selection of articles obtained based on predetermined inclusion and exclusion criteria, using a Prisma Flowchart for the flow of article selection, and doing by critical appraisal using the Mixed Methods Appraisal Tool (MMAT) instrument. The results of the review of a total search of 2,018 articles, then found 10 articles that were included in the aim and criteria of the literature study that were set. The articles obtained from various countries consist of quantitative, qualitative, and mix method studies, which obtained 3 themes and 5 sub-themes, namely benefits, curriculum development, and factors that influence the use of ultrasonography (USG) by midwives. It can be concluded that from a review of 10 articles, the need for training and additional curriculum for midwives can use ultrasonography (USG) to determine early pregnancy status and detect abnormalities in pregnant woman.

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A B S T R A K

Ultrasonografi (USG) merupakan salah satu alat teknologi dalam bidang kesehatan khususnya kebidanan. Bidan dianjurkan untuk bisa menggunakan teknologi dalam bidang kebidanan untuk mengurangi angka kematian ibu dan anak terutama di Indonesia. Tujuan dari studi literatur ini untuk mengetahui peran bidan dalam penggunaan alat ultrasonografi (USG) dalam pelayanan *Antenatal Care* (ANC). Metode yang digunakan dalam studi literatur ini yaitu *scoping review,* pencarian literatur dalam studi ini menggunakan 3 database jurnal kesehatan (*PubMed, ProQuest, SciencDirect*). Untuk sleksi artikel yang didapat berdasarkan kriteria inklusi dan eksklusi yang telah ditentukan, menggunakan *Prisma Flowchart* untuk alur penyeleksian artikel, serta dilakukannya *critical apparaisal* dengan menggunakan instrumen *Mixed methods Appraisal Tool* (MMAT). Hasil *review* dari total pencarian sebanyak 2.018 artikel, kemudian ditemukan 10 artikel yang masuk kedalam tujuan dan kriteria studi literatur yang ditetapkan. Artikel yang didapat berasal dari berbagai negara yang terdiri dari penelitian kuantitatif, kualitatif, dan *mix method study,* yang didapatkan 3 tema dan 5 subtema yaitu manfaat, pengembangan kurikulum, dan faktor yang berpengaruh dalam penggunaan ultrasonografi (USG) oleh bidan. Dapat disimpulkan bahwa dari ulasan 10 artikel, perlunya pelatihan dan penambahan kurikulum untuk bidan bisa menggunakan ultrasonografi (USG) guna untuk mengetahui secara dini status kehamilan dan deteksi kelainan pada wanita hamil.

INTRODUCTION

Ultrasonography (USG) is one of the most important tools for health workers in obstetrics (Matiang'i et al., 2020). The World Health Organization (WHO) recommended for ≤ 24 weeks pregnant women should perform an ultrasound at least once, and twice for all pregnant women. In most developed countries, obstetric ultrasound during pregnancy is considered the standard of care. Ultrasound can quickly and accurately identify gestational anatomy and pathology, such as placental position, fetal lie, number of pregnancies, ectopic pregnancies, and fetal viability. When abnormalities are identified, medical treatment can be changed significantly (Bentley et al., 2015).

Less than 5% of pregnant women don't access ultrasound during pregnancy. Therefore, gestational age is often difficult to determine, multiple pregnancies are diagnosed late, and fetal and pregnancy-related anomalies may go undetected. Increasing the number of qualified radiologists, gynecologists, and sonographers can be a solution. Innovative Human Resources for Health (HR) division of labor, maternal health workforce (MCH) training initiatives, and capacity building involving development designed to train midwives in the use of Sonography and partnerships between specialist radiologists, sonographers, and midwives (Holmlund et al., 2017). However, this ultrasound technology has obstacles for mothers to do an ultrasound because the uneven distribution in developing countries can be one of the causes of maternal death.

Midwives are health workers who serve the community, especially in primary health care facilities. Research by Vinayak (Vinayak et al., 2017) proved that midwives could learn basic ultrasound skills to determine early pregnancy status (Horwood et al., 2018). This can provide an opportunity for midwives to receive training in basic skills using obstetric ultrasound (USG) technology equipment. In developed countries, the implementation of obstetric ultrasound programs is focused on trained midwives. They reduce the potential for maternal and newborn mortality.

In Indonesia, midwives who have joined the One Heart Midwifery Care have implemented the use of Tele-CTG tools since 2019 in every pregnancy consultation process of pregnant women patients. The data obtained will be entered into a database which will later be consulted with obstetricians to obtain more accurate information or referrals for maternal and child health.

Midwives as central figures who can become agents of social change in advocating the use of health technology, especially regarding maternal and child health, are considered to following the big goal of reducing the ratio of maternal and child mortality which is still high in Indonesia (Devi et al., 2022). Based on the description above, the purpose of this scoping review study is to find out the role of midwives in the use of ultrasound equipment in Antenatal Care (ANC) services.

METHOD

This study uses a narrative review method to identify and summarize an article that has been published previously, avoid duplication of research, and look for new fields of study that have not been studied (Ulhaq, Zulviqar Syambani, 2019). The steps used in the scoping review are determining the topic and review questions, searching for literature effectively, selecting the literature that has been obtained according to the inclusion and exclusion criteria, making data charting, critical appraisal, then reporting the results of the review (Kemenkes RI, 2017).

STEP 1. Article Identification Search and Initial Screening

To identify review questions, the author uses the PEO framework (Arksey et al., 2005):

Table 1. ***Framework***

P (Population)	E (Exposure)	O (Outcome)
Midwives*OR Miwivery*	-	*Antenatal Care (ANC)**
AND Pregnancy*		OR Prenatal Care*
OR Pregnant Women*		OR *Ultrasonography (USG)**
AND		*AND*

Based on the above framework, the research question was obtained "what is the role of midwives in the use of ultrasound equipment in Antenatal Care (ANC) services?".

STEP 2. Identifying Relevant Articels

The next step is a literature search based on inclusion and exclusion criteria:

Table 2. Kriteria

Inclusion Criteria
1. Articles published in English.
2. Articles published in 2013-2022.
3. Articles from developing countres and developed countries.
4. *Original Research*.
5. Articels quantitative and qualitative.
6. Document and report.

Exclusion Criteria
1. Articles opinion.
2. Articles *Commentary*.
3. Letter and book reviews.
4. Thesis research.

This article is searched based on predefined keywords which use Boolean operators, such as AND and OR (Pham et al., 2014). The keywords are Midwives **OR** midwifery **AND** ultrasonography **AND** pregnancy **OR** pregnant woman **OR** ANC **OR** prenatal care. This study uses three databases to search for relevant articles developed based on keywords, namely PubMed, Science Direct, and ProQuest. The focus of

this research is on the use of ultrasonography (USG) equipment by midwives in Antenatal Care (ANC) services.

STEP 3. Articles Selection

Based on the specified keywords, the search results for articles were found in 2018. PubMed found 1,102 articles. Science Direct found 220 articles, and ProQuest found 696 articles. Next, the articles were selected or screened based on the suitability of the title, abstract, and content following the objectives of the narrative review with the issues rose which is the use of ultrasonography (USG) tools performed by midwives for Antenatal Care (ANC) examinations. The results obtained were 10 articles that met the inclusion criteria based on the results of the analysis conducted by the researcher. The process of searching for articles used in the literature review was using the PRISMA Flowchart (Tricco et al., 2018).

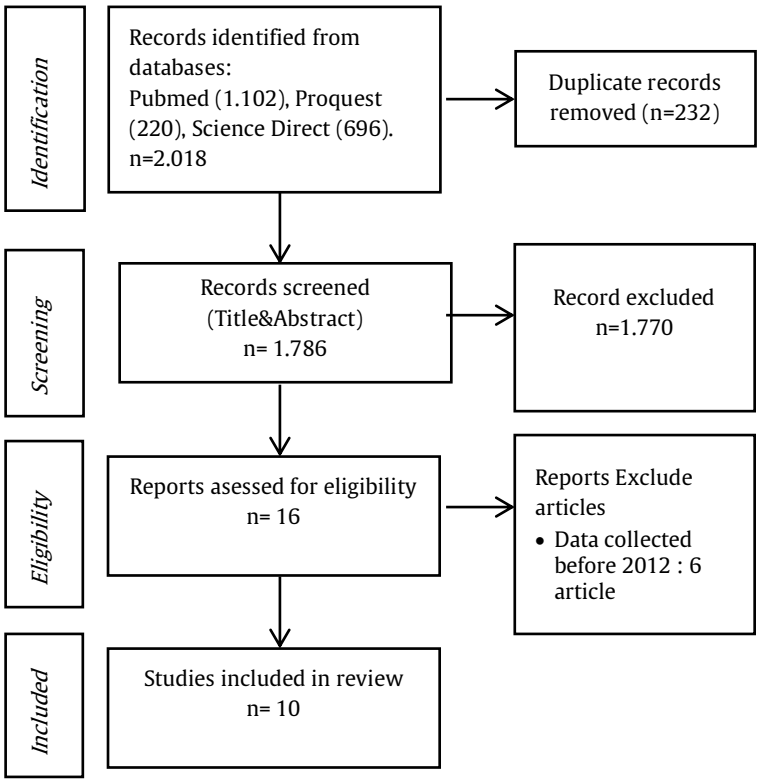


Figure 1. ***PRISMA Flow Chart***

The results of searches based on keywords and databases were obtained for 2018 articles. Then, the articles obtained were extracted using the Mendeley Desktop application. 232 articles were deleted through article duplication checking. The article title screening was carried out manually from 1,786 research articles that were screened. Then, 1,639 articles were excluded because they did not meet the inclusion and exclusion criteria. 147 abstracts of the remaining articles were re-selected manually. Then, 131 articles were excluded because they were not following the objectives of the study. The remaining 16 articles were thoroughly screened. Then, 6 articles were excluded because they exceeded the data collection year, which was 10 years. There are 10 articles left that meet the requirements for extraction and an assessment of the quality of the articles which will then be entered into the charting data.

STEP 4. Data Charting

The 10 articles were critically assessed as a whole. Then, they were extracted by entering the main criteria including author, year, research title, purpose, country, research design and research methods, and research results. Data mapping was carried out through discussions with the 2nd, 3rd, and 4th authors using a modification of the Mixed Method Appraisal Tool (MMAT). Then the authors recorded and compared the extracted data which can be seen in the table 3

Table 3. Data Charting

No	Author(s)/ Year/ Title	Country	Purpose	Research design and method	Result
A1	(Matiang' i et al., 2021) Barriers and Enablers That Influence Utilization of Ultrasound Screening Services among Antenatal Women in Kajiado and Kisii Counties Kenya	Kenya, Africa	To implement and bring technology or Managed Equipment Service (MES) to the public in Kenya	A cross-sectional quantitative study using a questionnaire with a logistic regression approach	• Increase the need to confirm pregnancy by 68.1% which is the main motivator for health care facilities in two districts in Kenya. • Initial training and direct mentoring carried out by midwives continuously with the TOT technique made a major contribution to the improvement of basic obstetric ultrasound examinations. • Economic status, education, and distance to health care facilities have a significant effect on the results with the use of USG.
A2	(Mulowooza et al., 2021) Midwife-performed checklist and ultrasound to identify obstetric conditions at labour triage in Uganda: A quasi-experimental study	Uganda, Africa	To evaluate the effect of a midwife checklist and the limitations of obstetric ultrasound on its sensitivity and positive predictive value for the outcome of abnormalities in pregnancy	Intervention study with Quasi-experimental pre-post approach. The number of samples in this study was 3,865 pregnant women. Chi-Square test was conducted to determine the sample and t-test for means.	The supporting factors are that the results of labor data are used to determine the presence of complications, while intake data and checklist data are used to diagnose pregnant women before giving birth.
A3	(Vinayak et al., 2017) Training Midwives To Perform Basic Obstetric Point-Of-Care Ultrasound In Rural Areas Using A Tablet Platform And Mobile Phone Transmission Technology–Awfumb Coe Project	Kenya, Africa	To assess the accuracy of ultrasound images and reports produced by trained midwives who perform ultrasound examinations	Quantitative study with a cross-sectional design. The samples in this study were 271 pregnant women aged 18-50 years.	By using ultrasound, the experienced midwife can be trained to confidently perform obstetric ultrasound examinations. With confidence, they reassure patients that their baby is healthy. Working as a team of radiologists can be of great benefit to midwives in remote health facilities in middle to low-income countries.
A4	(Bentley et al., 2015) Evaluation of an Obstetric Ultrasound Curriculum for Midwives in Liberia	Monrovia, Liberia	To evaluate the effectiveness of 1-week Obstetric ultrasound training for midwives at the Monrovia Teaching Hospital	Prospective Quantitative Study. The numbers of samples obtained in this study were 31 midwives.	The training carried out for midwives for 1 week increased in knowledge and comfort in the use of ultrasound equipment. This is beneficial for midwives in both the short and long term.
A5	(Argaw et al., 2022) Experiences of midwives on Vscan limited obstetric ultrasound use: a qualitative exploratory study	Ethiopia, Africa	To explore and describe the experiences and opinions of midwives regarding limited obstetric ultrasound services Vscan at a medical center in Ethiopia	This study is qualitative descriptive and exploratory. Twenty-four participants were selected through the purposive sampling technique. In-depth individual interviews with trained midwives with practical experience providing limited obstetric ultrasound services were conducted.	This study explores the experiences and opinions of trained midwives on the provision of obstetric ultrasound services in serving the community at a health center in a rural part of Ethiopia. This study reveals intervention's positive impact on perceived self-efficacy, facilitation, and removing barriers to obstetric ultrasound services. Before scaling up limited obstetric ultrasound interventions, healthcare managers should ensure and commit to providing essential supplies (e.g. paper towels, ultrasound gel, and hard disk memory), arranging private rooms, and training other mid-level healthcare professionals. In addition, it is recommended to increase the literacy of pregnant women on the examination schedule for ultrasound services.
A6	(Swanson et al., 2014)	Uganda, Africa	To evaluate the diagnostic	This prospective study	Limited obstetric US examination performed by midwives

	The diagnostic impact of limited, screening obstetric ultrasound when performed by midwives in rural Uganda		impact of limited obstetric ultrasound in identifying high-risk pregnancies when used as a screening tool by midwives in rural Uganda	observed 939 midwife examinations with ultrasound on pregnant women. The midwives have attended a 6-week training course for US-limited midwifery.	with focused obstetric US training demonstrated a diagnostic impact for identifying conditions associated with high-risk pregnancies in 6.7 to 12% of screened patients. Limited obstetric US improves the diagnosis of complications of early pregnancy as well as later multiple pregnancies and malpresentation. Midwives who have undergone focused limited obstetric AS training for 6 weeks can diagnose twins and fetal presentations with high sensitivity and specificity.
A7	(Shah et al., 2020) Efficacy of an ultrasound training program for nurse-midwives to assess high-risk conditions at labor triage in rural Uganda	Uganda, Africa	To evaluate a new curriculum on the use of ultrasound for novice midwives in Eastern Uganda in diagnosing high-risk conditions at the triage point of labor using POCUS. On identification of 6 obstetric complications (preterm delivery, oligohydramnios, placenta previa, multiple pregnancies, malpresentation, fetal distress, or stillbirth)	It is a mixed-methods study for 23 nurses and 2 doctors as respondents	A two-week intensive training course with short lectures and long-term hands-on training, followed by ongoing mentoring by local trainers increases midwifery confidence and POCUS skills to identify critical conditions in labor. Nurse-midwives in rural Uganda can accurately perform an ultrasound at labor triage to detect fetal distress, placenta previa, and high-risk conditions such as multiple.
A8	(Reiso et al., 2020) A qualitative study of the work experiences of midwives performing obstetric ultrasound in Norway	Norway, Europe	To gain insight into how midwife sonographers view their work in obstetric ultrasound	A qualitative study with individual interviews was conducted in 2018. The respondents were 13 midwives with postgraduate ultrasound qualifications who performed midwifery ultrasound in private clinics and/or in the public health sector	Holistic care for pregnant women, their partners, and the unborn baby is an important part of the midwife's job. Midwives want to work together with their peers in developing their skills to increase midwife satisfaction.
A9	(Viner et al., 2022) Training in Ultrasound to Determine Gestational Age (TUDA): Evaluation of a Novel Education Package to Teach Ultrasound-Naive Midwives Basic Obstetric Ultrasound in Malawi	Malawi, Africa	To evaluate a novel, package context-specific education to teach midwives basic obstetric ultrasound, including determination of gestational age by measurement of fetal femur length	A suitable pre- and post-course survey method explores participants' attitudes and beliefs in performing ultrasound examinations on 29 midwives	Practitioners who are not yet skilled in the use of ultrasound can be trained in basic obstetric ultrasound, confidently and competently. After 10 days of training, the training can also be done virtually. The development of the syllabus must be adjusted so that it does not become an obstacle for the midwife.
A10	(Matiang'i et al., 2020) Knowledge and Skills Gap of Midwives to Conduct Obstetric Ultrasonography Screening in Primary Health Care Facilities in Kajiado and Kisii	Kenya, Africa	To assess gaps in knowledge and skills of midwives in the use of obstetric ultrasound in primary health care	A cross-sectional study using a mixed-method was conducted in July and August 2019 with a sample of 274 midwives. The tools used in the form	• Midwives have not received basic obstetric ultrasound training by 94.5%. • Point of Care Ultrasound (POCUS) screening services are hampered due to a lack of basic skills in obstetric ultrasound examination. • The motivation and desire of midwives to learn basic

Counties, Kenya		of questionnaires, focus groups, and interviews.	ultrasound basic skills is increasing because it aims to promote Universal Health Coverage (UHC) and provide Antenatal Care (ANC) services that are applied to mothers/clients.

STEP 5. Article Quality Assessment with the Critical Appraisal Tool

A tool to carry out a careful and systematic assessment of the results of scientific research is the Critical Appraisal to assess the quality of articles (Pollock et al., 2021). Critical Appraisal in this scoping review uses the Mixed Method Appraisal Tool (MMAT) to assess quantitative, qualitative, descriptive, and mixed-method research articles. (Hong et al., 2018). The quality assessment in the articles used is CASP which is based on the assessment criteria:

2 : Questions are well answered and explained in detail
1 : Questions are answered but not explained in detail
0 : Questions are not answered and or not explained in the article

After evaluating the articles, the next step is to group the quality of articles based on the grade scale, namely:

A : Very good (Final score 14-12)
B : Good (Final score 11-8)
C : Pretty good (Final score 7-4)
D : Not good (Final score 3-0)

RESULT AND DISCUSSION

RESULT

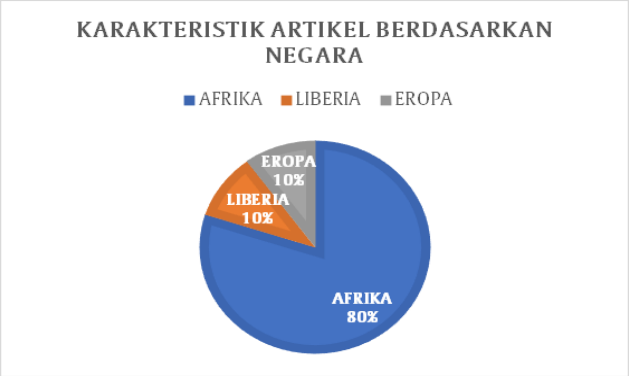
There were 10 international articles based on the database on charting data, while the characteristics of the studies obtained were:

1. Article Characteristics

a. Based on country

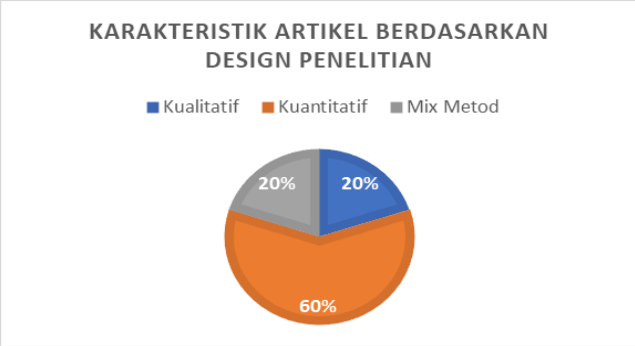
Based on the results of table 1, the most articles are in African countries, namely 8 articles. While the other 2 are in Liberia and Europe.

Table 1. Analisis Study Based on Country



b. Based on research design

Table 2. Analisis Study Based on Research Design



In the table above, the results are based on the research design, namely from 10 articles there are 2 qualitative research articles, 2 mix-method research articles, and 6 quantitative research articles of which 2 are cross-sectional articles, 2 prospective articles, 1 survey article, and 1 article. Quasi-experimental.

c. Based on Article Themes

Table 4.
Analysis and Mapping of Research Article Themes

No	Theme	Sub Theme	Research Articles
1	Benefits of using Ultrasonography (USG) for midwives	Increased skill, efficiency, and self-confidence	A3, A5, A6
		Holistic care for pregnant women	A8
2	Midwifery Curriculum Development	Development of Syllabus and Skills in Midwives About Ultrasonography (USG)	A4, A7, A9
3	Infuential Factor	Supporting factors	A1, A2, A9
		Obtacle factors	A1, A9, A10

DISCUSSION

Benefits of Using Ultrasonography (USG) for Midwives

Improved Skill, Effect, and Confidence

The use of Ultrasonography (USG) tools performed by midwives is very necessary to improve the skills, effectiveness, and confidence of the midwife to carry out further examinations or actions. The use of ultrasonography (USG) by midwives adds to the experience for the midwife. This also can have a good impact on pregnant women because it can identify high-risk pregnancies [A3 and A5]. Midwives are the health workers who have the main position in the care of pregnant women. Most of the midwife's job is to provide delivery care which provides information to pregnant women about ultrasound examinations. If ultrasound training is held for midwives, the skills, effectiveness, and confidence of midwives to explain

the results of ultrasound examinations will increase (Holmlund et al., 2017).

In the article [6] Midwives who have attended obstetric ultrasound training for 6 weeks are proven to be able to diagnose multiple pregnancies and fetal presentations with high sensitivity and specificity. This proves that midwives can perform obstetric ultrasound examinations and it can increase knowledge for midwives. The use of ultrasound by midwives is very necessary, both professionals and in society to protect women's rights to informed decision-making and autonomy in pregnancy and childbirth because the experience and views of midwives reflect a significant influence on pregnancy care and delivery.

Holistic care for pregnant women

If a midwife can perform a basic midwifery ultrasound (USG), the midwife can provide holistic midwifery care for the biopsychosocial and spiritual well-being of pregnant women and their families. This is also explained in the article [8] that midwives need to provide holistic care for pregnant women because they do not only need medical treatment resulting from an ultrasound examination, but also a holistic approach. Becoming a midwife involves a great responsibility for the health of pregnant women and fetuses. Therefore, midwives are the right health workers to carry out ultrasound examinations because the midwife's focus is on competence, skills, and communication, namely health and psychosocial care (Edvardsson et al., 2015).

Midwifery Curriculum Development

Development of syllabus and skills in midwives on USG

The development of a midwife curriculum on pregnancy ultrasound is necessary considering that the purpose of ultrasound performed by a midwife is to detect any abnormalities during pregnancy. This is according to the articles [4 and 7] that the midwife curriculum on pregnancy ultrasound skills can increase knowledge both short and long term for midwives. Ultrasound skills in this regard are related to simple ultrasound examinations to assess the fetal presentation and fetal heart rate (Bentley et al., 2015).

Article [9] explained that after the success of the USG training for midwives, an evaluation by the Directorate of Reproductive Health of the Ministry of Health of Malawi, the Malawian Midwives Association, and the Malawian Association of Obstetricians and Gynecologists discussed how to incorporate basic obstetric ultrasound into the nursing and midwifery curriculum in Malawi by integrating ultrasound training in improving the skills of midwives (Viner et al., 2022). In improving the skills of midwives regarding ultrasound pregnancy, it is necessary to develop a curriculum; curriculum outline; pedagogical framework; teaching methods; assessment process; resources; and other considerations in improving the program (Vinayak et al., 2021).

Influencing Factors in the Use of Ultrasound Equipment by Midwives

Supporting Factors

A supporting factor in the role of midwives in the implementation of pregnancy ultrasound according to the article [1] is the high motivation for pregnant women to perform ultrasound pregnancy. Midwives are allowed to perform ultrasound pregnancy after attending POCUS training. While the obstacles to utilizing the service are the distance to the facility, inadequate knowledge about the benefits of ultrasound services, and the increasing cost of this service in health facilities (Matiang'i et al., 2021).

The supporting factor was also described in the article [2] that midwives can receive limited obstetric ultrasound training, while the inhibiting factor is that because some midwives are trained, the workload increases for midwives who are not trained, so it is necessary to add more staff. (Mulowooza et al., 2021). A supporting factor was also described in the article [9] that midwives received the TUDA training program which is an effective method for training midwives in basic obstetric ultrasound within 2weeks (Viner et al., 2022).

Inhibiting Factors

The inhibiting factors indicated in the article [10] that there is still a large gap as far as the training of midwives on basic ultrasound screening and the lack of basic obstetric ultrasound examination skills are obstacles to participating in Point of Care Ultrasound (POCUS) examination services (Matiang'i et al., 2020). Ultrasound training for midwives directly with a longer training duration can detect high-risk pregnancy conditions during labor with a high level of quality and accuracy after training (Shah et al., 2020). Obstetric ultrasound is used as an integral part of antenatal care at all levels of health facilities, and the access is reported to be high. However, there are reports of insufficient ultrasound training resulting in less than optimal management of antenatal care for which it is necessary to improve ultrasound training for midwives (Holmlund et al., 2019).

CONCLUSION

Midwives are health workers who serve the community, especially in primary health care facilities. Midwives can learn basic ultrasound skills to determine early pregnancy status, assess the fetal presentation, and early detection of abnormalities in the fetus. In improving the skills of midwives regarding ultrasound pregnancy, it is necessary to develop a curriculum and training that can support these skills.

RECOMMENDATION

There needs to be a policy to manage that midwives are allowed to carry out ultrasound examinations after receiving training and being certified. For this reason, the role of the midwife profession is very necessary to support the competence of midwives in ultrasound examination of pregnancy.

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