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Challenges and Opportunities of Ultrasound in Pregnancy at Primary Care in Low-Middle Income Countries

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Abstract

The use of ultrasound in pregnancy was becoming more popular in LMICs as a routine antenatal care to detect early pregnancy complications. However, the challenges and opportunities of ultrasound in LMICs were not completely understood. This study aims to explore the challenges and opportunities of utilizing ultrasound in pregnancy at primary care in low-middle income countries. Method: The electronic databases from Springer, PubMed, and Science Direct through keywords "challenges AND opportunities AND ultrasound OR ultrasonography AND pregnancy OR pregnant AND primary care AND low middle income countries" were searched from 2014 to 2024 for studies available in English, qualitative or quantitative research, and free full text. A total of 8 articles from Australian rural/remote area, Kenya, Ethiopia, Rwanda, Vietnam, South Africa, and cross countries studies consist of Asia, Africa, and South America were included in this scoping review. Ultrasound training, availability of ultrasound equipment, and patient access to ultrasound service were the challenges of utilizing ultrasound. Stakeholder support and health systems became the opportunities to improve the utilizing and quality of ultrasound. Ultrasound examinations in LMICs still face several challenges. Opportunities that could overcome these obstacles would arise from the collaboration of multiple stakeholders.

Keywords

ultrasound; pregnancy; primary care; low middle income countries

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Introduction

Pregnancy and delivery complications were the main reasons of maternal death. The Maternal Mortality Ratio (MMR) in low-middle income countries in 2020 was 430 per 100.000 live births. Based on SDGs target in 2030, MMR would be less than 70 per 100,000 live births, so there was still a very large gap (WHO, 2024). In 2020, about 95% of all maternal deaths took place in low-middle-income countries and the majority of these deaths were avoidable. Since maternal deaths had a significant social and economic impact, maternal mortality was not just a health indicator but also a crucial indicator of a nation's progress (Bauserman et al., 2020; Kruse et al., 2019; WHO, 2024).

Disparity of MMR and trends in cause of maternal deaths between developed countries and low-middle income countries were 13 per 100.000 live births versus 430 per 100.000 live births in 2020 (WHO, 2024). Cause of maternal mortality in develop countries were cardiovascular diseases, bleeding, and infection, while in low-middle income countries were hemorrhage, infection and pre-eclpamsia/eclampsia (Bauserman et al., 2020) The improvement of maternal health services, including early detection of pregnancy complications, led to decrease in MMR and a shift in the causes of maternal death in develpoed countries (Eugene Declercq, 2020).

Based on WHO recommendation, at least one ultrasound examination prior to 24 weeks of pregnancy and eight prenatal care visits during pregnancy, according to their most recent antenatal care guidelines (WHO, 2022). Ultrasound could be used for early detection of pregnancy complications. Ultrasound examination was more accurate in detecting fetal growth that was smaller than gestational age than leoplod, so it could detect low birth weight (LBW) dan intauterine growth restriction (IUGR) (Khatri et al., 2024; Yasmeen et al., 2023). The only examination that could confirm the diagnosis of ectopic pregnancy was ultrasound, which was the leading cause of death in the first trimester (Gadayeva et al., 2020; Mullany et al., 2023). Placenta previa was one of the causes of bleeding in pregnancy. An effective screening examination for placenta previa was an ultrasound (Quant et al., 2014).

The trend of using ultrasound was increasing in low-middle income countries (Stewart et al., 2020). Ultrasound also caused shifting in pregnancy management in LMICs (Ibrahimi, Mumtaz, 2024). There has been no study focussing about the challenges and opportunities of ultrasound service in low-middle income countries. We conducted study to identify the challenges and opportunities of ultrasound in pregnancy at primary care in LMICs. We believe that challenges and opportunities in this stdy would provide a basis for improving ultrasound service that would affect MMR, especially at primary care in LMICs.

Method

To investigate the challenges and opportunities of ultrasound in pregnancy at primary care in low-middle income countries, this study applied the scoping review technique, which was highly relevant to the research objectives. Through scoping review of the literature, this study examined the evidence that available on challenges and opportunities of ultrasound service in pregnancy at primary care in low-middle income countries. The initial phase was a filtering of articles from database (PubMed, Springer, and Science Direct) with a time limit of the last ten years (2014-2024), free full text, and quantitative and qualitative research types. The article search was done through keywords "challenges OR barriers OR inhibitors AND opportunities OR enablers OR supporting AND ultrasound OR ultrasonography AND pregnancy OR gestation OR pregnant AND primary care AND low middle income countries OR low resource setting" resulted 855 articles according to the keyword and there were two articles from other resources. Based on these criteria, there were 8 articles, as shown in Figure 1.

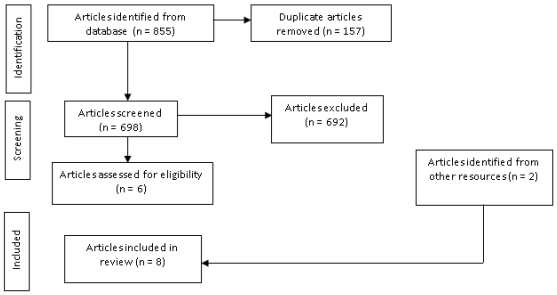

Figure 1. Prism Analysis Report

Result and Discussion

Nine articles which met the inclusion criteria were included in the scoping review using both qualitative and quantitative research methods. The extracted articles come from Australian rural/remote area (Bidner et al., 2023), Kenya (Matiang et al., 2021), Ethiopia (Roro et al., 2022), Rwanda (Id et al., 2018), Vietnam (Holmlund et al., 2019), South Africa (Hlongwane et al., 2023; Mashamba et al., 2022), and cross countries studies consist of Asia, Africa, and South America (Shah et al., 2015). Table 1 presented the research findings from the 8 articles.

Based on 8 articles in this study, there were 7 studies that showed that limited ultrasound training and equipment were the biggest challenges in the use of ultrasound (Bidner et al., 2023; Hlongwane et al., 2023; Holmlund et al., 2019; Holmlund et al., 2018; Matiang et al., 2021; Roro et al., 2022). There were 2 studies showed that patient access influenced the ultrasound service (Bidner et al., 2023; Roro et al., 2022) and 5 studies stated that support from stakeholder and health system could improve the utilizing of ultrasound (Bidner et al., 2023; Hlongwane et al., 2023; Mashamba et al., 2022; Roro et al., 2022). In this scoping review, there were four main themes that emerged from analysis of the articles as follows: ultrasound training, availability of ultrasound equipment, patient access to ultrasound service, and stakeholder and health system support.Ultrasound training

Inaccessibility of training opportunities was the main reason of inability using ultrasound. Lack of access to training was caused by the distance that must be traveled, lack of accommodation and training cost, and short training day without clinical practice (Bidner et al., 2023; Hlongwane et al., 2023; Holmlund et al., 2019; Id et al., 2018; Matiang et al., 2021; Roro et al., 2022; Shah et al., 2015). Training for health workers was important to improve their knowledge, skills, and motivation. It was also related to their level of confidence when examining patients. Some of patients doubted about mid-level healthcare providers' knowledge and skill in providing ultrasound service (Roro et al., 2022). Limited number training staff and long time scanning patients caused high work load so they did not prioritize provision of the ultrasound service (Bidner et al., 2023; Roro et al., 2022). Suboptimal pregnancy treatment might result from the ultrasound operator's lack of training (Holmlund et al., 2019).

By offering financial aid for ultrasound training programs that paid for their tuition and acommodation or provided local/rural-based training programs, clinicians might be encouraged to upgrade their skills (Bidner et al., 2023). Besides training, access to supervision and mentorship were needed but it was also challenges for clinicians (Bidner et al., 2023; Roro et al., 2022). Telehealth or teleultrasound could be the solution to enhance access for traing, supervision, continuing assistance and mentoring, and discuss patient images (Bidner et al., 2023).

Availability equipment

The inaccessibility of ultrasound equipment was the most commonly cited excuse for not using ultrasound during antenatal care visit. (Benson et al., 2021; Bidner et al., 2023; Hlongwane et al., 2023; Holmlund et al., 2019; Id et al., 2018a; Roro et al., 2022) It was not only about lack of ultrasound machine, but also the ultrasound breakge, lack access of maintanance, cost of maintanance, and limited of electricity power supply (Benson et al., 2021; Hlongwane et al., 2023; Holmlund et al., 2019; Id et al., 2018; Roro et al., 2022). The service could be interrupted because of ultrasound breakege that need maintenance, which was done outside of health facilities and takes a long time (Roro et al., 2022). In one case, an ultrasound was shared among six health facilities so patient required advanced booking appointment (Bidner et al., 2023). Ensure the

Table 1. Research Findings

Article title, author, year	Study design	Location	Challenges	Opportunities
Bidner, et al. 2023. Antenatal ultrasound needs-analysis survey of Australian rural/remote healthcare clinicians	Quantitative and qualitative	Australian rural/ remote area	Lack of ultrasound equipment Inaccessibility of training opportunities Limited patient access to ultrasound service Limited access to clinical supervision and mentorship	Telehealth or teleultrasound Offering local/rural-based training programs Providing subsidies for ultrasound training programs Improving telecommunications infrastructure and adopt telehealth systems
Roro, et al. 2022. Enablers and barriers to introduction of obstetrics ultrasound service at primary care facilities in a resource-limited setting	Qualitative	Ethiopia	Ultrasound breakge Limited of electricity power supply Limited number and high work load of health workers Short training day without enough clinical practice Mothers doubted about mid-level healthcare providers' knowledge and skill in providing the ultrasound service and the quality of ultrasound	High motivated health workers Supportive supervision Availability of ultrasound machine Availability of free of charge ultrasound service
Hlongwane, et al. 2023. Implementation of continuous-wave Doppler ultrasound to detect the high-risk foetus in the low-risk mother	Qualitative	South Africa	Training the staff and assure the equipment Integrating ultrasound screening and antenatal care consultation	Creating awareness and commiting from stakeholder about the problem and solution Improvement of the referral pathways and communication between the different levels of care
Matiang'I, et al. 2021. Barriers and enablers that influence utilization of ultrasound screening services among antenatal women in Kajiado and Kisii Counties Kenya	Quantitative	Kajiado and Kisii Counties Kenya	Lack of ultrasound training Limited ultrasound equipmement	Increasing in community education level Near health facility that provided ultrasound service Low cost of ultrasound service Improving quality ultrasound service Shortened waiting time
Shah, et al. 2015. Perceived barriers in the use of ultrasound in developing countries	Quantitative	44 LMICs (Africa, South America, and Asia)	Lack of ultrasound training Lack of sufficient equipment Lack of access to reliable machine maintenance	
Holmlund, et al. 2018. Health professionals' experiences and views on obstetric ultrasound in Rwanda	Quantitative	Rwanda	Lack of ultrasound training Limited access to maintanance Cost of machines	
Holmlund, et al. 2019. Health professionals' experiences and views on obstetric ultrasound in Vietnam	Quantitative	Vietnam	Insufficient training of the ultrasound operator Lack of equipment and maintenance High cost of ultrasound machines	
Mashamba, et al. 2022. Limited Obstetrics Ultrasound in Primary Health care	Qualitative	South Africa		Clear process for referrals based on ultrasound results Strategy to counter back referrals from the referral facility

equipment was crucial to assure the readiness of ultrasound service in health care facilites (Hlongwane et al., 2023).

Patient access to ultrasound service

Pregnant women faced significant obstacles in getting health care and ultrasound services due to geographic isolation and travel distances. According to the study, the primary obstacles that prevent women from obtaining prenatal ultrasound services were the absence of childcare options, the long travel times to go to the ultrasound service, the availability of appointments, and the

lack of transportation (Bidner et al., 2023; Matiang'i et al., 2021).

Affordable ultrasound services cost were associated with higher probability of utilizing the ultrasound service (Matiang'i et al., 2021; Roro et al., 2022). Even though the cost of ultrasound examination was free, for patients who had to travel a long distance to health facility, they still need a lot of money for transportation and accommodation (Bidner et al., 2023; Roro et al., 2022). Portable ultrasound should be considered because it would allow clinicians to travel with the equipment and provide opportunistic scanning at community/home/outreach visits so patient did not need to travel long distance to health care facilites (Becker et al., 2016; Bidner et al., 2023).

Health care systems

Increasing stakeholder awareness, commitment, and resolution of the problem were the first phase in the implementation framework (Hlongwane et al., 2023). Once these steps be completed, government support would facilitate the subsequent steps. The procedures, organizations, and structures in place to oversee and manage nation's healthcare system were referred to health systems governance. It played crucial role to make sure that the healthcare system could adapt to the need of everyone in the community. For healthcare services to be available, equitable, efficient, economical, and of high quality for everyone, effective governance of health systems was crucial. Effective and fair distribution of healthcare resources, the existence of laws and rules governing the provision of healthcare, and systems for monitoring, assessing, and analyzing the effectiveness of the healthcare system are all necessary for this (WHO, 2024).

In one study, the most common barriers of utilizing ultrasound service was misconceptions about the maternal healthcare system's operation, eligibility for the services, and/or the availability of such services (Bains et al., 2021) Raising public awareness of this is a collaborative effort that required government support. Telehealth and teleultrasound offer solution to ultrasound training for healthcare workers (Bidner et al., 2023). Government support was needed for rural area to implement telehealth systems and upgrade their telecommunications infrastructure (Bidner et al., 2023).

Waiting time was identified as one of the key influencers to utilization of ultrasound services (Matiang'i et al., 2021). Patient flow would improved and waiting and consultation times would decrease by integrating ultrasound screening with antenatal care counsultation (Hlongwane et al., 2023). Pregnant women's management would change at primary health care due to ultrasound. Healthcare providers should get ready for and set up a clear procedure for referrals based on ultrasonography findings and communication between the different levels of care could be facilitated (Hlongwane et al., 2023; Kuupiel et al., 2019).

Conclusion

Ultrasound examinations in LMICs still face several challenges, including lack of access and opportunities for ultrasound training for health workers, availability of ultrasound equipment and its maintenance, patient access to health facilities that provide ultrasound services, and health system. In facing these challenges, cooperation was needed from various parties, such as stakeholders, health facilities, and health workers. However, there were many opportunities for improvement that could be made to improve the quality of ultrasound services. By knowing the challenges and taking advantage of opportunities, ultrasound examinations in LMICs could be improved. Further studies were expected to explore how effective and the quality of ultrasound service in low-middle income countries.

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