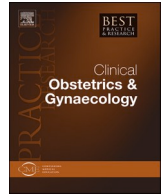




Contents lists available at ScienceDirect

Best Practice & Research Clinical Obstetrics & Gynaecology

journal homepage: www.elsevier.com/locate/bpobgyn

Improving access to emergency obstetric care in low- and middle-income countries

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ARTICLE INFO

Keywords:

Access
Barriers
Solutions
Emergency obstetric care
Low- and middle-income countries
Maternal mortality
Three delay model

ABSTRACT

While maternal deaths have declined by a third between 2000 and 2020, approximately 800 women continue to die every day due to pregnancy-related complications. For every woman who dies, many more experience life-debilitating conditions. Most of these deaths occur in low- and middle-income countries (LMICs). Women in Sub-Saharan Africa (SSA) face the highest risk of mortality, with a lifetime risk of dying from pregnancy-related complications estimated at 1 in 40. Given the unpredictable nature of pregnancy complications, emergency obstetric care (EmOC) remains the most effective strategy to reduce the global burden of maternal deaths due to pregnancy related complications. Investing in EmOC can assist countries struggling with high burden of maternal mortality in staying on track toward achieving the United Nations' 2030 Sustainable Development Goals (SDGs). However, LMICs encounter several challenges in accessing these life-saving interventions. This article utilises Thaddeus and Maine's three-delay model to analyse barriers to EmOC in LMICs and to propose potential solutions.

1. Introduction

Despite the global commitment to reduce maternal mortality as outlined in the United Nations Sustainable Development Goal (SDG) 3.1, which aims to decrease the rate to less than 70 per 100,000 live births by the year 2030, daily, approximately 800 women continue to die from pregnancy-related complications [1,2]. For every woman who dies, many more experience life-debilitating conditions. The majority of the maternal deaths occur in low- and middle-income countries (LMICs). Sub Saharan Africa (SSA) and Southern Asia are the two regions within LMICs with the highest maternal mortality rate, accounting for 70% and 16% of global maternal mortality figures, respectively [3]. In SSA the lifetime risk of a woman dying from pregnancy-related complications is estimated at 1 in 40 [2]. Almost all the maternal deaths due to pregnancy related complications can be prevented using cost effective and evidence-based interventions that are readily accessible to LMICs [2,3]. The most recent global maternal mortality figures [3,4] indicate that, without a change in the current strategies, many countries, particularly those in LMICs, are unlikely to meet SDG 3.1. This is due to the persistent disparity in access to and quality of maternal healthcare services between LMICs and high-income countries (HICs).

Considering the current global maternal mortality figures, achieving SDG 3.1 by 2030 will require an annual reduction of 11.3% in the annual global burden of maternal deaths, specifically targeting those that result from pregnancy-related complications [3].

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<https://doi.org/10.1016/j.bpobgyn.2024.102572>

Received 26 June 2024; Received in revised form 13 September 2024; Accepted 1 December 2024

Available online 6 December 2024

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However, achieving this goal will not be without challenges, as approximately 15% of pregnant women who experience pregnancy related complications have no identifiable risk factors [5]. In certain contexts, the incidence of pregnancy complications may be even higher, as evidenced by a study conducted in the United States (USA) due to personal and contextual factors [6]. This study found that 29% of the 38% of pregnant women classified as low-risk experienced complications during the course of their pregnancies. The situation may be more severe in SSA due to the high levels of poverty and healthcare-related challenges, specifically, poor quality and limited access to healthcare [7]. Poverty in general has been associated with an increased risk of pregnancy-related complications such as hypertension and preterm labour [7,8]. The pathophysiological mechanisms underlying poverty-induced encompass weakened immunity, stress, and nutritional deficiencies [8]. Currently, not tools exist that can accurately identify the specific group of women likely to develop complications during pregnancy, making prevention efforts more challenging [9]. Even if such tools were available, preventing these complications would still be challenging, as there are no universally effective preventative measures for every pregnancy-related complication. Therefore, ensuring access to high-quality Emergency Obstetric Care (EmOC) remains the most practical and viable solution. It is widely acknowledged that EmOC played a crucial role in the 43% reduction in global maternal mortality observed between 2000 and 2015 [10].

2. Emergency obstetric care

EmOC refers to the lifesaving interventions that are provided to mothers facing life-threatening complications during pregnancy, delivery, and the immediate postpartum period [6]. These interventions include a range of medical and surgical procedures employed to treat conditions such as severe bleeding, infections, hypertensive disorders of pregnancy, obstructed labour, and unsafe abortions [6, 7]. Depending on the care packages, EmOC can be divided into Basic Emergency Obstetric Care (BEmOC) and Comprehensive Emergency Obstetric Care (CEmOC) [6–9]. BEmOC is comprised of six key interventions: administration of intravenous antibiotics, administration of magnesium sulphate for the prevention and management of pre-eclampsia and eclampsia, administration of uterotonics for the management of the third stage of labour and prevention of postpartum haemorrhage (PPH), manual removal of the

Table 1
EmOC related barriers and solutions in LMICs and conflict zones.

Type of Delay	Barriers	Solutions
Delay 1: Deciding to seek care	Low status of women in society	Ensuring education access for girls and creating employment opportunities for women
	Lack of education	Women empowerment programs
	Lack of awareness of obstetric complications and risk factors	Community awareness and education campaigns
	Cultural and religious beliefs and practices	Respectful maternity care (RMC)
	Previous unpleasant experience with healthcare services	Financial support schemes
Delay 2: Delay in reaching healthcare facility	Poverty, unemployment and financial constraints	
	Long distance to healthcare facilities	Ensuring equitable distribution and accessibility of EmOC and other maternal and reproductive healthcare services and facilities
	Inadequate and high cost of transportation	Ensuring availability and accessibility of emergency transport services
	Poor road infrastructure	Improving road infrastructure and networks
	Poor referral and communication systems	Ensuring effective referral pathways and communication systems
Delay 3: Delay in receiving appropriate care upon reaching healthcare facilities in a timely manner	Hospital diverts	Ensuring availability of adequate healthcare resources
	Security concerns in conflict areas	Ensuring safe passage during conflicts
	Shortage of healthcare resources (e.g. skilled healthcare providers, infrastructure, equipment, medical and blood supplies)	Provision of adequate healthcare resources (infrastructure, human resources, equipment and supplies)
	Overcrowding in healthcare facilities	Healthcare worker training and capacity building
		Task shifting Recruitment and upskilling of local healthcare workers and volunteer organizations
		Partnership between government and NGOs, international organizations private sectors, etc.
	Poor quality of care	Establishing and promoting use of standardised guidelines and protocols
	Unreliable power supply	Ensuring constant power supplies e.g. using solar and other forms of energy
	Interruption services and security concerns during conflicts	Advocacy by public and civil organizations for the prioritization of maternal health Collaboration among stakeholders, including policymakers, humanitarian organizations, human rights organizations, and the displaced population.
		Ensuring the availability of transportation and security both within and along the route to healthcare facilities.

placenta, removal of retained products of conception and assisted delivery [6,7]. Healthcare facilities are classified as either Basic Emergency Obstetric Care (BEmOC) or Comprehensive Emergency Obstetric Care (CEmOC) facilities, depending on the specific EmOC services they offer [7]. According to the World Health Organization (WHO), two interventions—timely access to appropriate and high-quality obstetric care, which includes delivery in healthcare facilities with skilled birth attendants and high-quality EmOC—can potentially prevent approximately 88–98% of maternal deaths resulting from pregnancy related complications [11]. The statement above is supported by the findings that many LMICs with persistently high maternal mortality rates face significant challenges with regard to the availability, accessibility, quality and utilization of EmOC and deliveries in healthcare facilities managed by skilled birth attendants [6,7,12,13].

3. EmOC and maternal mortality

The role of EmOC in the global effort to reduce maternal mortality has been clearly established. There is substantial evidence supporting EmOC as the most cost-effective strategy for reducing maternal mortality in LMICs [11,14–20]. However, despite this evidence, women in this region continue to die of preventable pregnancy related complications due to barriers related to the provision, access, and utilization of EmOC life-saving interventions [2–10,12,18]. The three-delay model developed by Thaddeus and Maine, offers a valuable framework for conceptualizing these barriers and identifying potential solutions [6,12,18–22]. Addressing these barriers could prevent a repetition of the Millennium Development Goal (MDG) era, during which many countries in LMICs, specifically in SSA, failed to achieve the global target of reducing maternal mortality by 75% by the year 2015 [17,18]. LMICs must intensify their investments and efforts in strategies aimed at reducing maternal deaths, as the deadline for achieving the SDG 3.1 target is only six years away.

4. Delays in accessing EmOC

4.1. Three delay model

The three-delay model developed by Thaddeus and Maine in 1994 in the context of maternal mortality, identifies three delays that could prevent women from accessing EmOC and other maternal, and reproductive healthcare services. The delays include (1) delay in deciding to seek care, (2) delay in reaching a healthcare facility once a decision to seek care has been made and finally, (3) delay in receiving timely and appropriate care upon arrival at healthcare facility [21]. The model has proven effective in conceptualizing EmOC-related services and addressing barriers associated with EmOC, intrapartum care, and maternal mortality [23,24]. These barriers can result in multiple delays, including creating feedback loops among them. Table 1 below summarises the most common forms of delays and their potential solutions.

4.2. First delay: deciding to seek care

The initial delay in seeking care can be attributed to socio-economic and cultural factors. A systematic review conducted by Geleto et al. revealed that specific demographic groups, namely younger, unemployed, and unmarried women, as well as women residing in rural areas, are more likely to postpone seeking healthcare during an obstetric emergency [12]. This phenomenon is believed to stem from the subordinate status of women in certain cultures and societies, coupled with limited access to education, employment, and economic opportunities [12,18,20–23,25,26]. In some cultures, women are required to obtain permission from their spouses, family members, or community elders before seeking healthcare assistance [12]. Consequently, delays or denials in granting such requests could have catastrophic outcomes for the women in question. The initial delay may also be due to a woman's lack of knowledge regarding pregnancy danger signs and her failure to recognise the severity of her symptoms [12,24,27,28]. Furthermore, certain cultural and religious beliefs have been reported to lead some women to perceive complications during pregnancy as normal, often attributing them to non-medical causes [12,21,23,28].

Additional factors contributing to this delay include unintended pregnancies, a history of uncomplicated pregnancies, and negative experiences with maternity healthcare services in the past (e.g. staff misconduct, abuse) as well as an unwelcoming hospital environment [6,7,12]. Such negative experiences may lead women to opt to stay at home or seek assistance from traditional or spiritual healers within their communities, rather than pursuing medical help in the event of an obstetric emergency [6,12]. This choice may significantly jeopardise the woman's health and well-being and increase her risk of premature death.

4.3. Second delay: delay in reaching healthcare facilities

The second delay refers to the challenges that pregnant women encounter in accessing appropriate healthcare facilities after deciding to seek medical care [21]. This delay is influenced by various factors such as long distances between women's places of residence and healthcare facilities, transportation-related barriers (e.g. limited access to an inadequate transport system, insufficient financial resources to cover transport-related costs, poor road infrastructure, adverse weather conditions, hazardous travel conditions such as conflict zones), inadequate referral and communication systems, and overcrowding in referral facilities) [6,7,12,15,18,21–33]. Overcrowding in healthcare facilities may result in temporary closures, referred to as diversion (meaning a hospital declines accepting referrals due to lack of bedspace and diverting the referral to other hospitals), to alleviate the strain on both the facilities and healthcare workers [7,12,15,18,20,21,25,23,28]. During this period, the referring institution must identify an alternative healthcare

facility that is capable of accommodating and providing care for the patient, a process that can take long to achieve. Furthermore, when a suitable facility is located, it may be situated very far, further jeopardising the woman's chance of survival.

Although the World Health Organisation (WHO) considers a 2-h travel time during an obstetrics emergency transfer to be acceptable [17], a study conducted in Nigeria found that a travel time of 120 min and 10–25 min or more for referred and non-referred pregnant women, respectively, were associated with an increased likelihood of dying during an obstetric emergency [31]. This observation might suggest that referred patients can tolerate longer traveling time as they are likely to have been stabilised before transfer and transferred using professional emergency transport services compared to non-referred patients. In certain areas, the time interval from the point of requesting an emergency transport to its actual arrival can span anywhere between 45 min and 48 hrs, irrespective of the patient's clinical condition, significantly reducing a woman's chance of survival [33]. Based on the above, it is reasonable to suggest that healthcare workers should be concerned when an emergency transfer time to an EmOC facility exceed 25–30 min. Obstetric emergencies require prompt interventions, making every minute crucial [34]. The suitability of emergency transportation for the patient's condition and the road terrain should also be considered during an obstetric emergency transfer. An unsuitable transport system, such as vehicles that are ill-suited for road conditions, those lacking appropriate equipment and/or appropriately trained emergency personnel for the woman's condition, can lead to delays and insufficient support during emergency transfer.

4.4. *Third delay: delay in receiving appropriate care*

After having successfully navigated the first two delays, a woman may still experience further setbacks in receiving appropriate care upon arriving at a healthcare facility. This may occur due factors such as inadequate referral information, lack of prior arrangements before referral, limited availability of critical resources (e.g. infrastructure, ICU, personnel, equipment, medications, and blood products), non-compliance with evidence-based treatment guidelines and protocols, insufficient supervision, overcrowding in healthcare facilities (resulting in long waiting times) and, low staff morale (resulting in negative staff attitudes) [12,15–21].

Unreliable power supplies and labour unrest can also contribute to third delay by disrupting the provision of healthcare services [35–40]. The issue of unreliable power supply is an important consideration in Africa. A study conducted in this region, reported that approximately 52% of the 48 African countries studied experienced unreliable power supply [35,36]. Additionally, research conducted in Ghana identified a correlation between power outages and increased mortality rates [37]. Power supply influences various aspects of the healthcare system, in particular, functioning of operating theatres, inpatient and outpatient services, maternity units, water supply, drug storage, and both neonatal and adult intensive care services. Similarly, labour unrest or protests, which are common in many LMICs, can further exacerbate mortality risk by directly disrupting healthcare provision [38,39]. During labour protests, staff may abandon patients, leaving them without access to essential emergency services such as medical care, surgery, and monitoring [38–40].

5. Solutions

5.1. *Significance of maternal mortality*

In the previous section the barriers preventing women from accessing EmOC in LMICs and conflict zones were discussed using the three-delay model. This section utilises the same model to explore potential solutions. Adopting a human rights approach, maternal mortality is not merely an unfortunate occurrence; it represents a violation of women's right to life and reflects the failures of governments and society to uphold and protect these rights. Furthermore, the death of a mother has long-lasting impact on the well-being of her orphaned children, affected families, and society as a whole [41,42]. The prevention of maternal mortality require recognition of the above mentioned factors and collaboration among individuals, communities, civil society, healthcare providers, healthcare leaders, governments, politicians, and other stakeholders.

5.2. *Frist delay*

Mitigating the initial delay necessitates addressing the socioeconomic, cultural, religious, and political factors that contribute to it. This can be achieved by prioritising women's rights and health within societal and governmental expenditure, supported by public education initiatives aimed at enhancing awareness among women and the wider community regarding pregnancy complications and encouraging timely healthcare-seeking behaviour [6,12]. Furthermore, these initiatives should be complemented by policies and legislations that uphold women's rights, provide access to education and economic opportunities, including investing in high-quality maternal health services such as EmOC [22,25,24,41]. The above measures will improve women's access to education, secure employment opportunities, and ensure the availability of high-quality maternal and reproductive healthcare services, addressing the initial delay.

Furthermore, the affirmation and safeguarding of women's rights must recognise that every woman has the right to make decisions regarding her body and reproductive health without the necessity to provide justification for such decisions. These rights encompass the right to utilise contraception to prevent unwanted and unplanned pregnancies, as well as access to termination of pregnancy (TOP) services. It is estimated that approximately 218 million women in LMICs currently lack access to modern contraceptive methods (39). There is also evidence of low utilization of contraceptive in LMICs due to multiple factors, amongst them, limited knowledge of contraceptive benefits and mechanisms, contraception related stigma, safety concerns, restricted contraceptive options, limited

availability of sexual and reproductive health (SRH) services, high costs, restrictive policies, cultural and religious beliefs, healthcare providers' attitudes, and a lack of confidentiality and privacy in SRH service centres (39,40). If these issues are not effectively addressed, it is projected that there will be an estimated 97 million unintended pregnancies by the year 2030 (39,41). This concerning statistic poses a significant risk due to the potential increase in pregnancy-related complications and maternal mortality rates.

Improving access to contraceptives and other SRH services requires formulation of a comprehensive national policy on SRH. This policy should ensure universal access to contraceptive services for all individuals, regardless of age, geographical location, social and educational status, or religious beliefs (43, 44). Furthermore, regulations should be introduced to facilitate the controlled and authorised sale of emergency contraceptive products in supermarkets and other retail outlets, including vending machines (45). This intervention should be accompanied by rigorous monitoring mechanisms to prevent the proliferation of counterfeit products and to protect the health of the individuals the policy aims to serve. Ensuring the ready availability of emergency contraception could assist in the reduction of unplanned and unwanted pregnancies and consequently, reduction of preventable maternal deaths (29). Efforts should also be made to establish dedicated adolescent-friendly SRH services, which encompass contraception and other reproductive health services, such as termination of pregnancy (TOP), to reduce the risk of unplanned and unwanted pregnancies, including the associated risk of mortality in this vulnerable group (44, 46).

Public awareness campaigns are among the effective strategies that are used to educate women and society about the safety and significance of contraception in the fight against maternal mortality [12]. This should be accompanied by educating healthcare professionals on the importance of establishing a healthcare environment that promotes respect, cultural sensitivity, women's autonomy, confidentiality, while also acknowledging and respecting their cultural and religious values. Moreover, healthcare workers should always prioritize the protection of patient privacy and confidentiality [6,12]. The above strategies will improve women's perceptions, experiences, and utilization of healthcare services [6].

Policymakers and government leaders can play a crucial role in reducing the first delay by ensuring access to education and employment for women. These interventions will improve women's, socioeconomic status, empowering them financially, and enabling them to make informed decisions about their health and seek healthcare services when necessary [6,12]. The above must be complemented by community education aimed at promoting women's rights, including highlighting their important contributions to society. Furthermore, emphasis should be placed on the importance of family planning, regular attendance of antenatal care, recognition of pregnancy danger signs, and the timely seeking of healthcare services during obstetric emergencies, as these are key to reducing adverse outcomes. These measures have been proven to significantly contribute to preventing maternal deaths [6,12,42–45]. Research indicates that women who receive antenatal care are less likely to delay seeking healthcare in the event of an obstetric emergency [46]. Disseminating health-related information to the public can be effectively achieved using communication channels such as social media, mobile health (m-health), community radio stations, and other community platforms and structures [6,12]. Removing financial barriers associated with healthcare can be used to incentivise women to seek antenatal care and utilise maternal and other SRH services [46]. Several studies have consistently demonstrated that such interventions positively impact women's utilization of healthcare services and are strongly associated with decreased rates of maternal and neonatal mortality [6,16,46–49].

5.3. Second delay

Addressing the second delay, similar to the first, necessitates collaboration among the various stakeholders involved in maternal health. The primary objective should be to eliminate the barriers associated with the second delay that hinder pregnant women from accessing EmOC healthcare facilities. This can be accomplished through interventions such as ensuring adequate numbers and equitable distribution of EmOC healthcare facilities and improving access to them within reasonable distances and travel times [12, 46]. Furthermore, these facilities must be adequately equipped with the necessary infrastructure, personnel, medical equipment, and supplies. In addition, the above interventions should be supported by clear referral policies, efficient communication systems, and timely access to effective and appropriately equipped emergency transport services, tailored to the terrain and the woman's clinical condition [6,12,46].

To ensure optimal operational efficiency of emergency transport services, it is essential to allocate a dedicated budget for maintenance and operations. Investing in specialized emergency obstetric and neonatal transport services is widely recognized as a highly effective and economically viable strategy for reducing maternal and neonatal mortality rates in LMICs [6,12,46,50]. Furthermore, partnerships with the commercial transport industry, including the taxi sector, utilization of motorbike ambulances, establishment of community-based transport financing schemes, and implementation of transport vouchers have proven effective in improving access to emergency transport and addressing the second delay [46,50]. A systematic review focusing on access to emergency transport interventions in LMICs revealed that motorbike ambulances may be more efficient means of transport during obstetric emergencies compared to motor vehicle ambulances [50]. According to this review, motorbikes were able to reduce referral delays by 2–4.5 h when compared to car ambulances. Additionally, the review highlighted the capability of four-wheel-drive (4x4) vehicle ambulances to effectively navigate hazardous road conditions in remote settings. The above underscores the necessity of evaluating the various emergency transport options available and selecting the most suitable one for the specific context and conditions. In certain situations, the most appropriate mode of transport may be an animal-drawn cart or a hammock due to the lack of road infrastructure [46,50].

Effective communication is essential for improving access to EmOC services and facilitating referrals between institutions. This can be achieved through the establishment of national toll-free numbers, provision of dedicated phone lines for voice calls and short service messages (SMS) to the public, and providing healthcare workers with cell phones and radio communication devices to streamline referrals [50–53]. Technologies such as WhatsApp and the Vula app have been used to facilitate referrals between institutions, including enabling referring doctors to seek advice from specialists [53,54]. Additionally, GPS-enabled smartphones and

other devices, along with Google Maps, can assist women and emergency transport personnel in locating and reaching healthcare facilities, thereby enabling access to timely treatment [55,56]. Telemedicine can be used to support healthcare providers in remote settings by facilitating specialist consultations and enabling effective remote consultations with patients [57].

Addressing the second delay effectively, requires removal of third delay-related barriers, particularly ensuring availability and accessibility of sufficient number of EmOC healthcare facilities. According to the World Health Organization (WHO), there should be a minimum of four BEmOC and one CEmOC facilities per 500,000 population [14]. These facilities should be readily available and easily accessible within a maximum travel time of 2 h [17,46] and ideally within 30 min [31]. Healthcare planners ought to consider this when planning for maternity healthcare services and use strategies such as facility upgrades, construction of new facilities, and establishment of public-private partnerships to address EmOC facility shortages [6,12,46].

5.4. Third delay

The third delay can be addressed by improving the healthcare system, most importantly, ensuring availability of adequate numbers and appropriately staffed EmOC healthcare facilities and strengthening supply chain management to ensure constant supply of drugs, equipment, and blood products [6,14,11,16]. Additionally, other factors such as power interruptions, overcrowding, long waiting times, and labour disputes, which impede functioning and efficiency of healthcare services should be addressed. The implementation of evidence-based protocols and guidelines, regular EmOC drills, continuous professional development for staff, and adequate supervision can improve the quality of care and minimize adverse patient health outcomes [18,20]. Interventions such as developing a national healthcare workforce strategy, task shifting, and fostering collaboration among governments, non-governmental organizations (NGOs), the private sector, and other stakeholders can including use of technology (discussed in detailed later) help alleviate staff shortages in settings with severe staff shortages [42,45,58–63].

Furthermore, establishing supportive working environments by improving working conditions and providing appropriate financial incentives for staff can significantly contribute to employee retention, strengthen employer-employee relationships, and mitigate labour disputes. These strategies have the potential to minimize service disruptions, improving women's access to EmOC and other obstetric services. Additionally, healthcare managers should minimise rotating specialized nurses in maternity and critical care areas to preserve essential skills. Improving access to social amenities and educational opportunities for staff and their families in remote and rural areas has been shown to improve staff recruitment and retention in these settings [59–62]. While task shifting has been implemented with varying degrees of success to address staff shortages in LMICs, such interventions could be beneficial in settings facing acute staff shortages and therefore, should be considered. Traditional birth attendants (TBAs), community healthcare workers (CHCWs), enrolled nurse assistants (ENAs), enrolled nurses (ENs), as well as physician assistants (PAs) or clinical associates (CAs) have been successfully employed in various contexts to address skill shortages [46,59–63].

Decentralizing CEmOC services to lower levels of care, particularly community healthcare centres (CHCs), can improve access to life-saving CEmOC interventions such as caesarean section. Achieving the above will require upgrading CHCs through the establishment of operating theatres and laboratory facilities in CHCs and, training of physician assistants (clinical associates), and midwives to perform caesarean sections. Additionally, where there is shortage of scrub nurses, theatre technicians can be trained to fulfil this, depending on the context and the country's regulatory/legal framework. The successful implementation of task shifting in Kigoma, Tanzania, resulted in a substantial decrease in maternal and neonatal mortality rates over time [63].

Technology has the potential to enhance access to EmOC services in LMICs. Telemedicine and drones can help mitigate delays in clinical diagnosis and patient management by providing specialist clinical support to healthcare workers in remote areas, facilitating the transportation of blood specimens, and delivering laboratory and radiological results, and blood products hence ensuring timely diagnosis and treatment [64–66]. Electronic Health Records (EHRs) grant healthcare providers easy access to patients' medical histories and essential information [66]. Incorporating Decision Support Software (DSS) within EHRs could improve patient diagnosis and management, particularly in regions with limited clinical expertise. DSS utilises artificial intelligence (AI) to suggest diagnoses and treatment options based on patient's clinical information [67]. Furthermore, technology can play an important role in the professional development of staff and clinical training. Self-directed e-learning modules, simulations, and virtual training workshops conducted via online platforms such as Microsoft Teams and Zoom can be employed to educate healthcare workers on EmOC-related topics [68–70]. Additionally, technology can be leveraged to support supply chain management and mitigate stockouts by facilitating efficient ordering and monitoring of drugs and consumables [71].

5.5. Humanitarian emergencies and conflict settings

The past decade has seen a significant rise in the population residing within areas of conflict and those experiencing humanitarian crisis. Women and children are disproportionately affected, specifically in terms of access to healthcare services and education [72]. Consequently, most of the countries that are experiencing high maternal mortality rates, have either experienced or are currently embroiled in armed conflicts. Although the surge in maternal mortality may be directly linked to these conflicts, lack of access to EmOC and other SRH services is a major contributing factor [72–77]. Without improvements in access and quality of EmOC, countries caught in conflict remains at risk of failing to achieve SDG 3.1 by the year 2030.

While barriers to EmOC access are similar in both conflict and non-conflict settings [78], the situation is significantly worse in conflict zones. During periods of conflict, many individuals are displaced to regions that lack adequate resources such as housing, water and sanitation, healthcare infrastructure, personnel, equipment, medication, and transportation. The absence of these essential amenities creates an environment that facilitates the spread of communicable diseases, some of which can result in pregnancy complications such

as preterm labor. Furthermore insecurity in conflict settings makes travel to healthcare facilities and the provision of healthcare services hazardous. These challenges impact on the availability and accessibility of EmOC, contributing to the high rates of maternal and neonatal mortality observed in these areas. Consequently, investing in EmOC services is imperative.

Improving access to EmOC in conflict-affected settings can be achieved through stakeholder collaboration that includes, policy-makers, human rights organizations, non-governmental organizations (NGOs), and the displaced population. This collaboration should prioritize funding for maternal healthcare programs, recruitment of staff from local and volunteer organizations, staff training, and supervision. The above should begin with needs assessment and evaluation of existing EmOC capacity, specifically, infrastructure, staffing, equipment, existing EmOC signal functions, communication systems, transport, and security. The information gathered should be utilized to develop targeted healthcare interventions.

While all the interventions discussed in the preceding sections are valid for improving access to EmOC in conflict zones, task shifting warrants special attention due to the frequent shortage of skilled personnel in these settings. This skills shortage can be mitigated by training traditional birth attendants (TBAs), community healthcare workers (CHWs), and mid-level healthcare workers (such as Physician Assistants or Clinical Associates) to deliver BEmOC and CEmOC services. Additionally, efforts should be made to address the challenges related to unsafe abortion, which is the leading cause of maternal deaths and disabilities in conflict settings 79. This can be addressed through the promotion and provision of family planning services, as well as the provision of safe TOP services 79–81.

6. Conclusion

LMICs and settings impacted by conflicts, bear a disproportionate burden of global maternal mortality rates. These fatalities are due to preventable pregnancy-related complications, for which effective, affordable, and evidence-based solutions are readily available. Consequently, investing in EmOC represents one of the most cost-effective strategies for reducing maternal mortality in LMICs. This approach has the potential to significantly assist affected countries in achieving Sustainable Development Goal 3.1.

Practice points

- The high number of maternal deaths in LMICs is predominantly due to preventable pregnancy-related conditions.
- Investing in EmOC remains the most cost-effective strategy to reduce maternal deaths in LMICs.
- The three-delay model offers a valuable framework for identifying and addressing EmOC related barriers
- Women residing in conflict zones are exposed to the highest risk of mortality and therefore require special attention.

Research agenda

- What is the impact of health policies on improving access to EmOC in LMICs?
- What is the impact of upgrading community healthcare centres (CHCs) to provide comprehensive EmOC services in terms of reducing maternal deaths in LMICs.
- How can technology such as telehealth assists in reducing the third delay in accessing EmOC?
- What is the effectiveness of EmOC staff development training programs in decreasing maternal mortality in LMICs?

Funding

This work received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The author has no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bpobgyn.2024.102572>.

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