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# Evaluating safe delivery app-integrated catchment-based clinical mentorship in Ethiopia's Afar and Somali Regions

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**Abstract**
This study employs a mixed-methods approach to evaluate integrating the Safe Delivery App into catchment-based clinical mentorship in Ethiopia's Afar and Somali regions. In the Afar region, knowledge increased from baseline to end line (58.6±26.2% to 87±15.5%), along with skills in hypertension (66.2±24% to 92.3±10.8%), postpartum hemorrhage (58.1±15.9% to 85.7±9.7%), and new-born care (64.1±15.2% to 89.3±6.6%). Similarly, in the Somali region, knowledge improved (51.5±18.7% to 75.8±21%), as did skills in hypertension (42.9±30.4% to 94.5±8.6%), postpartum hemorrhage (36.4±25.2% to 87.5±10.4%), and new-born care (57.5±24% to 89.4±9.1%). Qualitative insights from participants highlighted increased knowledge, confidence, and improved service delivery, along with positive perceptions of mentorship. However, challenges such as resource shortages and infrastructure gaps were also noted.

**Keywords:** Catchment based clinical mentorship, safe delivery app, maternal and newborn health, skills improvement, knowledge, digital health tool

## 1. Introduction
Ethiopia has made significant progress in maternal and newborn health. Between 2000 and 2020, the maternal mortality ratio decreased from 953 to 267 per 100,000 live births, while neonatal mortality fell from 48 to 27 per 1,000 live births [1]. Despite this progress, Ethiopia still faces challenges in meeting national and international maternal and newborn health targets [2]. A key concern is the quality of care, with significant gaps in providers' knowledge and skills [2, 3].

Addressing these gaps is critical in remote regions like Afar and Somali, where skilled birth attendance remains low at 26.0% and 30.6%, respectively, and facility births at 23.3% and 28.3% [4]. Beyond these regional-level statistics, Afar and Somali face unique maternal and newborn health challenges due to nomadic lifestyles, sparse populations, and limited infrastructure [5]. Cultural practices such as early marriage and female genital mutilation, along with recurrent droughts and conflicts, further disrupt healthcare access [6]. Given these contextual factors, interventions tailored to the specific needs and challenges of these regions are crucial.

Recognizing the importance of strengthening healthcare workers' capacity, the Ethiopian Federal Ministry of Health introduced catchment-based mentorship in 2018 to improve the quality of maternal and newborn healthcare [7]. This approach involves healthcare workers in the district and referral hospitals mentoring those in health centres within their catchment area, focusing on improving knowledge and skills in reproductive, maternal, newborn, child, and adolescent health [7].

Limited studies have examined the integration of digital tools within catchment-based clinical mentorship to strengthen healthcare workers' knowledge and skills. Understanding this approach is essential to assessing the potential of digital tools to complement clinical mentorship and build healthcare workers' capacity in maternal and newborn health.

In collaboration with UNICEF and Afar and Somali regional health bureau, Maternity Foundation implemented catchment-based clinical mentorship in the Afar and Somali regions, integrating the Safe Delivery App to support training, onsite mentoring and continuous learning between mentoring.

Maternity Foundation's Safe Delivery App (SDA) is an evidence-based mobile application that provides instant access to up-to-date clinical guidelines for assisting births and managing common complications [8]. The app is free to use and works offline, ensuring healthcare workers can access essential information anytime. It features culturally adapted animated instructional videos, practical procedure guides, action cards, and drug lists, serving as both a training tool and an on-the-job reference [8]. The SDA strengthens healthcare workers' knowledge and skills, improving the quality of care. In Ethiopia, more than 15,000 healthcare workers have used the SDA, which is available in Amharic, Oromiffa, Somali, and English versions [9].

This study evaluates the integration the Safe Delivery App (SDA) into catchment-based clinical mentorship in Ethiopia's afar and Somali regions to strengthen maternal and newborn care. Specifically, the study examines the impact of the SDA-integrated mentorship initiative on healthcare providers' knowledge and skills in maternal and newborn health. Additionally, it explores participants' experiences and perceptions of the program.

## 2. Materials and Methods

### 2.1 Study Design

This study uses a mixed-methods design, comprising of qualitative and quantitative methods. The quantitative approach assesses changes in healthcare workers' knowledge and skills through baseline and endline knowledge and skills assessments. The qualitative component explores stakeholders' experiences and perceptions of the mentorship program. This combined methodology provides a comprehensive understanding of the program's impact and areas for improvement.

### 2.2 Study Sites

This study was conducted in 45 health centres across the Jarar (7 woredas), Qorahey (6 woredas), Dollo (5 woredas), Fafan (5 woredas), and Shebelle (5 woredas) zones of the Somali region, covering a total of 28 woredas. Additionally, it included 19 health centres across Zone 1 (5 woredas), Zone 3 (7 woredas), and Zone 5 (3 woredas) in the Afar region, totalling 15 woredas. These facilities served as project sites for the Maternity Foundation's Safe Delivery App-integrated catchment-based clinical mentorship program.

### 2.3 Catchment-based clinical mentorship

The Safe Delivery App integrated catchment-based clinical mentorship[1] project was implemented by the Maternity Foundation from October 2021 to June 2024 in collaboration with UNICEF, regional health bureaus, finance and economic development bureaus, and local health offices. This initiative aimed to enhance healthcare workers' capacity to manage obstetric and neonatal emergencies through targeted catchment-based clinical mentorship and training.

Mentors were selected based on experience, education, communication skills, commitment and a baseline assessment requiring at least 60% knowledge and 70% skills. Selected mentors underwent multi-day training based on national mentorship guidelines, covering Helping Mothers Survive (Bleeding after birth complete and pre-Eclampsia & Eclampsia), Essential newborn care, helping babies breathe/newborn resuscitation, female genital mutilation, protection against sexual exploitation and abuse, and social analysis and action. Baseline-endline assessments measured improvements in knowledge and skills.

Catchment-based clinical mentorship was implemented over six months, with mentors traveling onsite for multiple visits. Supported by Maternity Foundation supervisors, they conducted on average four rounds of mentorship, with each round lasting five days per facility. The added layer of supervisory support helped mentors refine their skills and deliver high-quality mentorship. Mentorship covered postpartum hemorrhage, hypertensive disorders, essential newborn care, and cross-cutting topics such as female genital mutilation prevention, infection prevention control, partograph use, and data recording. Mentees also received guidance on protection against sexual exploitation and abuse and de-infibulation procedures.

The Safe Delivery App was integrated into the mentorship program to provide mentees with evidence-based protocols and support self-directed learning. Simulation drills using high-fidelity models, such as MamaNatalie and NeoNatalie, allowed mentees to practice managing obstetric and neonatal emergencies during mentors' visits. Scenario-based exercises, developed by the Maternity Foundation, helped reinforce skills and provided continuous learning opportunities, especially when real cases were limited due to low case flow. A WhatsApp group facilitated ongoing knowledge sharing and peer support among participants, fostering a collaborative learning environment.

Baseline and endline assessments were conducted to evaluate mentees' knowledge and skills. The baseline assessment used a standardized checklist for essential maternal and newborn care, combined with simulation-based case drills to measure both knowledge and practical skills [10]. Experienced midwives, trained in maternal and newborn care and proficient in using the Safe Delivery App, conducted the assessments. Through this structured approach, a total of 211 health professionals received mentorship in key maternal and newborn health areas.

### 2.4 Data Collection

Quantitative data on mentees' baseline and endline knowledge and skills were gathered using offline data collection forms on KoboCollect developed on Kobo Toolbox. These tools were designed to evaluate mentees' knowledge and skills in Basic Emergency Obstetric and Newborn Care (BEmONC) signal functions, specifically the management of hypertension during pregnancy, postpartum hemorrhage, and essential newborn care at the project health centres. Additionally, qualitative data were collected through in-depth interviews with mentees and key informant interviews with facility heads. Participants were purposively

[1] CBCM is a personal learning relationship outside of hierarchies and operations. A mentor (an experienced person) allows a mentee (a less experienced person) to gain and develop knowledge, abilities, and maturity in a specific position or a professional area that they share.

selected based on their involvement in the mentorship program. Mentees were chosen for their full attendance and active participation throughout the mentorship sessions. Facility heads were selected through a combination of purposive and convenience sampling, prioritizing those who were familiar with the project and who remained consistently present during the mentorship period.

### 2.5 Data analysis

Descriptive statistics summarized baseline and endline knowledge and skill scores of the health care provider in the Somali and Afar regions. Mean differences in knowledge and skills before and after mentorship were assessed, with knowledge scores combining hypertension management, postpartum hemorrhage, and essential newborn care, while skill scores were analysed separately. Due to the non-normal data distribution, the Wilcoxon signed-rank test evaluated improvements within-region, and the Wilcoxon rank-sum test compared changes between regions. Statistical significance was set at $p<0.05$, and analyses were conducted using R (version 2024.12.0).

Qualitative data from mentees and facility heads were analysed thematically using ATLAS.ti (Version 25.0.1). Transcripts were reviewed and translated verbatim, coded, and categorized into key themes.

### 2.6 Ethical Consideration

This project was initially designed for capacity-building and evaluation activity, and ethical approval was not sought at the outset as it was not intended for academic research. Following the project, findings were found to be of broader relevance, prompting this publication. Throughout the project, standard ethical procedures were followed to ensure ethical conduct. Informed consent was verbally obtained from all participants, data were anonymised, and potential risks to participants were minimised. Furthermore, a Monitoring and Evaluation protocol detailing data collection procedures, including the full informed consent process and data management practices, was developed prior to initiating the project.

## 3. Results

### 3.1 Quantitative Assessment

#### 3.1.1 Description of Dataset

A total of 187 mentees from 63 facilities completed both baseline and endline assessments. This included 58 mentees from 19 facilities in Afar and 129 from 44 facilities in Somali. One facility was excluded due to the mentee's absence at endline.

#### 3.1.2 Knowledge and skill scores within the region

Table 1 presents the baseline and endline knowledge and skill scores on postpartum hemorrhage (PPH), hypertension (HTN), and essential newborn care (ENC) for 58 mentees in the Afar region, highlighting improvements following the mentorship program.

In the Afar region, mentees' knowledge increased from an average score of 58.6±26.2% at baseline to 87±15.5% at endline. The Wilcoxon signed-rank test confirmed that the change from baseline to endline was statistically significant ($p<0.001$).

Hypertension skills increased from an average score of 66.2±24% at baseline to 92.3±10.8% at endline. Postpartum hemorrhage management skills improved from 58.1±15.9% at baseline to 85.7±9.7% at endline. Essential newborn care skills increased from 64.1±15.2% at baseline to 89.3±6.6% at endline. The Wilcoxon signed-rank test confirmed that the change from baseline to endline was statistically significant across all three skill areas ($p<0.001$).

**Table 1:** Baseline and endline knowledge and skill scores on PPH, HTN, and ENC for 58 mentees in the Afar region

| Variable | Knowledge Assessment | | | Skills on PPH | | | Skills on HTN | | | Skills on ENC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre (%) | Post (%) | Wilcoxon test | Pre (%) | Post (%) | Wilcoxon test | Pre (%) | Post (%) | Wilcoxon test | Pre (%) | Post (%) | Wilcoxon test |
| Mean | 58.6 | 87 | V=64.5, p-value=3.239e-08 | 58.1 | 85.7 | V=26, p-value=2.062e-10 | 66.2 | 92.3 | V=46.5, p-value=6.495e-09 | 64.1 | 89.3 | V=12, p-value=9.903e-11 |
| SD | 26.2 | 15.5 | | 15.9 | 9.7 | | 24 | 10.8 | | 15.2 | 6.6 | |

Table 2 presents the baseline and endline knowledge and skill scores on postpartum hemorrhage (PPH), hypertension (HTN), and essential newborn care (ENC) for 129 mentees in the Somali region, showing improvements following the mentorship program.

In the Somali region, mentees' knowledge increased from an average score of 51.5±18.7% at baseline to 75.8±21% at endline. While the baseline score in Somali was lower compared to Afar, both regions showed similar endline scores, with afar demonstrating slightly greater overall improvement. The Wilcoxon signed-rank test confirmed that the change in knowledge scores from baseline to endline in Somali was statistically significant ($p<0.001$).

Hypertension skills in Somali improved from 42.9±30.4% at baseline to 94.5±8.6% at endline. Although Somali started with a lower baseline, both regions achieved identical endline scores. Similarly, postpartum hemorrhage management skills increased from 36.4±25.2% at baseline to 87.5±10.4% at endline, while essential newborn care skills rose from 57.5±24% at baseline to 89.4±9.1% at endline. The Wilcoxon signed-rank test showed that the change from baseline to endline in Somali was statistically significant for all three skill areas ($p<0.001$).

**Table 2:** Baseline and endline knowledge and skill scores on PPH, HTN, and ENC for 129 mentees in the Somali region

| Variable | Knowledge Assessment | | | Skills on PHP | | | Skills on HTN | | | Skills on ENC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre (%) | Post (%) | Wilcoxon test | Pre (%) | Post (%) | Wilcoxon test | Pre (%) | Post (%) | Wilcoxon test | Pre (%) | Post (%) | Wilcoxon test |
| Mean | 51.5 | 75.8 | V=508.5, p-value < 2.2e-16 | 36.4 | 87.5 | V=11, p-value < 2.2e-16 | 42.9 | 94.5 | V=8.5, p-value < 2.2e-16 | 57.5 | 89.4 | V=161.5, p-value < 2.2e-16 |
| SD | 18.7 | 21 | | 25.2 | 10.4 | | 30.4 | 8.6 | | 24 | 9.1 | |

### 3.1.3 Knowledge and skill scores between the Somali and Afar

Table 3 compares the baseline and endline knowledge and skill scores on postpartum hemorrhage (PPH), hypertension (HTN), and essential newborn care (ENC) between the Afar and Somali regions, highlighting regional differences in improvements following the mentorship program.

The Wilcoxon rank-sum test comparing changes in knowledge scores from baseline to endline between the Somali and Afar regions showed no significant difference (P=0.2309). On average, knowledge scores increased by 24.3% in Somali and 28.4% in Afar, indicating that while both regions demonstrated substantial improvements, the mentorship had a comparable impact on knowledge gains across both regions.

For hypertension skills, the Wilcoxon rank-sum test revealed a significant difference in score improvements between regions (P=5.167e-07). The average increase was 51.6% in Somali compared to 26.1% in Afar. This suggests that the mentorship had a greater effect in Somali, where a lower baseline score allowed for more significant progress.

Similarly, postpartum hemorrhage management skills, where the Wilcoxon rank-sum test indicated a significant difference between regions (P=4.724e-09). The average increase was 51.1% in Somali compared to 27.6% in Afar, suggesting a stronger impact in Somali due to its lower starting point, leading to a larger relative improvement.

For essential newborn care skills, the Wilcoxon rank-sum test showed no significant difference in score changes between regions (P=0.08272). The average increase was 31.9% in Somali and 25.2% in Afar. Both regions improved, but the difference in ENC skill gains was not significant, suggesting the mentorship was equally effective in both.

**Table 3:** Comparison of knowledge and skill scores on PPH, HTN, and ENC between Afar and Somali regions

| | Knowledge Assessment | Skills on PPH | Skills on HTN | Skills on ENC |
|---|---|---|---|---|
| Wilcoxon test | W=4151.5, p-value=0.2309 | W=1735.5, p-value=4.724e-09 | W=2029.5, p-value=5.167e-07 | W=3146.5, p-value=0.08272 |

### 3.2 Qualitative Findings

The qualitative analysis explored mentees' and facility heads' perspectives on the mentorship program, highlighting its benefits, challenges, and areas for improvement. Both groups valued the mentorship and the Safe Delivery App for enhancing knowledge, confidence, and service delivery. However, they also identified resource shortages, infrastructure gaps, and the need for continued support and expanded training.

### 3.3 Perceived value of mentorship

The catchment-based clinical mentorship program was perceived positively by both mentees and facility heads. Mentees expressed high regard for the practical, hands-on approach that the mentorship provided, noting that it helped bridge significant knowledge and skill gaps. One mentee shared, "MF SDA integrated Catchment-based mentorship is one of a kind along with demonstration or practical sessions, which was very interesting. It helped us to evaluate ourselves".

Mentees reported increased confidence and competence in managing obstetric and newborn emergencies, particularly preeclampsia, postpartum hemorrhage, and newborn resuscitation. Many noted that cases they previously referred to catchment hospitals could now be managed within the facility. “Previously, we referred hypertension cases, but now we can manage them,” one participant shared. Facility heads observed improvements in the quality of care provided, with a decrease in the need for referrals. “There has been a noticeable improvement in the quality of care provided. The mentorship has decreased referrals and helped midwives manage cases within the facility”, one facility head noted. Safe Delivery App further reinforced learning, helping mentees review procedures and correct mistakes. “If I encounter a case I don't know, I refer to SDA and manage it”, one participant explained.

### 3.4 Challenges in Mentorship

Mentees faced challenges in attending the mentorship sessions, as many had other responsibilities or were on leave. Those who remained on duty prior to the mentorship also found it difficult to participate. One mentee explained, “It was difficult to attend the mentorship sessions due to workload, attending the mentorship after we stayed on duty all night”.

The lack of essential medical equipment in some facilities also emerged as a significant challenge. One mentee noted, “We faced challenges with facilities lacking basic equipment, such as BP apparatus and delivery sets. What was available, we made do with”. Facility heads confirmed these gaps, especially for emergency obstetric care, and also pointed generally poor infrastructure, including unreliable water and electricity.

## 4. Recommendation for strengthening mentorship

Mentees and facility heads emphasized the need for continued support through improved resources and infrastructure. This included essential equipment like ultrasound machines and emergency obstetric kits, along with reliable water and electricity.

A key request was for longer and more frequent mentorship sessions, as some mentees felt they lacked enough patient cases to fully practice their skills: “We don’t have many cases at the health centre, so continued mentorship would help us gain more experience.” Facility heads echoed this need and suggested expanding mentorship to other departments. There was also strong interest in additional training on specialized topics, such as abortion care, emergency obstetric and newborn care. “We need more practical training, especially in areas like safe abortion care and ultrasound screening,” one mentee noted.

## 5. Discussion

Our study evaluated the effectiveness of catchment-based clinical mentorship with the Safe Delivery App in Ethiopia’s Afar and Somali regions. The study measured changes in healthcare workers' knowledge and skills in managing hypertension during pregnancy, postpartum hemorrhage, and essential newborn care at baseline and endline. Additionally, a qualitative assessment with mentees and facility heads, explored their experiences with the mentorship program, including its challenges, and recommendations for improvement.

Findings from the quantitative assessment showed significant improvements in knowledge and skills across both regions after the mentorship. Somali achieved greater

relative gains in hypertension and postpartum hemorrhage management despite a lower baseline. These results indicate that combining clinical mentorship with the Safe Delivery App (SDA) strengthened healthcare workers' knowledge and skills in maternal and newborn care across Ethiopia. Most studies have either examined the SDA or catchment-based clinical mentorship separately as individual approaches to enhancing healthcare workers' knowledge and skills. Our findings align with research on catchment-based clinical mentorship, showing similar improvements in knowledge and skills. A nurse-led onsite mentoring program in Karnataka, India, provided six mentoring visits, leading to higher provider knowledge in active management of the third stage of labour (82.4% vs.35.8%); management of maternal sepsis (73.5% vs. 10.9%); neonatal resuscitation (48.5% vs.11.7%) and low birth weight newborn care (58.1% vs. 40.9%) [11]. Another study in Lilongwe, Malawi, found that an emergency obstetric and neonatal care mentorship program improved knowledge and skills, with written scores increasing by 22.9% (N=134, $p$<0.001) and practical scores by 29.5% (N=125, $p$<0.001) after mentorship, with retention at six months [12].

Similarly, research on the Safe Delivery App (SDA) has reported comparable improvements in knowledge and skills. A randomized trial in West Wollega, Ethiopia, showed that using SDA significantly improved knowledge (8.5-point increase) and skills (29.6-point increase) [13]. Likewise, a study in New Delhi found that using the SDA significantly improved nursing students' knowledge on active management of the third stage of labour, postpartum hemorrhage, and neonatal resuscitation, with scores increasing from 17.12% to 42.26% [14].

Limited research has examined the combined use of clinical mentorship and the Safe Delivery App (SDA) to enhance healthcare workers' knowledge and skills. A study in Somali region, Ethiopia, found that after three months of mentorship and use of SDA, mentees' knowledge scores increased from 54.41% to 75.86%, while skills in managing postpartum hemorrhage and hypertension in pregnancy improved from 68.23% to 85.51% and 62.18% to 80.27%, respectively [15]. In another study conducted in the Somali region of Ethiopia, a mentorship program for midwives resulted in a 42% increase in knowledge levels over one year, while skill assessment scores improved from 52% at baseline to 63% at the endline [16].

In our study, baseline knowledge and skill scores in Somali were lower than those in Afar across hypertension, postpartum hemorrhage, and essential newborn care. This regional disparity may be due to the weaker maternal health system in Somali compared to Afar. Somali has lower antenatal care coverage, fewer skilled providers, and a smaller workforce of nurses and midwives [4]. These structural gaps likely contributed to the lower baseline scores. Previous mentorship programs have also shown greater improvements in lower-performing facilities, which may explain the larger mentorship impact in Somali [17-19].

Furthermore, our study explored mentees' and facility heads' perspectives on integrating the Safe Delivery App (SDA) into catchment-based clinical mentorship. Findings indicate strong appreciation for the mentorship, with mentees highlighting improvements in their knowledge, skills, and confidence. They valued SDA for its accessibility and role in reinforcing clinical learning. Facility heads observed positive changes in service delivery, and reduced referrals. These findings align with studies exploring clinical mentorship from participants' perspectives, highlighting its effectiveness in improving knowledge, skills, and confidence among healthcare workers [20, 21].

The findings of this study highlight several challenges faced during the mentorship program. Retaining participants was a key issue, with only 187 of 211 mentees completing both baseline and endline assessments. Mentees left the mentorship due to various factors, including workload, or personal circumstances such as maternity leave. Shortages of essential supplies, including ultrasound machines, also hindered effective mentorship. Additionally, unreliable electricity and water supply created difficulties for both mentees and facility staff. These challenges align with previous studies on clinical mentorship, which have reported difficulties in sustaining participation due to staff turnover, limited availability, and resource constraints [15, 16, 21]. Our study was unique in involving a supervisor from Maternity Foundation, which added significant value in addressing skill gaps among mentors during coaching. This approach enabled the identification of individual participant gaps, and the provision of tailored mentorship based on each mentee's baseline assessment and scores. Additionally, the supervisor provided extra coaching whenever gaps were identified, ensuring continuous support and improvement throughout the mentorship process.

Finally, this study is among the few that combine clinical mentorship with the digital tool, Safe Delivery App, to enhance healthcare workers' knowledge and skills in maternal and newborn health. The findings show significant improvements, particularly in settings with weaker health systems. Qualitative insights revealed strong appreciation for the mentorship, with participants reporting increased confidence, competence and improved service delivery. These results may inform policies that integrate digital tools with mentorship to strengthen healthcare provider capacity in responding to obstetric and neonatal emergencies. Scaling up such approaches could further support healthcare workers in similar contexts.

This study has limitations. While it assessed improvements in healthcare workers' knowledge and skills, it did not examine their retention of those skills and knowledge after mentorship. Assessing retention over time would help determine whether mentees can sustain their knowledge and skills, particularly with support from the Safe Delivery App. Additionally, the study did not rigorously evaluate the impact of these improvements on quality of care or obstetric outcomes. Future research should explore how mentorship influences these outcomes.

## 6. Conclusion

This study highlights the effectiveness of combining digital tools with capacity-building approaches to strengthen maternal and newborn care. The mentorship program, supported by the Safe Delivery App, significantly improved healthcare providers' knowledge and skills. Participants valued the mentorship but emphasized the need for sustained support, better resources, and extended mentorship to enhance its long-term impact. Scaling up and institutionalizing this approach within health systems can ensure sustainability and long-term impact.

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