

Scaling Village Health Leader–Led Community Maternal and Newborn Health Interventions in Underserved Ethiopian Communities: Evidence on Effectiveness, Safety, and Implementation

Gizachew Tadele Tiruneh

gizt121@gmail.com

JSI Research & Training Institute, Inc

Agumasie Semahegn

Amref Health Africa in Ethiopia

Nebreed Fesseha

JSI Research & Training Institute, Inc

Mesele Damte Argaw

Amref Health Africa in Ethiopia

Hillina Tadesse

JSI Research & Training Institute, Inc

Tamar Chitashvili

John Snow (United States)

Alemnesh Hailemariam Mirkuzie

JSI Research & Training Institute, Inc

Addis Girma

Amref Health Africa in Ethiopia

Biruk Bogale

JSI Research & Training Institute, Inc

Biruhtesfa Bekele

JSI Research & Training Institute, Inc

Abdulhalik Workicho

Fenot Associates

Ismael Ali

JSI Research & Training Institute, Inc

Chala Tesfaye

JSI Research & Training Institute, Inc

Bezawit Mesfin

JSI Research & Training Institute, Inc

Lidiya Tefera

Gates Foundation

Frank DelPizzo

Gates Foundation

Temesgen Ayehu

Amref Health Africa in Ethiopia

Mariamawit Asfaw

Ministry of Health

Mirkuzie Woldie

Fenot Associates

Shegaw Mulu

Amref Health Africa in Ethiopia

Netsanet Belete

JSI Research & Training Institute, Inc

Hillina Worku

Amref Health Africa in Ethiopia

Zemzem Mohammed

Ministry of Health

Addis Tamire

Amref Health Africa in Ethiopia

Dessalew Emaway

JSI Research & Training Institute, Inc

Research Article

Keywords: Ethiopia, community health, community health worker, iron and folic acid, maternal and newborn health, misoprostol, primary health care, Village Health Leader

Posted Date: July 14th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10124652/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Introduction: Women in remote agrarian and pastoralist populations in Ethiopia face substantial barriers to accessing timely, quality facility-based maternal and newborn health (MNH) services, contributing to persistently high rates of home births and preventable maternal and neonatal deaths. Community-based delivery strategies that extend high-impact interventions into underserved communities have shown promise in improving care practices and outcomes. This study assessed the effectiveness and safety of community-based MNH interventions delivered by trained Village Health Leaders (VHLs) in Ethiopia's agrarian and pastoralist settings.

Methods: The project implemented and tested a scalable VHL-led community-based delivery model of life-saving MNH interventions, including advance distribution of iron and folic acid supplements, misoprostol, chlorhexidine, and progestin-only pills. We conducted an embedded implementation research study using a quasi-experimental, controlled before-and-after household survey design. Data were drawn from 4,017 mothers of children aged 0–11 months (1,631 intervention; 2,386 comparison). A two-stage cluster sampling approach was used to identify eligible households across 25 intervention and 54 comparison kebeles. Baseline data were collected in August–September 2023 and end-line data in June–September 2025. To estimate causal effects while accounting for non-random program placement and baseline differences, we employed a propensity score–matched difference-in-differences (PSM-DiD) approach. Propensity scores were estimated using logistic regression with separate models for agrarian and pastoralist contexts.

Results: Misoprostol was used correctly by more than 97% of women who delivered at home, with only minor side effects and no reported adverse maternal or neonatal events. Facility delivery increased significantly in intervention areas. In agrarian settings, it increased from 19.2% at baseline to 26.5% at end line (+ 7.6%), while it declined in comparison areas (–7.5%; OR 2.4, $p < 0.001$). In pastoralist settings, facility delivery increased from 11.7% to 25.2% (+ 13.5%), compared with a + 5.1% increase in comparison areas (OR 1.8, $p = 0.027$).

Suspected postpartum hemorrhage significantly declined in agrarian intervention areas (from 3.5% to 0.5%) but increased in comparison areas. Coverage of key maternal health indicators improved across both contexts, including at least one ANC contact and four or more ANC visits. Uptake of iron-folic acid supplementation increased significantly in agrarian (DiD + 13.5, $p < 0.001$) and pastoralist (DiD + 7.2, $p = 0.016$) populations. Delayed newborn bathing after 24 hours rose substantially in intervention areas (agrarian + 26.4%, pastoralist + 28.2%; both $p < 0.001$). Adoption of postpartum family planning improved significantly in agrarian intervention areas, contrasting with declines in comparison areas (OR 3.5, $p < 0.01$).

Conclusions: VHL-led community delivery of MNH interventions was feasible, acceptable, safe, and effective, significantly increasing the uptake of evidence-based care practices and reducing preventable risks in underserved communities. This study provides further evidence that addresses and clarifies common concerns about the safety of community-level distribution of misoprostol and other essential MNH commodities. To maximize impact and equity, policymakers should prioritize the institutionalization and scale-up of VHL-led community MNH interventions within the primary health care framework.

Background

While global maternal mortality declined by approximately 34% in the past two decades, progress has slowed in high-burden countries such as Ethiopia, where coverage of essential facility-based maternal and newborn health (MNH) services—including at least four antenatal care visits and skilled birth attendance—remains below the 90% target and continues to exhibit substantial equity gaps. [1, 2]. This gap is especially acute in remote agrarian and pastoralist regions, where geographic isolation, limited transport options, financial hardship, socio-cultural norms, and mistrust of formal health systems hinder access to skilled care and contribute to high rates of preventable maternal and neonatal deaths from causes such as postpartum hemorrhage, sepsis, hypothermia, and birth asphyxia [3–7].

Community-based delivery platforms have gained prominence as an avenue to bridge these gaps, with evidence showing that trained community health workers (CHWs) can improve maternal and newborn outcomes by conducting home visits and supporting health education and referral linkages [8–11]. For example, systematic reviews suggest that CHW-led home visit programs and community mobilization activities can improve essential MNH practices and enhance care-seeking behaviors, potentially narrowing socioeconomic inequities in health outcomes [11–13]. When integrated with targeted distribution of MNH commodities—such as misoprostol for postpartum hemorrhage (PPH) prevention, chlorhexidine for umbilical cord care, and materials to support newborn thermal care—community interventions have further demonstrated positive impacts on care practices and survival [13]. Yet despite these promising results, broader scale-up of such community-based strategies remains uneven, impeded by policy hesitations, inconsistent training and supervision, supply chain challenges, and concerns about safety and misuse in the absence of robust monitoring, accountability, and support systems [14, 15].

Community-based advance distribution of misoprostol during pregnancy has been implemented in Ethiopia and has been shown to increase its uptake among women at risk of home delivery [15]. However, concerns among policymakers and program managers regarding possible diversion from facility births, inappropriate use, and potential adverse effects have limited broader adoption and scale-up of the strategy. In 2019, the Ethiopian Ministry of Health (MOH) commissioned the National Research Advisory Council (RAC) to examine whether these concerns were supported by available evidence. The RAC conducted a scoping review of studies from low-income settings and found no evidence that community-based distribution of misoprostol reduced facility delivery rates; several studies reported increases in facility births. The review also found no evidence of misuse for indications other than postpartum hemorrhage (PPH) prevention [16]. The findings were presented to the MOH Maternal, Child and Adolescent Health Service Lead Executive Office and discussed during a national policy dialogue involving key maternal health stakeholders. While participants acknowledged the promising evidence, concerns remained regarding the strength and contextual relevance of the available studies, leading to a recommendation for further implementation research before considering national scale-up.

To generate locally relevant evidence for policy and scale-up decisions, JSI and Amref Health Africa, in collaboration with the MOH and regional health bureaus, implemented and evaluated a community health worker (CHW)-led maternal and newborn health (MNH) delivery model between December 2023 and July

2025 in underserved agrarian and pastoralist communities with limited access to facility-based care. Building on Ethiopia's Health Extension Program (HEP) and global evidence on community-based MNH service delivery, the study served as a real-world test of a scalable implementation model designed to extend access to essential MNH interventions. The implementation research assessed the feasibility, acceptability, safety, and effectiveness of CHW-led community delivery of key MNH commodities and services. Findings are intended to inform national policy decisions on the expansion, institutionalization, and scale-up of community-based MNH service delivery models in Ethiopia and other resource-constrained settings.

Methods

Study Setting

Ethiopia's primary health care system is anchored in Primary Health Care Units (PHCUs), which comprise health centers and their satellite health posts, linked to primary hospitals to deliver promotive, preventive, and basic curative services. To strengthen community engagement and optimize HEP, the MOH introduced the Village Health Leader (VHL) initiative in 2020. VHLs are community-selected volunteers who receive standardized six-day training on the community health programs to support Health Extension Workers (HEWs) in linking households to essential reproductive, maternal, newborn, and child health (RMNCH) services, including antenatal care (ANC), postnatal care (PNC), family planning, immunization, and health education.

Since April 2022, the JSI and Amref Health Africa consortium has implemented the Improving Primary Health Care Service Delivery (IPHCSD) project, which served as a real-world test of a scalable VHL-led community MNH delivery model. The implementation research examined whether the model could safely and effectively extend essential MNH interventions to women with limited access to facility-based care. Intervention woredas were purposively selected based on persistently low institutional delivery coverage identified through routine Health Management Information System data and consultations with regional and woreda health managers.

The implementation research spanned 17 PHCUs—comprising 5 intervention and 12 comparison units—across both agrarian and pastoral settings in eight woredas. Three intervention woredas were selected in collaboration with regional health bureaus and woreda health offices: Seka Chekorsa (Oromia, agrarian), Chifra (Afar, pastoral), and Degahabur (Somali, pastoral). The comparison woredas were Shebe Sombo (Oromia), Shey Bench (Southwest Ethiopia), and Bona Zuria (Sidama) in agrarian settings, as well as Telalak (Afar) and Gonagadu (Somali) in pastoral settings. In agrarian woredas, the two most hard-to-reach PHCUs distant from woreda hubs were included, while all PHCUs outside the hub were included in the pastoral woredas. As such, intervention and comparison sites encompassed 25 and 54 kebeles, respectively, for a total of 79 kebeles. The intervention PHCUs served an estimated population of 150,783, while the comparison PHCUs served 363,120 (Table 1).

Table 1
Profile of study sites

Study arm	Setting	# PHCUs	# Kebeles	Population
Intervention	Agrarian	2	8	62,830
	Pastoral	3	17	87,953
	Subtotal	5	25	150,783
Comparison	Agrarian	6	23	141,109
	Pastoral	6	31	222,011
	Subtotal	12	54	363,120
Total		17	79	513,903

Project description

The VHL-led community-based MNH intervention package aimed to expand access to essential, life-saving services through outreach and household engagement. Core components included: (1) birth preparedness/complication readiness and promotion of facility-based delivery; (2) advance distribution of key MNH commodities—iron and folic acid (IFA) supplements; misoprostol for postpartum hemorrhage prevention at home births; chlorhexidine for cord care; progestin-only pills (POPs) for postpartum family planning; and thermal care materials (baby wraps, socks, and caps) in pastoral settings; and (3) home-based postnatal support to promote early postnatal care uptake, immunization, breastfeeding, postpartum contraception, and maternal nutrition. The VHLs conducted scheduled home visits (two antepartum and one postpartum) to register pregnant women, provide counseling and preventive commodities, and facilitate linkage to facility care. The model also included active surveillance of pregnancies and strengthened referral linkages with health centers and maternity waiting homes.

To support implementation, 187 VHLs were recruited and received an additional two days of training on community-based MNH interventions and digital data entry using the District Health information Software (DHIS2) Tracker tool. They were equipped with starter kits containing essential medicines, counseling materials, and data tools, with adaptations for pastoralist contexts (e.g., clean birth supplies). A package of implementation tools—guides, monitoring forms, and reporting instruments—was developed in local languages to standardize delivery across sites. Details of the interventions and implementation strategies are reported elsewhere [17].

Study Design

This embedded implementation research utilized a quasi-experimental, controlled before-and-after household survey design to assess the safety and effectiveness of community-based delivery mechanisms for life-saving MNH interventions. In addition, data were drawn from a cohort of 1,380 pregnant women

enrolled in the study and followed at home by VHLs from early pregnancy through the first week postpartum during the intervention period, January 2024-June 2024.

Sampling Technique

A two-stage cluster sampling technique was used to select the households for interviews in both the intervention and comparison kebeles. In the first stage, from each intervention and comparison woredas, PHCUs having a high rate of home births were purposefully selected. Twenty-five intervention and 54 comparison kebeles in the selected PHCUs were the primary sampling units (PSUs). In each Kebele, samples were allocated proportionally to the Kebele population size. The updated list of households, with mothers of infants 0–11 months and their unique household identifiers, obtained from the family folder of the respective Kebele/health post was used as a sampling frame by the data collectors. In the second stage, a random sample of households was drawn proportional to the kebele clusters from the sampling frame. Similar sampling techniques/procedures were used to sample the comparison woredas. In each selected household, women aged 15–49 with infants aged 0–11 months were invited for questionnaire interviews. From sampled households, eligible consenting women were interviewed (Fig. 1).

Figure 1: Sampling strategies

Sample Size

The sample size required to examine the effectiveness of the community-based MNH was calculated using StatCalc [18] for the double population formula for a comparative cross-sectional household study design. The assumption made to calculate sample size was that considering a 95% confidence level ($Z_{\alpha/2} = 1.96$), the margin of error ($d = 5\%$), design effect ($D = 1.5$), power of 80% and two-sided alpha error set at 0.05 to detect 12% points change in the uptake of institutional delivery at the end of the project; and stratified by pastoralist and agrarian settings. Accordingly, 4,026 mothers who gave birth in the last year before the data collection were recruited.

Data Collection

Baseline data were collected between August-September 2023 and end-line between June-September 2025. Household surveys used a structured women's questionnaire adapted from DHS and similar surveys. The tool was translated into the local languages of the study areas (Amharic, Afaan Oromo, and Af-Somali). Experienced data collectors underwent two days of training and calibration on the questionnaire. Interviews were conducted with mothers aged 15–49 who had a live birth in the 12 months preceding data collection and/or caregivers of infants aged 0–11 months, at their homes. The surveys generated data on sociodemographic and obstetric characteristics, care-seeking across the MNH continuum, essential newborn care practices, women's autonomy in seeking MNH services, male engagement, and access to and control over financial resources (Additional File 1). Data were collected electronically using SurveyCTO on tablets and smartphones, which also enabled GPS coordinate capture. Supervisors and coordinators

monitored fieldwork and conducted random household revisits to validate responses and ensure data quality.

VHLs collected longitudinal quantitative data from enrolled women between January 2024 and June 2025 through repeated home visits, beginning early in pregnancy and continuing through the immediate postpartum period. During each visit, VHLs updated individual records with information on the uptake of life-saving MNH interventions and maternal conditions during the intrapartum and postpartum phases. In agrarian areas, VHLs were equipped with smartphones loaded with a customized DHIS2 Tracker tool for direct digital data entry. In pastoral areas, data were initially captured using paper forms and later digitized by HEP focal persons and HEWs at the health post and health center levels using the DHIS2 Tracker system.

Measurement

The outcome indicator definitions are presented in Table 2 below. Safety was measured by monitoring unintended consequences, including shifts in facility delivery rates, potential misuse or harm, and the timing and appropriate dose of misoprostol administration. Effectiveness was assessed by evaluating changes in MNH practices.

Table 2
Indicator definitions

Indicators	Definitions
Correct timing of misoprostol administration	The proportion of women with children aged 0–11 months who delivered outside a health facility and received oral misoprostol immediately after childbirth, within the first minutes of the third stage of labor, to prevent PPH.
Correct dose of misoprostol	Proportion of women with children 0–11 months who received the recommended dose 600 microgram (three tablets) misoprostol for PPH prevention.
At least one ANC	% of women who visited a health facility for a check-up during her last pregnancy at least once
ANC in 1st trimester	Proportion of women who visited a health facility for a check-up during the first trimester of last pregnancy
ANC 4+ visits	Proportion of women who went to a health facility for antenatal care at least 4 times during the last pregnancy
Took IFA	The proportion of pregnant women who reported consuming at least one dose of IFA supplements during their most recent pregnancy.
Institutional delivery	Proportion of women who delivered at a health facility (hospital, health center, or clinic) during the last childbirth
Suspected PPH	The prevalence of suspected PPH is defined as the proportion of mothers with infants aged 0–11 months who report experiencing excessive bleeding after childbirth, based on their recall of bleeding that led to health-seeking or acute symptoms.
PNC within 6 weeks	% of women who received postpartum care at their home or health facility within 6 weeks of the last childbirth
Delay bathing for at least 24 hours	Proportion of newborns whose first bath was postponed for a minimum of 24 hours after birth to support thermal protection and reduce the risk of hypothermia
Early adoption of postpartum family planning (PPFP)	Early adoption of PPFP is defined as the initiation of any modern contraceptive method within six weeks after childbirth

Data Analysis

Data were analyzed using Stata version 15.1. Socio-demographic data were summarized by frequency tables and summary statistics. The difference in the characteristics of the respondents, as well as the difference in the uptake of MNH outcomes (Table 2) by study domains and background characteristics, were examined using Pearson’s chi-square statistics adjusted for cluster survey design effects. The intervention’s treatment effect was estimated using a difference-in-differences approach implemented through a mixed-effects regression model.

To estimate the causal effect of the community-based MNH intervention while accounting for non-random program placement and baseline differences between intervention and comparison areas, we applied a

propensity score–matched difference-in-differences (PSM–DiD) approach. Propensity scores, defined as the probability of intervention exposure, were estimated using logistic regression, with separate models for agrarian and pastoralist settings to reflect contextual heterogeneity.

Covariates were selected a priori based on theoretical relevance and prior evidence of association with both intervention exposure and MNH outcomes. In agrarian settings, covariates included maternal age, parity, religion, distance to the nearest health facility, women’s decision-making autonomy, and number of ANC contacts. In pastoralist settings, covariates included maternal education, household wealth, parity, distance to the nearest health facility, women’s decision-making autonomy, and number of ANC contacts.

Following propensity score estimation, kernel matching was used to construct a weighted comparison group closely resembling the intervention group on observed characteristics. A caliper of 0.2 standard deviations of the propensity score was applied to minimize poor matches and residual bias, and observations outside the region of common support were excluded.

Covariate balance was assessed using standardized mean differences (SMDs), variance ratios, and two-sample t-tests. Balance was considered acceptable when post-matching SMDs fell below conventional thresholds and no statistically significant differences remained. After matching, the mean standardized bias was reduced from 32.9% to 7.5%, with all covariates well balanced ($p > 0.10$).

Intervention effects over time were estimated using a DiD model applied to the matched sample, comparing changes in outcomes from baseline to end line between intervention and comparison groups. Difference-in-difference models were estimated using multilevel logistic regression with random intercepts to account for clustering at the community level. Models included indicators for intervention exposure, time (pre- vs post-intervention), and their interaction, with the interaction term representing the DiD estimator. The coefficient on this term was interpreted as the average treatment effect on the treated.

Ethical Considerations

Ethical approval

for this study was obtained from the Ethiopian Public Health Association’s Research Ethics Review Committee (Ref. #: EPHA/OG/728/23, July 17, 2023; renewed Ref. #: EPHA/OG/466/24, August 07, 2024, and Ref. #: EPHA/OG/550/25, August 18, 2025). Written permission to conduct the study was also secured from regional health bureaus, zonal health departments, and other relevant institutions.

Informed consent

was obtained from all participants prior to data collection. Participants were informed about the purpose of the study, potential benefits and risks, and their right to withdraw or decline to answer any questions at any time. Participation was entirely voluntary, and interviews were conducted only after consent was documented. All data were de-identified before analysis, and strict measures were taken to ensure confidentiality and protect participants’ privacy.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and adhered to applicable national and institutional guidelines for research involving human participants.

Results

Respondent characteristics

After matching, the analysis included 1,631 mothers from the intervention areas (723 agrarian and 908 pastoral) and 2,386 mothers from the comparison areas (1,086 agrarian and 1,300 pastoral). Overall, most women were 34 years or younger and had no formal education. Across both agrarian and pastoralist settings, the age distribution of respondents differed between baseline and end line surveys. Distance to the nearest health facility (health post, health center, or hospital) also varied between baseline and end-line in both the MNH and control groups (Table 3).

Safety: Correct use of misoprostol

The end-line household survey in the intervention areas showed that 97% of mothers who gave birth at home received misoprostol; among them, 98% took it at the correct time and 90% took the correct dose (Fig. 2).

Figure 2: Uptake and correct use of misoprostol in agrarian and pastoral settings, June-October 2025

Safety: Facility birth rate and perinatal mortality

From both the household survey and qualitative evaluation, some study participants reported side effects from the medications, which did not affect their adherence. According to routine incident and adverse event monitoring using DHIS2 tracker conducted by VHLs, HEWs, and project field staff, no adverse outcomes—including maternal or newborn deaths or misuse of misoprostol—were reported in connection with the distribution of the life-saving package.

Program monitoring cohort data documented eight neonatal deaths among 1,380 births, corresponding to an overall neonatal mortality rate of 5.8 per 1,000 births. The rate was 6.3 per 1,000 births in agrarian settings and 5.7 per 1,000 births in pastoral settings, and varied by place of delivery, with 6.1 per 1,000 among home births and 5.4 per 1,000 among facility births.

Institutional delivery increased significantly in both settings. In agrarian intervention areas, the proportion of births occurring in health facilities rose from 19.2% at baseline to 26.5% at end-line (+ 7.6%), while the comparison group experienced a decrease from 76.1% to 68.6% (−7.5%), resulting in a substantial DiD effect (OR 2.4, $p < 0.001$). In pastoralist intervention areas, institutional delivery increased from 11.7% to 25.2% (+ 13.5%), compared with a smaller increase in the comparison group (11.3% to 16.4%, + 5.1%), yielding a significant DiD (OR 1.8, $p = 0.027$).

The prevalence of suspected PPH—measured as severe bleeding—declined significantly in agrarian intervention areas, falling from 3.5% to 0.5% (−3.0%). In comparison areas, suspected PPH increased slightly (3.1% to 4.4%) (Table 4).

Uptake of other MNH services

For at least one ANC visit, coverage increased in agrarian intervention sites from 80.1% to 88.6% (+ 8.5%, $p < 0.05$), alongside a smaller rise in comparison sites (89.3% to 94.8%, + 5.5%, $p < 0.05$), with a nonsignificant DiD (+ 3.0; OR 0.9, $p = 0.731$). In pastoralist settings, ANC uptake rose from 72.0% to 83.2% in intervention areas (+ 11.2%, $p < 0.05$) versus minimal change in comparison areas (46.7% to 47.8%, + 1.1%), yielding a significant DiD (+ 10.1; OR 2.0, $p = 0.002$). Coverage of four or more ANC contacts increased substantially in intervention sites in both agrarian (29.3% to 45.2%, + 15.9%, $p < 0.05$; DiD + 15.3, OR 2.0, $p = 0.001$) and pastoralist settings (20.8% to 33.7%, + 12.9%, $p < 0.05$; DiD + 12.0, OR 1.8, $p = 0.024$), while comparison areas showed minimal change. Early ANC initiation in the first trimester changed slightly in both contexts and showed no significant intervention effects (agrarian DiD + 1.7, OR 1.1, $p = 0.636$; pastoralist DiD + 0.3, OR 0.9, $p = 0.643$).

Iron and folic acid supplementation uptake improved substantially in both contexts. The DiD effect was significant in agrarian settings (+ 13.5 percentage points; OR = 4.6, $p < 0.001$) and in pastoral settings (+ 7.2 percentage points; OR = 1.7, $p = 0.016$) (Table 4).

Table 4

Changes in the uptake of MNH services by program domain and agrarian and pastoral settings, August-October 2023 and June-October 2025

MNH service	Setting	Intervention			Comparison			Difference-in-difference	
		Baseline	End-line	Change	Baseline	End-line	Change	DiD	OR (p-value)
At least one ANC	Agrarian	80.1	88.6	+ 8.5*	89.3	94.8	+ 5.5*	+ 3.0	0.9 (0.731)
	Pastoral	72.0	83.2	+ 11.2*	46.7	47.8	+ 1.1	+ 10.1	2.0 (0.002)
ANC 4 or more contacts	Agrarian	29.3	45.2	+ 15.9*	40.8	41.4	+ 0.6	+ 15.3	2.0 (0.001)
	Pastoral	20.8	33.7	+ 12.9*	7.0	7.9	+ 0.9	+ 12.0	1.8 (0.024)
ANC in the first trimester	Agrarian	19.2	21.5	+ 2.3	21.5	22.1	+ 0.6	+ 1.7	1.1 (0.636)
	Pastoral	13.6	15.3	+ 1.7	10.7	12.1	+ 1.4	+ 0.3	0.9 (0.643)
Took IFA	Agrarian	70.0	96.7	+ 26.7*	78.1	91.3	+ 13.2*	+ 13.5	4.6 (< 0.001)
	Pastoral	58.6	79.7	+ 21.1*	40.4	54.3	+ 13.9*	+ 7.2	1.7 (0.016)
Institutional delivery	Agrarian	19.2	26.5	+ 7.6**	76.1	68.6	-7.5**	+ 15.1	2.4 (< 0.001)
	Pastoral	11.7	25.2	13.5+	11.3	16.4	+ 5.1*	+ 8.4	1.8 (0.027)
Suspected PPH	Agrarian	3.5	0.5	-3.0*	3.1	4.4	+ 1.3	-4.4	0.1 (< 0.001)
	Pastoral	4.1	2.2	-1.9	6.1	3.5	-2.6	+ 0.7	0.92 (860)
PNC within 6 weeks	Agrarian	50.1	53.5	+ 3.4	66.1	62.0	-4.1	+ 7.5	1.4 (0.087)
	Pastoral	13.9	32.2	+ 18.3*	15.4	12.2	-3.2	+ 21.5	4.3 (< 0.001)
Postpartum mCPR	Agrarian	39.3	44.2	+ 4.9	64.9	61.0	-3.9	+ 8.8	1.5 (0.054)
	Pastoral	1.3	2.1	+ 0.8	1.2	0.8	-0.4	+ 1.2	2.8 (0.262)

Adoption of PPFP	Agrarian	28.1	32.9	+ 4.8	48.2	26.3	-21.9*	+ 26.7	3.5 (< 0.01)
	Pastoral	0.3	1.4	+ 1.1	0.8	0.6	-0.2	+ 0.9	6.4 (0.150)
Delay bathing	Agrarian	53.5	80.1	+ 26.4*	69.1	54.8	-14.3*	+ 40.7	7.7 (< 0.001)
	Pastoral	32.1	60.3	+ 28.2*	35.5	26.6	-8.9*	+ 37.1	6.9 (< 0.001)

***p-value < 0.01; ** p-value < 0.05**

Postnatal care within six weeks increased in pastoralist intervention areas from 13.9% at baseline to 32.2% at end-line (+ 18.3%), while the comparison group declined (15.4% to 12.2%, – 3.2%), resulting in a significant DiD effect (OR 4.3, $p < 0.001$). In agrarian areas, PNC uptake increased modestly in intervention sites (50.1% to 53.5%, + 3.4%) and declined slightly in comparison areas (66.1% to 62.0%, – 4.1%), yielding a positive but nonsignificant DiD (OR 1.4, $p = 0.087$).

Postpartum mCPR in agrarian settings increased in intervention areas (39.3% to 44.2%, + 4.9%) alongside a slight decline in comparison areas (64.9% to 61.0%, – 3.9%), producing a positive but borderline nonsignificant DiD (OR 1.5, $p = 0.054$). In pastoralist settings, postpartum mCPR remained low, with minimal change and a nonsignificant DiD. Adoption of postpartum family planning within six weeks increased in agrarian intervention areas (28.1% to 32.9%, + 4.8%) while declining in comparison areas (48.2% to 26.3%, – 21.9%), yielding a significant DiD effect (OR 3.5, $p < 0.01$). In pastoralist settings, PPFP uptake showed small, nonsignificant increases.

The proportion of delayed bathing of newborns for at least 24 hours increased substantially in both intervention settings: from 53.5% to 80.1% in agrarian areas (+ 26.4%) and from 32.1% to 60.3% in pastoralist areas (+ 28.2%). Both settings showed large, statistically significant DiD effects (agrarian: OR 7.7, $p < 0.001$; pastoralist: OR 6.9, $p < 0.001$).

Discussion

This embedded implementation research demonstrates that a VHL-led, community-based MNH intervention is feasible, acceptable, safe, and effective in improving critical MNH practices and outcomes in remote agrarian and pastoralist settings in Ethiopia. No serious maternal or neonatal adverse outcomes attributable to the intervention were observed. Most women took misoprostol correctly as instructed. Using a rigorous propensity score–matched, DiD approach, the study found a significant reduction in suspected severe bleeding and significant improvements in institutional delivery. Furthermore, the intervention was associated with increased antepartum care uptake, prenatal IFA supplementation, higher early postpartum family planning adoption, and enhanced essential newborn care practices, including delayed bathing.

In this study, community-based distribution of life-saving interventions including misoprostol was found to be safe. Importantly, no misuse of misoprostol, serious adverse events, or diversion of facility birth were

reported, reinforcing the safety of community distribution when accompanied by appropriate training, supervision, and monitoring. These findings contribute to the growing body of evidence supporting the safe use of MNH commodities at the community level in resource-constrained settings [13, 16, 19–22]. Most women adhered to the recommended misoprostol regimen, reflecting both the acceptability and feasibility of appropriate use in community settings. High levels of feasibility and acceptability among mothers, VHLs, and implementers reflect strong alignment with community needs and expectations. The process evaluation conducted alongside this study further confirmed that community-based distribution of misoprostol and other life-saving interventions is feasible and well-accepted [17]. These findings align with the broader evidence base: systematic reviews and global guidelines indicate that misoprostol substantially reduces the risk of postpartum hemorrhage and related complications, with only mild, self-limiting side effects [23]. Large-scale reviews have consistently found no significant increase in maternal mortality or severe morbidity when misoprostol is used at recommended doses, compared with controls or alternative uterotonics [16, 23–25]. This study provides further evidence that addresses and clarifies common concerns about the safety of community-level distribution of misoprostol and other essential MNH interventions.

This study demonstrated that community-based MNH interventions were safe and effective in increasing institutional delivery, reinforcing their role as a complement to facility-based care and addressing concerns that they could incentivize home birth. VHLs serve as a strategic bridge between communities and the formal health system, filling immediate gaps for vulnerable women while promoting facility use. The VHL-led model significantly increased institutional deliveries through early identification of pregnant women, repeated home-based counselling, and strengthened referral linkages, enhancing birth preparedness and trust in the health system. Similar findings in Ethiopia and other low-income settings show that community health workers supporting pregnancy surveillance and referral improve facility birth rates [13, 26]. By engaging communities directly, these interventions address demand-side barriers such as misinformation, sociocultural norms, and household decision-making constraints [26–28]. Policy-wise, integrating structured community registries, referral, and follow-up mechanisms into primary health care could accelerate progress toward universal skilled birth attendance, especially in remote and hard-to-reach populations.

Experience from other national and large-scale community programs demonstrate the feasibility and acceptability of community distribution of misoprostol for PPH prevention. In Nepal, the government's advance distribution program—implemented through Female Community Health Volunteers who counsel and supply misoprostol to pregnant women for self-administration at home births—was scaled across multiple districts and increased uterotonic coverage even in remote areas [29, 30]. In Mozambique, the MOH formally integrated misoprostol distribution into its national PPH strategy, expanding the program to many districts and engaging community health cadres and trained traditional birth attendants in advance distribution and use [31]. Nigeria approved misoprostol for community use in national essential medicine lists and has documented early experiences with large-scale community distribution in states like Sokoto, illustrating operational feasibility and stakeholder engagement at scale [32].

Our finding that VHL-led community-based delivery of MNH interventions was associated with a significant reduction in suspected PPH in agrarian settings is consistent with and reinforces existing evidence that well-implemented community approaches can reduce PPH risk in low-resource settings. Community distribution of misoprostol—when coupled with education on PPH danger signs, correct timing of administration, and linkage to referral—has been shown to increase uterotonic coverage in home birth contexts where injectable oxytocin and skilled attendance are limited [16, 33]. While in pastoral settings of this study and some controlled trials in specific contexts have not demonstrated clear clinical benefit for treatment of established PPH [34], the broader literature supports the preventive value of community-based misoprostol distribution and related maternal health promotion strategies. In this context, our study's results align with global evidence, underscoring that structured engagement of community cadres in delivering preventive MNH services can meaningfully lower the risk of PPH and contribute to improved maternal outcomes, particularly where health system constraints limit access to facility-based skilled care.

The significant improvement in prenatal IFA supplementation aligns with prior evidence demonstrating that community-based distribution and counseling improve adherence to antenatal nutrition interventions [19]. In contexts where frequent facility visits are constrained by distance or opportunity costs, VHL-led home visits provide a practical mechanism to reinforce ANC messages and ensure continuity of supplementation. Ethiopia has historically faced challenges in antenatal nutrition coverage, and community engagement has been shown to reduce inequities in uptake [27, 28, 35]. These findings suggest that extending selected ANC components through community platforms can enhance the effectiveness of facility-based services while improving equitable access.

The early adoption of postpartum family planning observed in this study highlights the value of timely, community-based counselling and method provision in increasing contraceptive uptake in the extended postpartum period. Evidence from LMICs shows that structured family planning counselling delivered at various maternal health contact points—including postnatal care and community interactions—is associated with increased initiation of modern contraception among postpartum women compared with routine care without such counselling [22, 36]. Community-based interventions that integrate postpartum family planning messaging and support into longitudinal contacts with women—such as home visits or follow-up discussions—have been shown to improve postpartum contraceptive use, addressing informational gaps and reinforcing decision-making at key moments after birth [36–38]. Providing progestin-only pills at the community level and linking women to facilities for access to other methods helps overcome both access and knowledge barriers that commonly limit postpartum uptake, particularly in areas where facility-based services are under-utilized or geographically distant [38]. These results support global recommendations to integrate postpartum family planning into community-based MNH platforms and underscore the importance of task-sharing and decentralized service delivery to expand contraceptive access and uptake in underserved settings.

The observed improvements in delayed newborn bathing underscore the effectiveness of community-based delivery of life-saving MNH interventions, particularly in settings where access to skilled attendance at birth is limited. Proactive community-level home visits and counselling on essential newborn care practices have been shown to increase uptake of key behaviors such as delaying the first bath, which is critical for thermal

regulation and can reduce risks of hypothermia and related complications in neonates [12, 39]. Community-based behavioral change interventions and home-based counselling delivered by trained CHWs result in significantly higher rates of delayed bathing compared with standard care, reflecting improved maternal knowledge and adoption of recommended practices [12, 40–42]. A broader body of community health research further supports these findings, showing that home visits and related community interventions improve thermal care behaviors by increasing awareness, reinforcing evidence-based practices, and fostering supportive environments that help families adopt and sustain recommended newborn care behaviors [39].

Overall, these experiences indicate that VHL-led community-based MNH interventions can serve as a strategic extension of Ethiopia's primary health care (PHC) system and support the HEP optimization agenda. As such, to maximize impact and equity, policymakers should prioritize the institutionalization and scale-up of VHL-led community MNH interventions within the PHC framework, ensuring they are resourced, linked with facility care, and integrated into national MNH strategies to sustainably improve outcomes across diverse contexts. Scaling up these interventions could accelerate progress toward national MNH targets, enhance service equity, and address persistent concerns about the safety and effectiveness of community distribution of misoprostol and other essential MNH commodities.

Embedding implementation research within program delivery yields actionable insights into what works, for whom, and under what conditions—strengthening key operational elements such as training, supervision, supply continuity, and referral linkages that are essential for sustainability and impact. The use of robust methods such as propensity score matching with balance diagnostics and difference-in-differences estimation helps improve causal inference in non-randomized evaluations by creating comparable intervention and control groups and isolating changes over time attributable to the program. However, even with these approaches, residual confounding from unmeasured factors cannot be fully excluded, since propensity scores balance only observed covariates. Additionally, many outcomes in this study were self-reported and may be affected by recall or social desirability bias, where respondents unintentionally misremember or overstate socially acceptable behaviors and practices. For example, self-reported suspected PPH reflects women's perception of severe postpartum bleeding rather than clinically confirmed cases and should be interpreted cautiously to avoid overstating the intervention's clinical impact.

Conclusions

VHL-led community-based MNH interventions effectively extend essential services to underserved populations, increase uptake of evidence-based MNH practices, and help reduce preventable health risks. By linking households to the formal health system, VHLs expand coverage of high-impact actions such as home visits, counselling on danger signs, timely referrals, and delivery of preventive commodities—addressing persistent access gaps in areas with limited skilled attendance. Evidence shows that well-implemented community interventions can increase institutional deliveries and improve MNH uptake when integrated with health systems.

Embedding implementation research within program delivery generates practical evidence on what works, for whom, and under what conditions, strengthening strategies, supervision, supply continuity, and referral linkages critical for sustainability and impact.

To maximize impact and equity, policymakers should prioritize the institutionalization and scale-up of VHL-led community MNH interventions within the PHC framework, ensuring they are resourced, linked with facility care, and incorporated into national MNH strategies to sustainably improve outcomes across diverse contexts. The institutionalization of VHL-led models offers a scalable, equity-focused strategy for LMICs to reduce preventable mortality among rural and mobile populations by bridging the gap between community and health facility.

Abbreviations

ANC	
antenatal care	
CHW	
community health worker	
DHIS2	
District Health information Software	
DiD	
difference-in-difference	
HEP	
Health Extension Program	
HEW	
Health Extension Worker	
IFA	
iron and folic acid	
IPHCSD	
Improving Primary Health Care Service Delivery project	
MNH	
maternal and newborn health	
MOH	
Ministry of Health	
PHC	
primary health care	
PHCU	
Primary Health Care Unit	
PNC	
postnatal care	
POP	
progestin-only pills	
PPFP	

postpartum family planning
PPH
postpartum hemorrhage
PSM
propensity score–matched analysis
PSU
primary sampling unit
RAC
National Research Advisory Council
RMNCH
reproductive, maternal, newborn, and child health
SMD
standardized mean difference
VHL
Village Health Leader

Declarations

Consent for publication

Not applicable as all figures were developed as part of the work.

Availability of data and materials

The dataset used and analyzed during this study is included as supplementary information to this article (Additional File 2).

Competing interests

None declared.

Funding

The IPHCSD project is funded by the Gates Foundation and implemented through JSI and Amref Health Africa. The funder has no role in the interpretation and implications of the content in this paper. This responsibility lies solely with the authors.

Acknowledgments

We extend our gratitude to the Ministry of Health, regional health bureaus, and woreda health offices for their support during the fieldwork and project implementation. We acknowledge the interviewers and supervisors for their hard work, dedication, and timely completion of the fieldwork. Finally, we are deeply grateful to all study participants who took the time to respond to the survey questionnaires and provided invaluable information.

References

1. Ethiopian Public Health Institute (EPHI). [Ethiopia], ICF. Ethiopia Mini Demographic and Health Survey 2019: Final Report. Maryland, USA: Rockville; 2021.
2. WHO. Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. World Health Organization; 2023.
3. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet global health*. 2014;2(6):e323–33.
4. Gabrysch S, Campbell OM. Still too far to walk: literature review of the determinants of delivery service use. *BMC Pregnancy Childbirth*. 2009;9:1–18.
5. Bohren MA, Hunter EC, Munthe-Kaas HM, Souza JP, Vogel JP, Gülmezoglu AM. Facilitators and barriers to facility-based delivery in low-and middle-income countries: a qualitative evidence synthesis. *Reproductive health*. 2014;11:1–17.
6. Kruk ME, Pate M, Mullan Z. Introducing the Lancet Global Health Commission on high-quality health systems in the SDG era. *Lancet Global Health*. 2017;5(5):e480–1.
7. Lancet WOMAN. reducing maternal deaths with tranexamic acid. *Lancet*. 2017;389(10084):2081. 10.1016/s0140-6736(17)31111-x.
8. Perry HB, Zulliger R, Rogers MM. Community health workers in low-, middle-, and high-income countries: an overview of their history, recent evolution, and current effectiveness. *Annu Rev Public Health*. 2014;35(1):399–421.
9. Scott K, Beckham SW, Gross M, Pariyo G, Rao KD, Cometto G, et al. What do we know about community-based health worker programs? A systematic review of existing reviews on community health workers. *Hum Resour health*. 2018;16(1):39.
10. Nishimwe C, McHunu GG, Mukamusoni D. Community- based maternal and newborn interventions in Africa: Systematic review. *J Clin Nurs*. 2021;30(17–18):2514–39. 10.1111/jocn.15737.
11. Miyares M, Stansert Katzen L, Vaughan K, Baskin C, Ballard M, Kok M, et al. Costs and cost-effectiveness of community health worker programs on reproductive, maternal, newborn and child health in low- and middle-income countries (2015–2024): A scoping review. *PLOS global public health*. 2026;6(1):e0004893. 10.1371/journal.pgph.0004893.
12. Gogia S, Sachdev HS. Home visits by community health workers to prevent neonatal deaths in developing countries: a systematic review. *Bull World Health Organ*. 2010;88(9):658–b66. 10.2471/blt.09.069369.
13. Lassi ZS, Bhutta ZA. Community-based intervention packages for reducing maternal and neonatal morbidity and mortality and improving neonatal outcomes. *Cochrane database Syst reviews*. 2015(3).
14. Blanchard AK, Prost A, Houweling TAJ. Effects of community health worker interventions on socioeconomic inequities in maternal and newborn health in low-income and middle-income countries: a mixed-methods systematic review. *BMJ global health*. 2019;4(3):e001308. 10.1136/bmjgh-2018-001308.

15. Sibley LM, Spangler SA, Barry D, Tesfaye S, Desta BF, Gobezaayehu AG. A regional comparison of distribution strategies and women's awareness, receipt, and use of misoprostol to prevent postpartum hemorrhage in rural Amhara and Oromiya regions of Ethiopia. *J Midwifery Women's Health*. 2014;59(s1):S73–82.
16. Tiruneh GT, Yakob B, Ayele WM, Yigzaw M, Roro MA, Medhanyi AA, et al. Effect of community-based distribution of misoprostol on facility delivery: a scoping review. *BMC Pregnancy Childbirth*. 2019;19(1):404.
17. Tiruneh GT, Agumasie Semahegn AH, Mirkuzie N, Fesseha A, Girma M, Teferi et al. Community-Based Delivery of Life-saving Maternal and Newborn Health Interventions in Vulnerable Ethiopian Communities: Lessons from Implementation Research. Under review. 2026.
18. CDC. Epi Info 7. Centers for Disease Control Prevention; 2017.
19. Nguyen PH, Sanghvi T, Kim SS, Tran LM, Afsana K, Mahmud Z, et al. Factors influencing maternal nutrition practices in a large scale maternal, newborn and child health program in Bangladesh. *PLoS ONE*. 2017;12(7):e0179873.
20. Imdad A, Mullany LC, Baqui AH, El Arifeen S, Tielsch JM, Khatry SK, et al. The effect of umbilical cord cleansing with chlorhexidine on omphalitis and neonatal mortality in community settings in developing countries: a meta-analysis. *BMC Public Health*. 2013;13:1–11.
21. Solo J, Festin M. Provider bias in family planning services: a review of its meaning and manifestations. *Global Health: Sci Pract*. 2019;7(3):371–85.
22. Hubacher D, Mavranazouli I, McGinn E. Unintended pregnancy in sub-Saharan Africa: magnitude of the problem and potential role of contraceptive implants to alleviate it. *Contraception*. 2008;78(1):73–8.
23. Oladapo OT. Misoprostol for preventing and treating postpartum hemorrhage in the community: a closer look at the evidence. *Int J Gynecol Obstet*. 2012;119(2):105–10. 10.1016/j.ijgo.2012.08.004.
24. Oladapo OT, Blum J, Abalos E, Okusanya BO. Advance misoprostol distribution to pregnant women for preventing and treating postpartum haemorrhage. *Cochrane Database Syst Reviews*. 2020;610.1002/14651858.CD009336.pub3.
25. WHO. WHO recommendations Uterotonics for the prevention of postpartum haemorrhage. World Health Organization; 2018.
26. Lassi ZS, Middleton PF, Bhutta ZA, Crowther C. Strategies for improving health care seeking for maternal and newborn illnesses in low-and middle-income countries: a systematic review and meta-analysis. *Global health action*. 2016;9(1):31408.
27. Tiruneh GT, Zemichael NF, Betemariam WA, Karim AM. Effectiveness of participatory community solutions strategy on improving household and provider health care behaviors and practices: A mixed-method evaluation. *PLoS ONE*. 2020;15(2):e0228137.
28. Karim AM, Admassu K, Schellenberg J, Alemu H, Getachew N, Ameha A, et al. Effect of Ethiopia's health extension program on maternal and newborn health care practices in 101 rural districts: a dose-response study. *PLoS ONE*. 2013;8(6):e65160.
29. Rajbhandari SP, Aryal K, Sheldon WR, Ban B, Upreti SR, Regmi K, et al. Postpartum hemorrhage prevention in Nepal: a program assessment. *BMC Pregnancy Childbirth*. 2017;17(1):169.

30. Rajbhandari S, Hodgins S, Sanghvi H, McPherson R, Pradhan YV, Baqui AH. Expanding uterotonic protection following childbirth through community-based distribution of misoprostol: operations research study in Nepal. *Int J Gynaecol Obstet.* 2010;108(3):282–8. 10.1016/j.ijgo.2009.11.006.
31. Hobday K, Hulme J, Prata N, Wate PZ, Belton S, Homer C. Scaling Up Misoprostol to Prevent Postpartum Hemorrhage at Home Births in Mozambique: A Case Study Applying the ExpandNet/WHO Framework. *Global Health: Sci Pract.* 2019;7(1):66–86. 10.9745/ghsp-d-18-00475.
32. Ejembi C, Shittu O, Moran M, Adiri F, Oguntunde O, Saadatu B, et al. Community-level distribution of misoprostol to prevent postpartum hemorrhage at home births in northern Nigeria. *Afr J Reprod Health.* 2014;18(2):166–75.
33. Jennings MC, Pradhan S, Schleiff M, Sacks E, Freeman PA, Gupta S, et al. Comprehensive review of the evidence regarding the effectiveness of community-based primary health care in improving maternal, neonatal and child health: 2. maternal health findings. *J global health.* 2017;7(1):010902. 10.7189/jogh.07.010902.
34. Abbas DF, Mirzazada S, Durocher J, Pamiri S, Byrne ME, Winikoff B. Testing a home-based model of care using misoprostol for prevention and treatment of postpartum hemorrhage: results from a randomized placebo-controlled trial conducted in Badakhshan province. *Afghanistan Reproductive health.* 2020;17(1):88. 10.1186/s12978-020-00933-8.
35. Assefa Y, Gelaw YA, Hill PS, Taye BW, Van Damme W. Community health extension program of Ethiopia, 2003–2018: successes and challenges toward universal coverage for primary healthcare services. *Globalization health.* 2019;15(1):24.
36. Mruts KB, Tessema GA, Gebremedhin AT, Scott J, Pereira G. The effect of family planning counselling on postpartum modern contraceptive uptake in sub-Saharan Africa: a systematic review. *Public Health.* 2022;206:46–56. <https://doi.org/10.1016/j.puhe.2022.02.017>.
37. Baqui AH, Ahmed S, Begum N, Khanam R, Mohan D, Harrison M, et al. Impact of integrating a postpartum family planning program into a community-based maternal and newborn health program on birth spacing and preterm birth in rural Bangladesh. *J global health.* 2018;8(2):020406. 10.7189/jogh.08.020406.
38. Sitrin D, Jima GH, Pfitzer A, Wondimu C, Belete TW, Pleah T, et al. Effect of integrating postpartum family planning into the health extension program in Ethiopia on postpartum adoption of modern contraception. *J global health Rep.* 2020;4:e2020058. 10.29392/001c.13511.
39. Lassi ZS, Kumar R, Bhutta ZA. Community-based care to improve maternal, newborn, and child health. 2016.
40. Penfold S, Manzi F, Mkumbo E, Temu S, Jaribu J, Shamba DD, et al. Effect of home-based counselling on newborn care practices in southern Tanzania one year after implementation: a cluster-randomised controlled trial. *BMC Pediatr.* 2014;14(1):187. 10.1186/1471-2431-14-187.
41. Cherie N, Wordofa MA, Debelew GT. The effect of an interactive mobile health intervention to improve community-based essential neonatal care practices among postpartum women in northeast Ethiopia: a cluster randomized controlled trial. *Int Health.* 2025;17(5):820–35. 10.1093/inthealth/ihae080.

42. Wafula ST, Kananura RM, Pande G, Kizito F, Namutamba S, Kyobe B, et al. Effect of community – facility linked interventions on maternal health service utilization and newborn care in rural low-resource settings in Eastern Uganda. BMC Pregnancy Childbirth. 2024;24(1):692. 10.1186/s12884-024-06883-4.

Table 3

Table 3 is available in the Supplementary Files section.

Figures

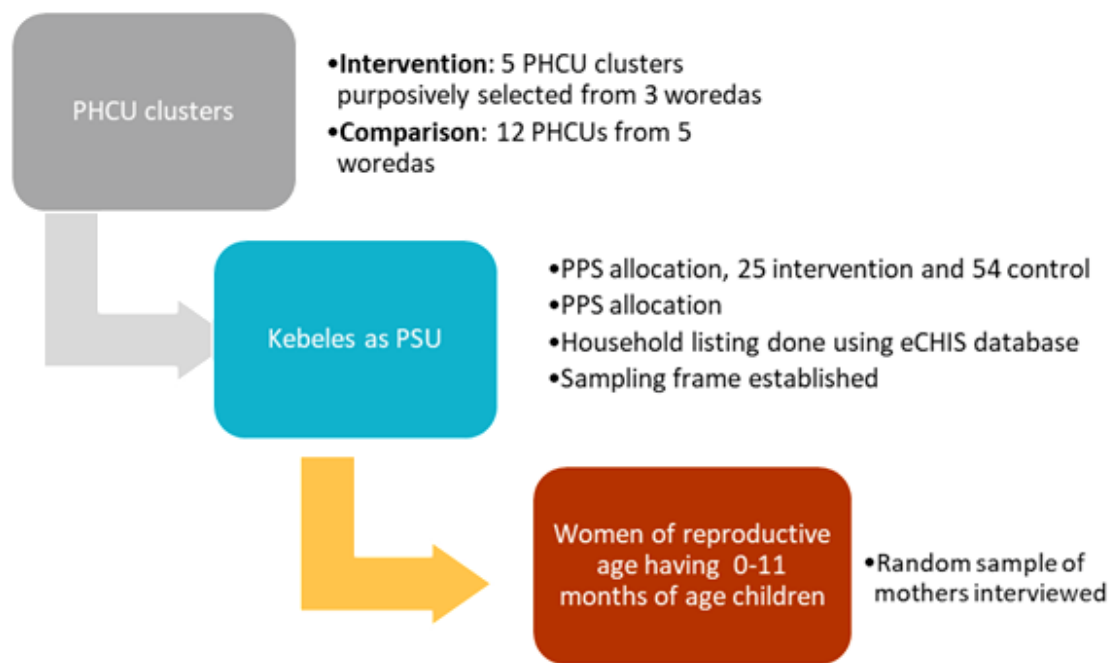


Figure 1

Sampling strategies

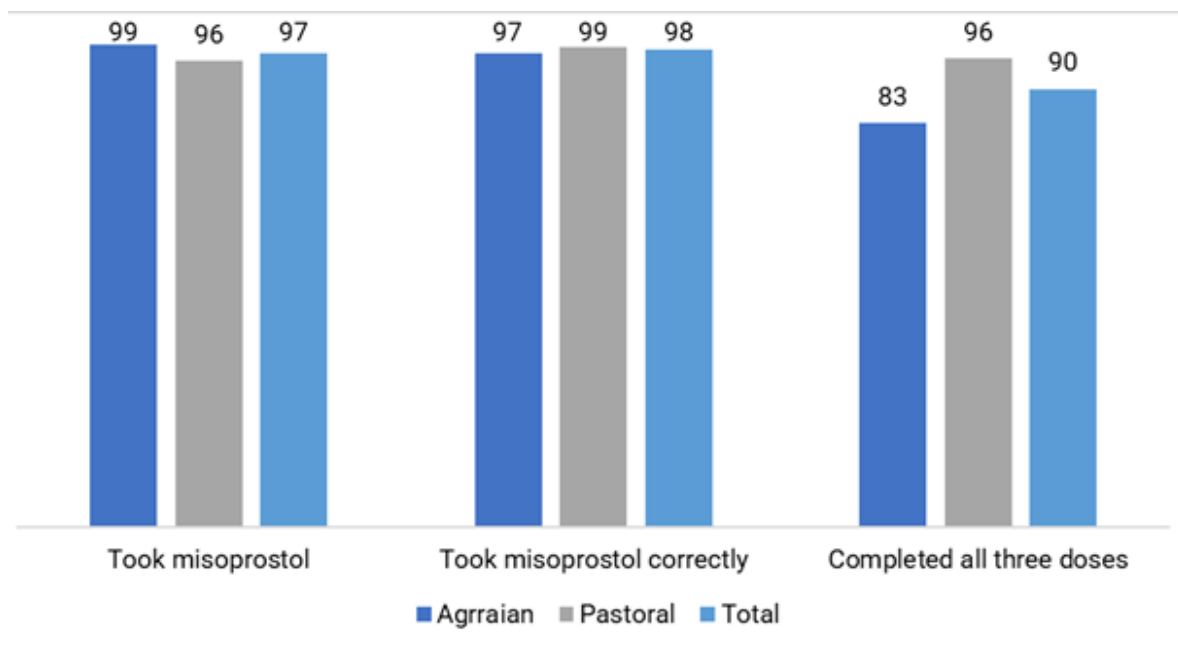


Figure 2

Uptake and correct use of misoprostol in agrarian and pastoral settings, June-October 2025

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AdditionalFile1.csv](#)
- [AdditionalFile2.xlsx](#)
- [Table3.docx](#)