

Current advances in contraceptive use, technology, and promotion

Edited by

Allen Kabagenyi and Ronald Anguzu

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Current advances in contraceptive use, technology, and promotion

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Experts' view on the role of oestrogens in combined oral contraceptives: emphasis on oestetrol (E4)

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Introduction: The evolution of contraception has been crucial for public health and reproductive well-being. Over the past 60 years, combined oral contraceptives (COCs) have remained an important part of the contraceptive landscape worldwide; continued development has worked toward maintaining efficacy and improving safety.

Methods: Seven global experts convened to discuss the clinical relevance of the oestrogen in COCs, focusing on the impact of the new oestrogen, oestetrol (E4). Participants then commented through an online forum on the summary content and other participants' feedback. We prepared this report to describe the experts' views, their follow-up from the open forum and the evidence supporting their views.

Results: Ethinylestradiol (EE) and oestradiol (E2) affect receptors similarly whereas E4 has differential effects, especially in the liver and breast. Adequate oestrogen doses in COCs ensure regular bleeding and user acceptability. EE and E4 have longer half-lives than E2; accordingly, COCs with EE and E4 offer more predictable bleeding than those with E2. Oestrogen type and progestin influence VTE risk; E2 poses a lower risk than EE; although promising, E4/DRSP VTE risk is lacking population-based data. COCs alleviate menstrual symptoms, impact mental health, cognition, libido, skin, and bone health.

Conclusion: Oestrogens play an important role in the contraceptive efficacy, bleeding patterns, and overall tolerability/safety of COCs. Recent studies exploring E4 combined with DRSP show promising results compared to traditional formulations, but more definitive conclusions await further research.

KEYWORDS

oestrogens, oestetrol, E4, oral contraception, combined hormonal contraceptives, effectiveness, safety, non-contraceptive benefits

1 Introduction

The development of safe and effective contraception is one of the most significant public health achievements of the 20th century (1). The availability and effective use of modern contraceptives to allow individuals to space or prevent pregnancies results in improved birth outcomes, decreased maternal morbidity and mortality, and improved well-being and population health (2–4). Combined oral contraceptives (COCs) have

been available for more than 60 years; many advances have been made during this time, resulting in fewer adverse events while maintaining contraceptive efficacy (5).

In this publication the perspectives of an expert panel on the clinical relevance of the oestrogen component in combined hormonal contraceptives, with a particular emphasis on estetrol (E4), the newest oestrogen introduced for contraception, are presented with the aim of providing better support for oral contraceptive choices.

2 Methods

To address the significance of the oestrogen component of combined hormonal contraceptives, including the impact of a new oral contraceptive containing E4, seven international experts (the authors of this paper) were invited to participate in an interactive virtual forum discussion on April 8, 2022. A moderator (MDC) guided a two-hour discussion through open-ended questions covering the following topics:

- The role of oestrogens in combined oral contraceptives.
- Key features of oestrogens in combined oral contraceptives, in relation to contraceptive efficacy and safety.
- The impact of oestrogenicity of COCs on safety.
- The non-contraceptive benefits of COCs, e.g., menstruation symptoms, mood and well-being, sexual life, body weight, skin care, and migraine.
- The effects of oestrogens in COCs used by adolescents and young adults.

The online session was audio-recorded and transcribed, and a summary prepared and posted in an online forum available to the experts. During the 3 weeks following the live session, the experts were asked to comment through the online forum on the summary content and other participants' feedback. In this report, we describe the experts' common views related to the questions, their follow-up from the open forum and the evidence supporting their views.

This publication is intended for healthcare professionals seeking up to date clinical information on the relevance of the estrogenic component in a COC. The main outcomes of the panel discussion related to each question and corroborating references are presented with a summary of the panel members' main points summarized in boxes at the beginning of each section.

3 What is the role of oestrogens contained in combined oral contraceptives?

Panel discussion summary remarks

- Progestin primarily drives contraceptive effects in COCs by preventing ovulation.
- Oestrogen in COCs enhances progestin's effects, stabilizing the endometrium and decreasing the likelihood of irregular bleeding.

(continued)

- COCs with an adequate dose of oestrogen offer consistent, regular bleeding patterns, improving user acceptability.
- Reliable bleeding patterns are crucial in contraception, as irregular bleeding often leads to discontinuation.
- Comparing trial results can be challenging due to differing definitions for bleeding events and cycle control parameters.

In a COC, the progestin component is primarily responsible for the contraceptive effect, mainly through ovulation inhibition (6, 7). The oestrogen component amplifies the progestational component's effectiveness, enhancing its ability to inhibit gonadotropin secretion and exert antifertility effects within the reproductive tract. The oestrogen also supports endometrial stability, preventing irregular shedding and undesired breakthrough bleeding, resulting in a consistent bleeding pattern (8–11).

The oestrogen-progestin equilibrium required for a regular bleeding pattern is disrupted by using an excessively low dose of ethinylestradiol (EE), as is present in the COC EE 10 µg/norethindrone acetate 1 mg. Substituting EE with 17β-estradiol (E2) or E2 valerate can also result in a less predictable bleeding pattern, likely related to the shorter half-life of E2 in comparison to the progestin (12). In contrast, replacing EE with estetrol (E4) 15 mg in combination with drospirenone (DRSP) 3 mg results most commonly in a consistent and predictable bleeding pattern (11). When estrogen is removed, as with the progestin-only pill (POP) containing DRSP 4 mg in a 24/4 regimen, high rates of unscheduled bleeding and a lack of scheduled bleeding occur as compared to combination products (11).

From a practical, user-orientated perspective, the greatest non-contraceptive advantage of combined oestrogen-progestin pills over progestin-only pills is their ability to produce a consistent, regular bleeding pattern (13). Therefore, a good reason for adding an oestrogen in a contraceptive is to enhance cycle control, users' acceptability, and product continuation (14–17). Nonetheless, comparing results across clinical trials can be challenging due to the varied definitions employed for reporting bleeding events or describing cycle control parameters (18).

4 What are key features of oestrogens contained in combined oral contraceptives in relation to contraceptive efficacy and safety?

Panel discussion summary remarks

- Oestrogens in COCs act through their effects on oestrogen receptors (ERα and ERβ).
- EE and E2/E2 V affect receptor interactions in a comparable manner but at different dose levels.
- E4 does not affect ERα receptors universally in the same way as all other oestrogens and is classified as a Native Oestrogen with Selective Action in Tissue (NEST).

(continued)

- The half-life of the oestrogen directly impacts menstrual cycle control. EE and E4, with long half-lives, typically provide a predictable bleeding pattern in combination with a progestin where E2, with a short half-life, commonly results in poor cycle control.
- EE increase VTE risk due to liver effects that induce hematologic changes; the impact of EE on the liver is modulated by the progestin component.

The physiological functions of oestrogenic products are modulated by the oestrogen receptors (ER) subtypes alpha (ER α) and beta (ER β) present in different tissues such as the breast, brain, liver, skin and epithelial and fibromuscular tissues (19). The oestrogens used in COCs all have different properties (20) (see Box 1). These properties relate to the way in which oestrogens exert their effects at their receptors which is more important than their relative amount in the pill (36).

E4 activates the nuclear ER α , but it antagonizes/agonizes (mixed) the membrane ER α , in contrast to other oestrogens

BOX 1 Key characteristics of oestrogens currently available in COCs.

EE

- Synthetic oestrogen (21).
- ER α selective agonist (22).
- Decreases luteinizing hormone to reduce endometrial vascularization.
- Diminishes gonadotrophic hormone to prevent ovulation.
- Long duration of action (23).
- Acceptable oral bioavailability (38%–48%) (21, 24).
- Binds significantly to plasma proteins (98.3%–98.5%) (23).
- Stronger effect than natural E2 on hepatic metabolism including liver protein synthesis (25).
- Half-life (oral) $\approx$ 24h (26) ($\approx$ 5–30 h) (20).
- Increased resistance to metabolism that implies high risk of thromboembolic events (27–29).
- The contribution of EE to total estrogenic load in the environment from all sources (including other human pharmaceutical oestrogens, endogenous oestrogens, natural environmental oestrogens, and industrial chemicals), while highly uncertain and variable, appears to be relatively low overall (30).
- EE is more persistent in the environment than natural oestrogens and may be a greater cause for environmental concern (31).

E2

- Natural oestrogen (20, 32).
- ER α and ER β agonist with approximately equal affinity (22) although slightly higher affinity for ER β (20).
- Decreases luteinizing hormone to reduce endometrial vascularization (20).
- Diminishes gonadotrophic hormone to prevent ovulation (20).
- Regulates blood pressure, stimulates endothelial healing and re-endothelialisation, prevents coronary vasospasm caused by endothelial dysfunction, and favours angiogenesis (28, 33).
- Low oral bioavailability (2%–10%) (32).
- Micronization and esterification needed to enhance oral bioavailability (24, 34).
- E2 valerate is the synthetic valerate ester of E2 (35).
- Binds significantly to plasma proteins (>95%) (32).
- Half-life (oral) $\approx$ 12 h–20 h (20, 32).
- Half-life of E2 in the environment is short and can be biodegraded relatively rapidly (31).

E4

- Native, human-specific oestrogen, produced predominately by the foetal liver during pregnancy only (28, 36, 37).
- Native Estrogen with Selective Activity in Tissues (NEST) with distinctive vascular and metabolic effects (28, 36).
- Activates the nuclear ER α but antagonizes/agonizes (mixed) the membrane ER α . (28).
- High oral bioavailability (70%) (28, 38, 39).
- High ER specificity diminishes the risk of effects on off-target tissues (36).
- Limited impact on the liver: limited impact on the production of liver proteins (36).
- Low impact on normal and malignant breast tissue, on haemostasis parameters, coagulation factors, coagulation inhibitors, fibrinolysis, angiotensinogen, triglycerides, and cholesterol, and bone and insulin-like growth parameters (28, 36, 40, 41).
- Binds moderately to plasma proteins (<50%); minimal binding to SHBG (36).
- Half-life (oral) $\approx$ 28 h (20, 36).
- Predicted environmental exposure to E4 will not affect the aquatic ecosystem (37).

EE, ethinylestradiol; E2, oestradiol; E4, oestetrol; ER, estrogen receptor; SHBG, sex hormone binding globulin.

BOX 2 Most important effects related to oestrogens and E4 (36, 48).

Target tissue (receptors involved)	Actions of oestrogens	E4 differential characteristics
Adipose tissue (ERα; ERβ) (49, 50)	- Adipogenesis - Adipose tissue metabolism	ERα inhibition Prevents weight gain and steatosis (animal finding) Enhances energy expenditure (animal finding) (51)
Bone (ERα; ERβ) (49, 50, 52)	- Bone turnover, growth - Osteoporosis prevention	Dose-related decrease of biomarkers of osteocalcin, bone resorption, and bone formation (50, 53)
Brain (ERα; ERβ) (49, 54)	- Neuroprotection - Pain sensitivity - Inhibition of inflammation - Memory	ERα activation (49)
Breast (ERα; ERβ) (49, 55)	Tissue (normal and neoplastic) proliferation	Inhibition Antiestrogenic effects on breast cancer cells (55)
Heart (ERα; ERβ) (49)	Cardio-protection	ERα activation (36)
Liver (ERα) (56)	- Cholesterol production - Clotting factors production	Minimal effect Minimal interference with liver cells and drug metabolism (57) Minimal impact on SBHG, coagulation factors, and triglycerides (58)
Ovaries (ERα; ERβ) (49, 54, 59)	Follicle growth	Inhibition Prevents ovulation (59)
Uterus (ERα) (60, 61)	Endometrial proliferation	ERα activation (61)
Vascular system (ERα; ERβ) (28, 49)	- Vasodilation - Atherosclerosis prevention	ERα activation (28, 49)

E4, estetrol; ERα, oestrogen receptor alpha; ERβ, oestrogen receptor beta; SBHG, sex hormone binding globulin.

(20, 28). Because of this differential mechanism of action, it is classified as a Native Oestrogen with Selective Action in Tissue (NEST). The selective tissue activities of E4 are the consequence of its unique pharmacological profile (42), displaying distinct effects on different tissues which implies a limited impact on the production of liver proteins, and on haemostasis, endocrine and metabolic parameters, rendering a better safety profile compared with other oral oestrogens (28, 36, 39, 40, 42). E4 is a terminal oestrogen that does not convert into other oestrogens and has a long half-life of about 28 h (20, 36, 43). EE also has a prolonged half-life of up to 30 h (20, 44, 45) and therefore both EE and E4, with a progestin, typically offer a predictable bleeding pattern (43, 46). However, EE has been linked to an increased risk of venous thromboembolism (VTE); its dosage and the type of progestin in an EE based COC play crucial roles in modifying this risk (47). Additionally, EE significantly affects the cytochrome P450 system influencing the metabolism of other drugs (23) (see Box 2). Oral E2, with a short half-life of up to 20 h (20), requires micronization to extend its half-life, yet still

it tends to result in poor cycle control (32, 45). E2 and E4 in COCs may have a lesser impact on stimulating coagulant proteins compared to EE (20) (Box 1).

5 How can oestrogenicity of COCs impact safety?

Panel discussion summary remarks

- Evidence linking COCs to increased VTE risk emerged soon after their introduction.
- VTE risk was higher in COCs containing 50 µg or more of oestrogen (mestranol or EE) compared to lower-dosage preparations.
- The type of oestrogen in the contraceptive and progestin influences VTE risk. The progestin component modifies this oestrogen effect and has no direct effect on VTE risk.

(continued)

- E2, while less thrombogenic than EE, did show lower VTE risk in a study with E2/nomegestrol acetate (NOMAC) compared to EE/levonorgestrel (LNG) COCs.
- E2 V/dienogest (DNG) appears to have a VTE risk similar to EE/LNG-containing COCs.
- E4 15 mg combined with DRSP 3 mg shows less pronounced changes in thrombosis factors compared to EE 20 µg/DRSP 3 mg and similar or smaller changes compared to EE 30 µg/LNG 150 µg. This could translate to a low potential for VTE and suggests a risk less than or similar to EE 30 µg/LNG 150 µg. Population-based data are lacking.

Evidence suggesting that oral contraceptives were associated with an increased VTE risk appeared rapidly after they were marketed (62). VTE occurred more frequently with COCs containing more than 50 µg of oestrogen, either mestranol or EE, compared to preparations containing a lower dosage (62). However, oestrogens differ in their effects on thrombotic markers irrespective of the progestin, and newer progestins may affect the impact of oestrogens on haemostatic markers differently than older progestins (62). For instance, the combination of E4 with DRSP resulted in less pronounced alterations in thrombosis factors compared to EE 20 µg/DRSP 3 mg, and comparable or smaller effects compared to EE 30 µg/LNG 150 µg (63). Also, E2 has less of an effect than EE on thrombosis parameters (13, 20). For instance, VTE in E2 COC users has been estimated at 20 cases in 61,600 woman-years (3.2/10,000 users per year) and in EE/LNG COC users at 28 cases in 62,807 woman-years (4.5/10,000 users per year) (64).

Thrombotic marker data are encouraging but are not sufficient to fully assess VTE risk, which requires more research, in particular large scale population based studies (63). Until now, limited epidemiological evidence suggests that E2 V/dienogest (DNG) may have an estimated VTE risk similar to LNG containing COCs (65), or lower vs. EE/LNG (66) while a population-based phase 4 study of E2/nomegestrol acetate (NOMAC) revealed a notably reduced risk of VTE in comparison to EE/LNG COCs [HR: 0.31 (95% CI, 0.13–0.75)] (67). Across the full E4/DRSP clinical program (pooled phase 2 and 3 trials) one VTE case was reported and the estimated annual VTE incidence was relatively low (3.66/10,000 woman-years). This relatively low risk was also reported in a recent modelling study that used the Activated Protein C Resistance as a predictor of VTE risk (68).

Overall, COCs containing natural oestrogens may be preferable over those with synthetic oestrogens due to their lower liver impact. Currently, the clinical and real-world data regarding E2 suggest a VTE profile that may be safer than EE. This promising finding raises expectations that a similar trend may be observed with the non-synthetic oestrogen E4 when combined with DRSP. Nevertheless, definitive conclusions regarding the VTE risk await the completion of post-marketing surveillance studies (40, 63, 69).

6 What are the non-contraceptive benefits of COCs?

Panel discussion summary remarks

- COCs can alleviate various menstruation-related symptoms, including premenstrual syndrome (PMS), premenstrual dysphoric disorder (PMDD), heavy menstrual bleeding, dysmenorrhea, and irregular bleeding.
- Oestrogens in COCs may have positive effects on mental health, mental performance, and cognition; and may also positively influence libido, sexual desire, and vaginal lubrication.
- COCs are prescribed for dermatological reasons, including the treatment of hirsutism and acne.
- Water retention and weight gain is associated with the use of oestrogens.
- E4 when combined with DRSP in a 24/4 regimen may offer several non-contraceptive beneficial effects. However, comprehensive insights into these effects are still premature at this stage.

Oestrogens play a vital role in the non-contraceptive benefits of COCs. Using the right oestrogen-progestin combination can alleviate symptoms and signs in various clinical scenarios, as acknowledged by the expert panel. Examples provided include menstrual-related depressive symptoms, heavy menstrual bleeding (HMB), painful periods, and irregular bleeding (70–74). Certain COCs are approved for treating these conditions (75). For example, E2 V/DNG is indicated for HMB treatment (76) and EE 20 µg/DRSP 3 mg for PMDD treatment (77).

Changes in hormone levels, whether natural or due to contraceptives, can significantly impact emotions (78). COCs with E2 may improve mental health and cognition (79–81), potentially easing depressive symptoms in PMDD (82, 83). COCs can influence libido and vaginal health (84, 85). COCs are also used to treat dermatologic conditions like hirsutism and acne due to their antiandrogenic effects (73, 74, 86–89).

Although trials suggest no direct evidence of COCs causing weight gain, patients still commonly associate their use with this outcome (90). COCs containing DRSP, however, may help prevent weight gain (91). Additionally, COCs could affect migraine frequency, especially menstruation-related migraines, with some formulations showing potential for providing relief (92, 93).

The evidence regarding the non-contraceptive effects of E4 on women's health is still at an early stage. Theoretically, due to its extended half-life and limited impact on the liver, E4 might effectively alleviate physical symptoms associated with PMS (94), such as breast tenderness, headaches, and water retention. Pre-clinical studies suggest that E4 may support vaginal health by promoting epithelial proliferation and lubrication (95, 96). Combining E4 with DRSP also seems to have minimal impact on weight gain (97, 98). There is speculation that contraceptives with natural oestrogens like E4 might be preferred by women experiencing menstrual migraines due to potentially lower cardiovascular risks compared to those containing synthetic oestrogens (92). However, further clinical

data is necessary for a more comprehensive understanding of the effects of E4 on users' health, especially those effects that will require follow-up of long-term use. It is noteworthy that in combination with DRSP, E4 has demonstrated high user acceptability and satisfaction, with users expressing a willingness to continue with the contraceptive and reporting a sense of well-being (98).

7 What are the bone effects of oestrogens in COCs in adolescents and young adults?

Panel discussion summary remarks

- Oestrogens play a critical role in bone development during puberty.
- Oestrogen deficiency in adolescence may heighten osteoporosis risk later in life.
- E4 may impact bone development differently than EE, potentially offering better prevention against bone loss, although further research is needed for confirmation.

Oestrogens are key regulators of bone turnover in both females and males and play a major role in longitudinal and width growth throughout puberty as well as in the regulation of bone turnover (52). Oestrogen deficiency in adolescence might increase the likelihood of osteoporosis, particularly in individuals with high baseline bone turnover (52, 99–101). Limited data exist regarding the effects of COCs containing E4 on bone tissue. E4, when compared to EE, may have a lesser impact on SHBG and androgens, with a potentially positive effect on bone development in teens (36). Initial findings suggest that E4 might be more effective in preventing bone loss and bone demineralization than other EE (36, 43, 102), but further research is necessary to confirm its efficacy.

In general, COCs are popular among adolescents for birth control, but poor adherence can result in contraceptive failure (103). Choosing the most suitable COCs among adolescents should include counselling on the non-contraceptive benefits of COC. Discussions about improvements in HMB and dysmenorrhea, cycle regularity, possibly acne, hirsutism, and premenstrual symptoms, which are all common amongst adolescents, are important (104). Additionally, information about the COC protective effect against endometrial and ovarian cancer can also be provided (104).

8 Conclusions

Oestrogens play an important role in the contraceptive efficacy, bleeding patterns, and overall tolerability/safety of COCs. Beyond contraception, oestrogens in COCs also can alleviate menstrual symptoms, have a positive impact on mood, and potentially affect bone health, and other aspects of well-being. All these

properties, alongside the risk of VTE are crucial in tailoring contraceptive choices. For adolescents, discussions around adherence and bone health should also shape COC choices. Recent studies exploring E4 combined with DRSP show promising results compared to traditional formulations. However, population-based outcomes and long-term effects will only come with further research. Continuous research promises deeper insights into the nuanced effects of E4 in COCs, enabling more informed and tailored contraceptive decisions.

Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding authors.

Author contributions

MC: Conceptualization, Writing – original draft, Writing – review & editing. AC: Writing – review & editing. RS: Writing – review & editing. PS: Writing – review & editing. NC: Writing – review & editing. TK: Writing – review & editing. TS: Conceptualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

MC has received speaking honoraria from Gedeon Richter, Mayne and OLIC, served on Advisory Boards for Gedeon Richter and Mayne, has stock options with Femasys, and has consulted for Estetra SRL, and Medicines360. The Department of Obstetrics and Gynecology, University of California, Davis, receives contraceptive research funding for MDC from Chemo Research SL, Evofem, Medicines360, Merck, Sebela, and Sumitomo Pharma. AC has received speaking honoraria and served on Advisory Boards for Gedeon Richter, Bayer, Organon, Exeltis, and Italfarmaco. RS has received speaking honoraria

from Gedeon Richter and Novo Nordisk Pharma, has consulted for Theramex Poland and Gedeon Richter, and participates in phase 4 clinical trial nr HUXX-NIS-E4DRSP-1/2020. PS has received speaking honoraria from Gedeon Richter, Max Zeller & Soehne, Jenapharm, Drossapharm, EFFIK, Labatec, Besins Healthcare, Astellas, Theramex, Schaer Pharma, Bayer and Exeltis. PS served on Advisory Boards for Gedeon Richter, Theramex and Astellas. NC-B has served on Advisory Boards for BESINS, Exeltis, and Gedeon Richter. NC-B participates on clinical trial for Bayer and Organon. TK has received consulting fees from Hervana, TEVA, Osteopharma, Starodub, Eagle Rock, Merck, Luye, QPharma, Disphar, PantaRhei, Gedeon Richter, Mithra, IPM, Myovant and Organon. TS has received consulting fees from Abbott, Astellas, Gedeon Richter, Mitsubishi Tanabe, Sojournix,

Estetra, Mithra, Actavis, Medtronic, Shionogi, Applied Medical and speakers' honoraria from Shionogi, Gedeon Richter, Intuitive Surgical, Applied Medical and Theramex.

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High adherence to intermittent and continuous use of a contraceptive vaginal ring among women in a randomized controlled trial in Kigali, Rwanda

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Background: The introduction of female-initiated drug-delivery methods, including vaginal rings, have proven to be a promising avenue to address sexually transmitted infections and unintended pregnancies, which disproportionately affects women and girls in sub-Saharan Africa. Efficient uptake of existing and new technologies such as vaginal rings requires in depth understanding of product adherence. This remains a major challenge as data on adherence to vaginal rings from African countries is limited. In this study, we explored adherence of contraceptive vaginal ring (NuvaRing®) use in Kigali, Rwanda using a mixed methods approach.

Methods: We collected quantitative and qualitative data at multiple time points from women participating in a clinical trial exploring the safety and acceptability of either intermittent or continuous use of the NuvaRing®. Various adherence categories were used including monthly and cumulative adherence measurement. The quantitative data were analysed using R and the qualitative data were analysed using a deductive, content-analytical approach based on categories related to the quantitative adherence measures. All data were compared and triangulated.

Results: Data from 120 enrolled participants showed that self-reported adherence was high at every study visit in both study groups. At first study visit 80% of the intermittent ring users and 79.7% of the continuous ring users reported perfect adherence (assessed as "the ring was never out"). Reporting of ring expulsions and removals were highest (28.3%) at the beginning of the trial. Self-reported perfect ring adherence increased during the study and reports of ring expulsions and removals declined as familiarity with this contraceptive method increased. The percentage of women with perfect cumulative adherence was non-significantly higher in the intermittent (61.7%) than in the continuous use group (54.3%). The low rate of discrepant adherence data after triangulation (6%) is in line with the perception of the participants as adherent throughout the study.

Conclusions: Self-reported adherence in both study groups was high with removals and expulsions being within the expected product range. Comprehensive adherence data triangulation allowed for a deeper understanding of context-driven behaviour that shaped adherence patterns and challenges. Our data categorisation and triangulation approach has shown potential for implementation in future vaginal ring studies aiming to better understand and measure adherence.

KEYWORDS

NuvaRing, contraceptive vaginal ring, adherence, mixed methods, Rwanda

Introduction

The burden of sexually transmitted infections (STIs), including HIV, and unintended pregnancies in women living in low- and middle-income countries remains high as was highlighted by the latest UNAIDS report “In Danger” (1). In 2021, women and girls in sub-Saharan Africa accounted for 63% of all new HIV infections and had the highest proportion of unmet need (21%) for modern contraception (2, 3). Women living with HIV, or in areas with high HIV prevalence, also have higher unmet needs for family planning and reproductive health services compared to the general population (4). Published data has shown that with an increase in family planning choices, there has been an increase in contraceptive users and, the reproductive health product pipeline of female-initiated drug-delivery methods, including vaginal rings, has progressed rapidly in recent years (5–9). Some examples of newly approved methods are a long acting (12-month) segesterone acetate/ethinyl estradiol contraceptive vaginal ring, the progesterone ring Progering® for postpartum women, and vaginal rings for HIV prevention such as the monthly dapivirine ring (10–13).

Whilst increasing choice remains crucial, efficient uptake of existing and new vaginal rings requires an in-depth understanding of user preferences, and barriers and facilitators to acceptability and adherence (8, 14–20). Multipurpose prevention technologies (MPTs) targeting combination(s) of HIV, other STIs, and unintended pregnancy are currently under development. MPTs, and especially long-acting MPTs, could be a game changer for many women and may improve adherence (5, 8, 21–23). For example, studies have shown that many women perceive their risk of getting pregnant as higher than their risk of getting infected with HIV (16, 24). In addition, contraceptive use is more normalized in most countries, and less controversial to discuss, than HIV prevention use (24). However, MPTs may also present new challenges; vaginal ring use for HIV prevention has to be continuous whereas vaginal ring use for contraception has historically been intermittent with a one week break to allow for menstruation (18, 21, 23–26).

Product adherence remains a major challenge (27). The female-initiated drug-delivery research field has seen an increase in user preferences research and a broader interest in socio-, cultural- and economic factors including partner and peer influences, but research into better (qualitative) adherence measures has been limited; most researchers still rely solely on self-report whereas

others have focussed on potential biomarkers (28–33). A clinical trial was conducted among Rwandan women to explore the safety and acceptability of a contraceptive vaginal ring (NuvaRing®). Women were randomized to either intermittent use or continuous use of this ring. The trial results showed that the use of the contraceptive vaginal ring was safe and reported a high acceptability in both groups (19, 34,35). However acceptability and adherence to a product are intrinsically linked and there is limited evidence on adherence to vaginal rings including contraceptive vaginal rings (28–33). In this study we aimed to better understand self-reported adherence patterns in intermittent and continuous first-time vaginal ring users to inform the future introduction of HIV prevention or MPT vaginal rings that require continuous use.

Methods

Study design

The RingPlus study was an open-label single-centre clinical trial with randomisation to either an arm of intermittent or an arm of continuous NuvaRing® use to evaluate its safety among Rwandan women (clinicaltrials.gov registration NCT01796613). The trial was conducted from June 2013 to March 2014 at the Rinda Ubuzima research site in Kigali, Rwanda, and included a comprehensive social science component to explore ring use acceptability and adherence. The study protocol, the primary safety outcomes, and the primary acceptability outcomes have been published elsewhere (19, 34–36). However, key methods are also summarized here to facilitate interpretation of the results.

Study participants

In order for women to be eligible for the study, they had to be in good physical and mental health, HIV negative, sexually active, and between 18 and 35 years old. They should not currently be using modern contraceptive methods but should be interested in, and medically eligible for, initiating hormonal contraceptive use. Exclusion criteria included currently smoking or breastfeeding, current use of antimicrobial medication, or having any medical contraindications to NuvaRing® use. All participants provided written informed consent.

Sample size

This clinical study sample size calculation was based on the primary objective to assess the pre-post changes in the vaginal microbiome. More details can be found in the protocol publication (34). For the qualitative research, sample sizes were determined by when data saturation was reached.

Study procedures

Due to the differences in ring use (intermittent or continuous use), this study was an open-label study. At enrolment, women were randomly assigned to either intermittent or continuous use of the ring based on the clinical trial database generated allocation codes. Treatment allocation was concealed until a participant has provided informed consent, was confirmed eligible, was included in the study and had inserted the CVR (34). The participants were taught how to use the ring and asked to insert their first ring in the presence of a female research nurse. If the participants felt uncomfortable for the initial insertion, a nurse or physician would help with insertion. Participants were advised to keep the ring in during menses and daily activities. They were counselled and received written instructions on how to clean and reinsert the ring in case of accidental expulsions or after purposeful removals. The total follow-up duration was a maximum of 14 weeks with a maximum of seven study visits. Intermittent users wore three rings, and continuous users wore four rings, during the study. Scheduled follow-up visits coincided with times of ring removal and/or insertion. At all ring removal visits, a physical and pelvic examination was done which included verification of the ring *in situ*, samples were collected, and case report forms (CRFs) and an interviewer-administered questionnaire (IAQ) were completed. Risk-reduction counselling and testing, condoms and treatment for curable STIs were offered as well as referrals for other medical conditions.

Data collection

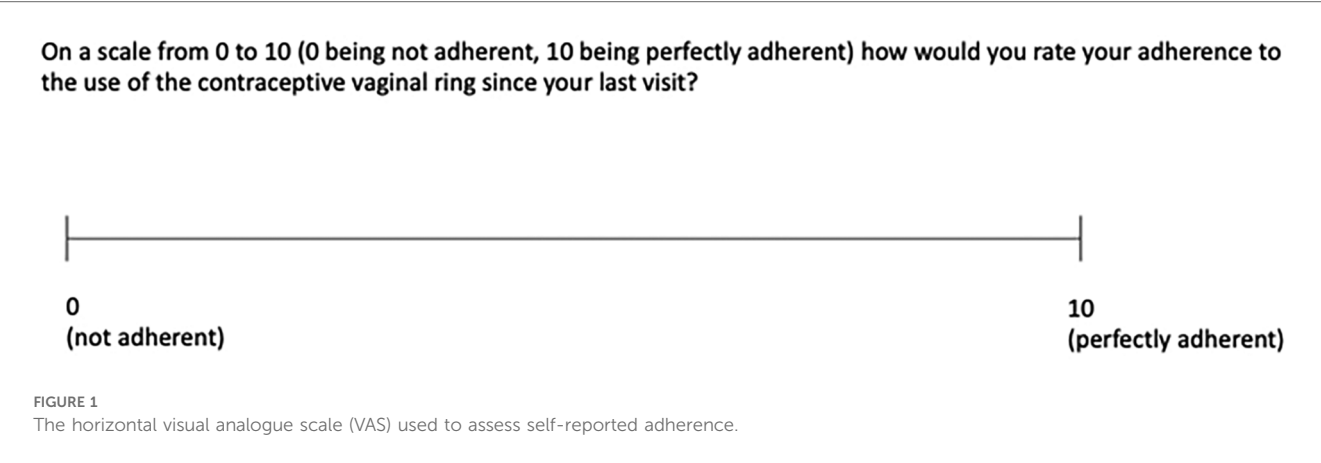
The team used a mixed methods approach, including triangulation of quantitative and qualitative data sources on adherence during and after the study (37). Study staff administered CRFs and IAQs at enrolment before the first ring insertion and at every ring removal follow-up visit. The CRFs documented the physical and pelvic examination findings, laboratory test results, social harms, adverse events and/or concomitant medications, and data on ring use and adherence. The latter was based on a discussion with the participant using a diary card that she had completed at home [Supplementary Appendix 1: Diary card]. Diary cards were provided at each visit to document all ring removals, expulsions, as well as sexual acts and vaginal practices between visits. The IAQs included (open-ended) questions on sexual activities, menses, ring acceptability and adherence (38). During the IAQ, the team collected

qualitative data to better understand the participants' underlying behaviours and what influenced them during the study. Participants were also asked if the ring ever came out of the vagina since their last visit, with detailed follow-up questions regarding duration of and reason for each ring removal and/or expulsion, and whether the ring was cleaned and reinserted. This detailed questioning was to allow the study team to evaluate whether more expulsions and/or removals would lead to reduced adherence as mentioned in other publications (39). Participants were also asked to complete a visual self-rating adherence scale (ranging from 0% to 100%) at each study visit (Figure 1).

The team collected qualitative data to better understand the participants' underlying behaviours and what influenced them during the study. In-Depth Interviews (IDIs) with purposively selected study participants were conducted during the study and after study completion until data saturation was reached. This comprehensive data collection approach was complemented by triangulation of CRF, IAQ, and diary data at regular intervals during the study, documenting any discrepancies on comparison forms. At the last study visit, study nurses discussed all inconsistencies documented on the comparison forms with the participants using individually tailored open-ended questions. At that same last visit, anonymous ballot box questionnaires were collected for all participants. These questionnaires consisted of six questions, which included (among other things) questions about overall adherence and women's satisfaction with study participation. Data triangulation was planned in two phases based on a methodology by Pool et al. (37). Phase one consisted of comparing individual participant data from different data collection tools and clarifying discrepant results with those participants. Phase two consisted of broader, contextual triangulation, in which the results from individual participants were combined and linked to more general data emerging from the qualitative data. After study completion one FGD with purposively selected study participants was conducted to probe further into ring expulsions.

Adherence and outcome measures

The level of adherence was (semi-)quantified in multiple ways. Adherence to the ring was based on observed product use at the visits and self-reported use. Observed product use was done during the scheduled pelvic exam by a physician and the following questions were answered on the CRF "Was the ring in place at the start of the visit?" For the self-reported use, we first considered the answer to the following question on the CRF and IAQ "Since your last regularly scheduled visit, how many times was the vaginal ring out of your vagina?" The response could be a number or a separate answer stating "the ring was never out of the vagina". The latter (the ring was never out) was defined as *perfect* adherence (Table 1). If the former (the answer was a number of times the ring was out), questions were asked about the last (most recent) time the ring was out first, followed by questions about the other times that the ring was out. These included questions about how the ring came out or was



removed, the duration that the ring was out, and whether the ring was reinserted. These events were coded as high, mid-high, mid-low, low, and non-adherence depending on the duration (in hours) that the ring was out of the vagina since the duration the ring is out of the vagina corresponds to levels of pregnancy risk (40–42). According to the NuvaRing® user instructions, a woman is considered to be at risk of pregnancy if the ring has been out for more than three hours, therefore in the categories mid-low, low, and non-adherence, protection from pregnancy may be reduced if a (new) ring is inserted more than 3 h after expulsion or removal (40). As an example, a participant was assigned to the mid-low adherence category if she reported that the ring was out of the vagina for a duration between 3 and 12 h since the previous visit. If the ring had been out of the vagina multiple times since the last regularly scheduled visit, the longest duration out of the vagina was considered to categorize self-reported adherence.

This type of categorization represents the rigorousness and strict follow-up of a clinical trial setting. It is less useful for assessing real-world contraceptive effectiveness or to inform

public health counselling and messaging. Multiple handbooks about family planning state that levels of protection are not affected if the ring was out of the vagina for more than 48 h or less from week 1 through week 3 (40, 43–45). The study team therefore also categorized self-reported adherence data for each visit based on the percentage of whole or partial days that participants wore the ring since the last regularly scheduled visit, as developed by Montgomery et al. (41). This was done by dividing the number of days or partial days (12 h or more) that participants wore the ring by the number of days that the ring should have been worn since the previous visit (21 days). For example, a participant was classified as “80% adherent” if she reported that the ring was in the vagina for 80% of the days since the previous visit. This categorization gives a more appropriate insight into levels of self-reported adherence that matter for behaviour change interventions and are required to achieve contraceptive coverage on a population level. In addition to the measures of self-reported adherence assessed at each visit for the period between the previous and the current visit, overall cumulative ring adherence was calculated across all visits.

TABLE 1 Overview of adherence measurements.

Adherence categories			
Monthly ring adherence	Self-reported ring adherence by study group and by visit based on duration (in hours) that the ring was out of the vagina.	Perfect adherence	Ring never out
		High adherence	Ring out < 1 h
		Mid-high Adherence	Ring out between 1 and 3 h
		Mid-low Adherence	Ring out between 3 and 12 h
		Low adherence	Ring out between 12 and 24 h
		Non-adherent	Ring out > 24 H
Monthly ring adherence (montgomery)	Self-reported ring adherence by study group and by visit based on the proportion (percentage) of whole or partial days (12 h or more) that the participants wore the ring by dividing the number of days that the ring was worn by the number of days that the ring should have been worn since the last regular scheduled visit.	Perfect adherence	Ring inserted 100% of 21 days
		Ring inserted > or equal to 80% of 21 days	
		Ring inserted < 80% of 21 days	
		Ring inserted < 50% of 21 days	
Cumulative ring adherence	For the cumulative adherence categorisation, this was done by adding all durations the ring was out during the study to arrive at an overall duration that the ring was out (in hours).		
Cumulative ring adherence (montgomery)	For the Montgomery cumulative adherence categorisation, this was done by dividing the number of days that the ring was worn across the duration of the study by the number of days that the ring should have been worn during the study.		

Cumulative adherence was added as a measurement to better understand self-reported adherence across a longer period of time (several menstrual cycles) as contraceptives are typically used for a long duration. Data suggests that some contraceptive methods (including the ring) are easier to use the longer they are used as sense of comfort, familiarity etc. increase and initial worries decrease, additionally, publications support findings that familiarity with a delivery method is correlated to preference (29). Cumulative adherence was calculated by adding all durations that the ring was out during the study to arrive at an overall duration that the ring was out (in hours). For the Montgomery adherence categorisation, this was done by dividing the number of days that the ring was worn across the duration of the study by the number of days that the ring should have been worn during the study. To evaluate the potential risk of pregnancy, women were asked whether they had had intercourse during the time that the ring was out of the vagina. Of note, these classifications make no distinction between expulsions and removals.

The self-rating adherence scale was a horizontal line of 10 cm on a piece of paper (Figure 1). Women were asked: “On a scale from 0 to 10 (0 being not adherent, 10 being perfectly adherent) how would you rate your adherence to the use of the contraceptive vaginal ring since your last visit?” and to draw a vertical line at the point reflecting their adherence perception. The distance from the left endpoint to the mark was measured in cm.

Data analysis

The quantitative data were analysed using R, version 4.1.1., and are presented in contingency tables (frequency for categorical data; median and interquartile range (IQR) for continuous data. Chi-square tests were used to compare categorical variables between study groups. The FGD and IDIs were audio-recorded, transcribed in Kinyarwanda, summarised into English, verified and uploaded into Nvivo 10. The open ended questions, the FGD and the IDIs were analysed using a deductive, content-analytical approach using a codebook based on categories related to the quantitative adherence measures. Coded data was summarised by key topics and presented to support and illustrate the quantitative findings.

Approvals

The study was approved by the Rwandan Ministry of Health and the Rwandan National Ethics Committee (approval number 481/RNEC/2013), the institutional review board of the Institute of Tropical Medicine (ITM) in Antwerp (approval number 864/13), the ethics committee of the University Hospital in Antwerp, Belgium (approval number 13/7/85) and the University of Liverpool in Liverpool, UK (approval number RETG000639IREC). The study was carried out according to the principles stated in the Declaration of Helsinki, all applicable national and international regulations, and the International Conference on

Harmonization and World Health Organization Good Clinical Practice guidelines.

Results

The study team collected quantitative data for all 120 enrolled participants. One participant was lost to follow up after enrolment but the team managed to reconnect with her and complete an end of study visit. The study team collected qualitative data for 104 of the 120 participants in at least one IDI and/or FGD.

Baseline characteristics of the study population

The baseline characteristics were well-balanced between randomisation groups (Table 2; see also (19)). The median age of the enrolled women was 28, 57.5% had a primary school or higher level of education, and 59.2% earned their own income. Most women were married (61.0%) or living with a steady partner (26.7%). About two thirds of the women (65.8%) had previously used a modern contraceptive method (mostly hormonal) and 38.3% had used a condom during their last sex act.

Categorising self-reported adherence

Monthly adherence

Self-reported adherence categorised by the duration (in hours) the ring was out of the vagina was high at every regular scheduled visit in both study groups (Figure 2 and Supplementary S1). Eighty percent of the intermittent users and 77.9% of the continuous users reported perfect adherence at the first scheduled study visit and this increased to 90% for both groups at the last scheduled study visit. Ten percent of the intermittent users and 13.6% of the continuous users were categorised as having high or mid-high adherence (which means they were still protected from pregnancy) at the first study visit and this decreased to 1.7% and 3.3%, respectively at the last study visit because perfect adherence increased. Of the seven intermittent users reporting high or mid-high adherence at the first scheduled study visit, six became and remained perfect adherers during the study. One woman reported perfect adherence at the second study visit but mid-high adherence at the last study visit due to ring removal because of discomfort. Of the eight continuous users reporting high or mid-high adherence at the first study visit, four became perfect adherers during the study, one was perfect adherent except for being high adherent at the third study visit. For the other three; one remained a high adherer at the second study visit and two reported respectively mid-low and low adherence at the second study visit. At the third study visit those three became perfect adherers and all remained perfect adherers till the end of the study.

The self-reported adherence categorised by the percentage of whole or partial days participants wore the ring was also high at each visit in both study groups (Figure 3 and Supplementary S2).

TABLE 2 Socio-demographic characteristics of all enrolled study participants (detailed per study group).

Baseline characteristics	All participants	Intermittent use	Continuous use
	(N = 120)	(N = 60)	(N = 60)
Age in years: (median; IQR)	28 (26; 31.9)	28 (25.5; 31)	28.5 (26; 32)
Highest level of education: n (%)			
No schooling	15 (12.5)	9 (15.0)	6 (10.0)
Primary school not completed	36 (30.0)	15 (25.0)	21 (35.0)
Primary school completed	44 (36.7)	24 (40.0)	20 (33.3)
Secondary school not completed	17 (14.2)	8 (13.3)	9 (15.0)
Secondary school completed	4 (3.3)	2 (3.3)	2 (3.3)
More than secondary school	4 (3.3)	2 (3.3)	2 (3.3)
Age of first intercourse in years: (median; IQR)	18 (15.7–21.1)	18 (15.5–20.8)	18.5 (15.8–21.4)
Marital status/home situation: n (%)			
Married	73 (60.8)	37 (61.7)	36 (60.0)
Not married, regular sex partner, living together	32 (26.7)	16 (26.7)	16 (26.7)
Not married, regular sex partner but not living together	15 (12.5)	7 (11.7)	8 (13.3)
Contraception history: n (%)			
None	41 (34.2)	19 (31.7)	22 (36.7)
Hormonal	79 (65.8)	41 (68.3)	38 (63.3)
IUD [†]	1 (0.83)	1 (1.7)	0 (0)
Injectables [†]	59 (49.2)	32 (53.3)	27 (45.0)
Pills [†]	29 (24.2)	11 (18.3)	18 (30.0)
Condom use at last sex act: n (%)	46 (38.3)	23 (38.3)	23 (38.3)
Any vaginal deliveries: n (%)	106 (88.3)	55 (91.7)	51 (85.0)
Any C-sections: n (%)	17 (14.2)	6 (10.0)	11 (18.3)
Ever anal sex: n (%)	1 (0.8)	1 (1.7)	0 (0)
Ever sex during menses: n (%)	18 (15.0)	5 (8.3)	13 (21.7)
Ever transactional sex: n (%)	9 (7.5)	5 (8.3)	4 (6.7)
Worried about getting HIV: n (%)			
Very worried	25 (20.8)	11 (18.3)	14 (23.3)
A little worried	41 (34.2)	21 (35.0)	20 (33.3)
Income			
Own income: n (%)	71 (59.2)	37 (61.6)	34 (56.7)
Average weekly income in Rwandese Francs	20,685	16,828 RwF	24,413 RwF

The majority of women in both groups were perfect adherers as described before. Using this adherence definition, 20% of the intermittent users and 18.6% of the continuous users were categorised as having good adherence (ring inserted for at least 80% of the expected 21 days) at the first study visit and this number decreased during the study to 6.7% at the last study visit as perfect adherence increased. None of these percentages were statically significant between the study groups. Adherence according to the self-rating scale was also high. In the intermittent use group, the median adherence value was 9.6 (visit 1), 9.7 (visit 2) and 9.7 (last study visit). In the continuous use group, the adherence data was 9.4 (visit 1), 9.4 (visit 2), 9.7 (visit 3) and 9.6 for the last study visit.

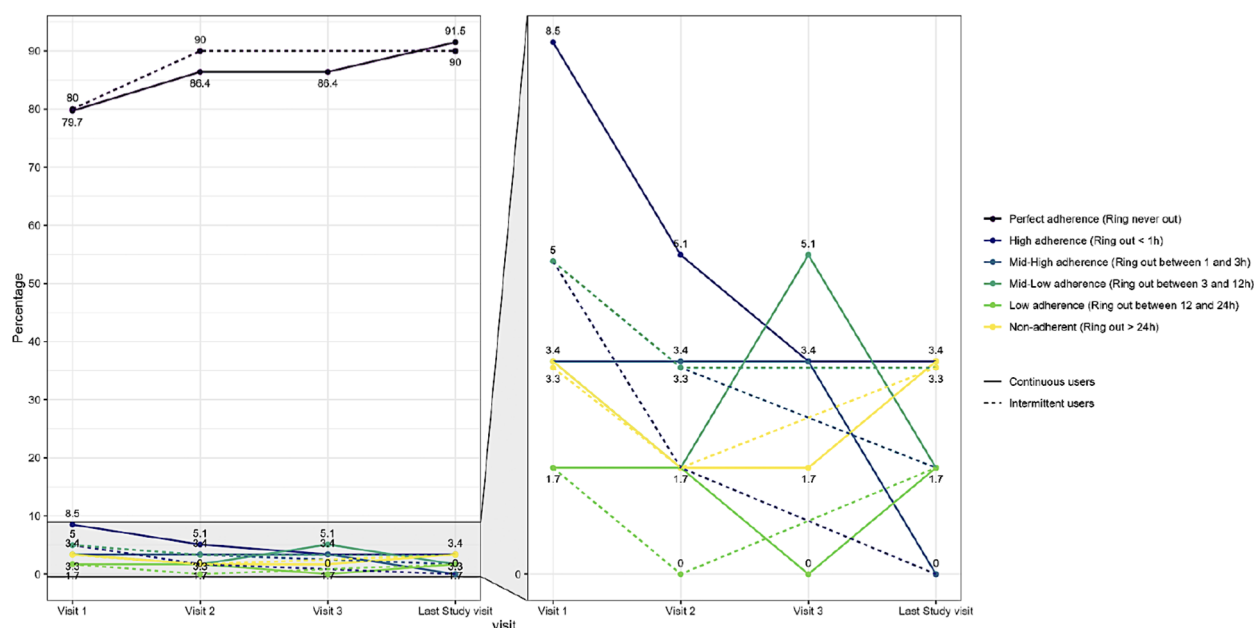
Cumulative adherence

Of the 120 participants enrolled, 119 had self-reported adherence data available for each of the three/four scheduled study visits and were included in the assessment of cumulative adherence. The percentage of women with perfect cumulative adherence was non-significantly higher in the intermittent use group (61.7%) than in the continuous use group (54.3%) (Table 3). However, 23.3% of the intermittent users and 23.8% of the continuous users were at risk of getting pregnant at some

point during the study period based on their reported adherence levels based on the number of hours that the ring was out of the vagina. The percentages of women with 80%–100% cumulative adherence based on the percentage of days that the ring was inserted were 93.4% and 96.7% for intermittent vs. continuous use, and only 6.6% and 3.3%, respectively, were considered non-adherent. None of the women became pregnant during the study. For the last study visit we also collected self-rating adherence data on the ballot box questionnaire for all participants. This was done anonymously so the data represents both study groups together. For the question: “Over the course of the study, was the ring out for more than three hours at any time (not considering the clinic visits or ring free periods)?” a total of 33 women ticked “YES”. This amounts to 27.5% of the participants, similar to the cumulative adherence data based on hours that the ring was out of the vagina.

Removals and expulsions

During the course of the study, 23 intermittent users (16.1%) reported 21 ring expulsions and eight ring removals out of a total of 180 ring insertions in that group, and 27 continuous users (17.3%) reported 36 ring expulsions and five ring removals out of a total of 237 ring insertions. Reporting of ring expulsions



Legend:

Adherence categories defined below as linked to Nuvaring® efficiency data.

Perfect adherence = The ring was never out of the vagina (answer to “Since your last regularly scheduled visit, how many times was the vaginal ring out of your vagina?”)

High Adherence = The ring was out < 1 h* outside scheduled removal visits

Mid-high Adherence = The ring was out between 1 and 3 hours outside scheduled removal visits

Mid-low Adherence = The ring was out between 3 and 12 hours outside scheduled removal visits

Low Adherence = The ring was out between 12 and 24 hours outside scheduled removal visits

Non-Adherence = The ring was out > 24 hours outside scheduled removal visits

* All hours are meant as continuous hours.

The figure on the left represents all adherence data points throughout the study and the figure on the right is an enlargement of the data points between 0% and 10% to enable better visualisation of trends.

FIGURE 2

Self-reported ring adherence by group and by visit based on duration (in hours) that the ring was out of the vagina. Legend: Adherence categories defined below as linked to Nuvaring® efficiency data. Perfect adherence = The ring was never out of the vagina (answer to “Since your last regularly scheduled visit, how many times was the vaginal ring out of your vagina?”). High adherence = The ring was out < 1 h* outside scheduled removal visits. Mid-high adherence = The ring was out between 1 and 3 h outside scheduled removal visits. Mid-low adherence = The ring was out between 3 and 12 h outside scheduled removal visits. Low adherence = The ring was out between 12 and 24 h outside scheduled removal visits. Non-adherence = The ring was out > 24 h outside scheduled removal visits. * All hours are meant as continuous hours. The figure on the left represents all adherence data points throughout the study and the figure on the right is an enlargement of the data points between 0% and 10% to enable better visualisation of trends.

and removals were highest at the beginning of the trial and declined during the study (Figure 4). The most frequent event associated with vaginal ring expulsion in the intermittent users was defecation and urination, which were associated with 28.6% of expulsions ($n = 11$ and $n = 14$, respectively; Supplementary S3). The most common reason for ring removal was discomfort/pain experienced by the participant or her partner ($n = 5$). Three rings were removed at the request of the male partner. There was no statistical difference between both study groups in terms of percentage of expulsions ($p = 0.372$) or removals ($p = 0.283$).

The intermittent users who reported ring removals or expulsions reported to have re-inserted the ring themselves 12 times (41.4%), and the ring was reinserted by clinic staff twice (6.9%) (Supplementary S3). The ring was rinsed with water 37.9% of the time, no one used soap as instructed. In the continuous user group, the ring was reinserted by the participants themselves 25 times (60.9%) and not reinserted by clinic staff. Half of the time (51.2%) the ring was rinsed with water, no one used soap. Although the majority of women did

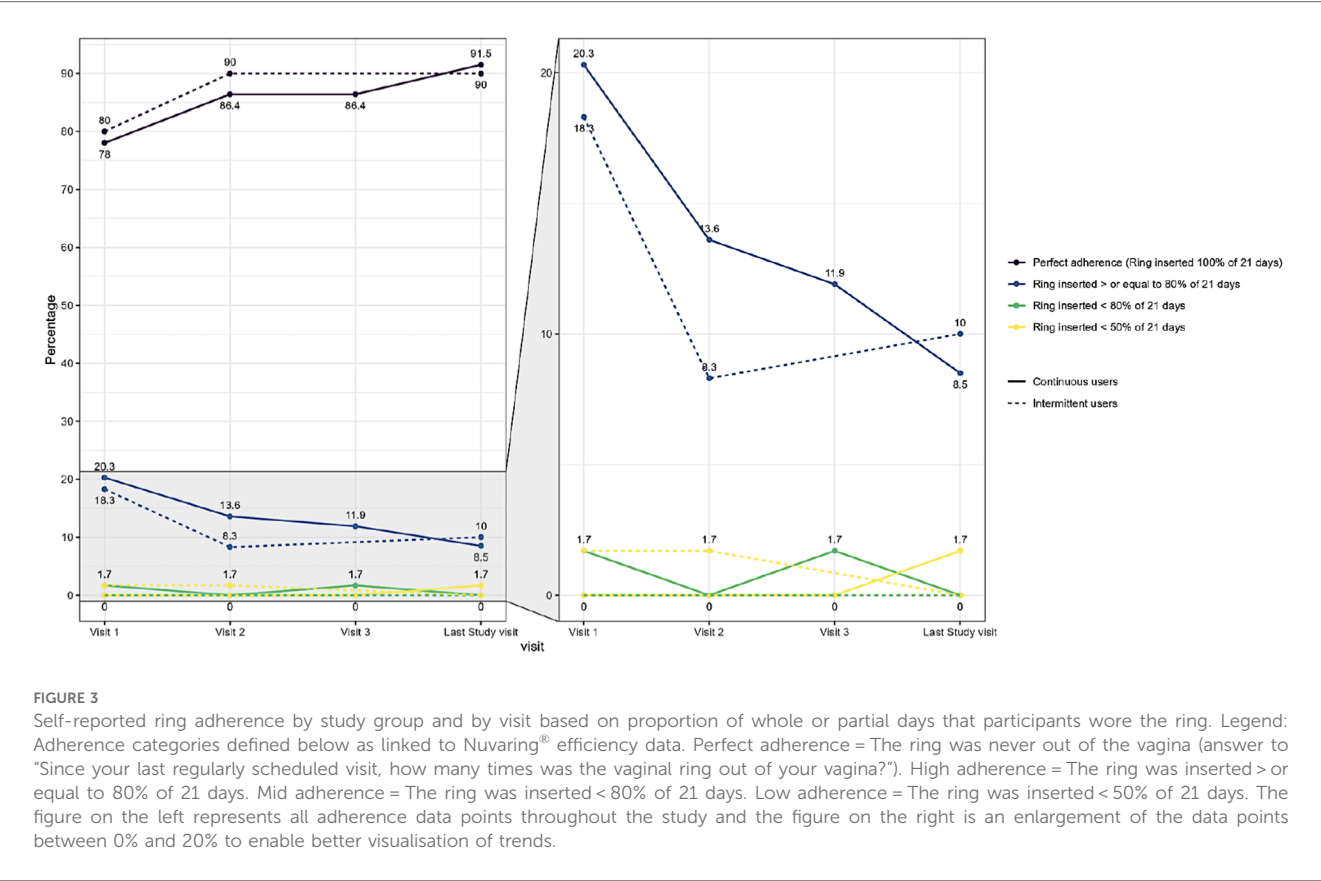
not engage in intercourse without the ring, one woman in the intermittent use group and nine in the continuous use group had sexual intercourse without the ring but all, except four in the continuous use group, used a condom.

Perceptions of adherence

When probing about how women defined adherence in our pre-trial IDIs, most of the women put a lot of weight on being compliant with study procedures which included coming on the right day and at the right time for the scheduled appointments.

P: “Adherence is fulfilling the program you have with someone or to do something that you have planned to do and you do it on time.” (29, married, 2 children)

P: “Adherence is like you have an appointment somewhere and you go there.”



P: “It is like you respect something, if they give you an appointment, you come on the time they gave you, don’t miss the appointment.” (35, married, 1 child)

Participant (P): “My adherence over the entire study was perfect, both myself and husband have liked the ring and would like to continue using it.” (29, not legally married, 2 children)

This finding was addressed by repeating how the study team defined adherence when subsequent questions were asked during the trial and at study end. On the last study visit we asked the following open-ended question: “How would you describe your adherence to the ring over the entire study?” Not a single woman (except the person who was lost to follow-up) stated that they had problems. The woman who was lost to follow-up came back for a last ring visit; she told the team that she stopped using the ring because she had not wanted to disclose her ring use to her partner. Almost half of the participants thought their adherence was perfect ($n = 54$).

The representation of the participants as being perfectly adherent was supported by additional insights provided by the IDIs.

P: “I would give myself 10/10.

Moderator (M): “10/10 meaning that you would adhere to all programs, isn’t what you told me that participation is? Adhering to all programs?”

P: “Yes.” (29, married, 4 children)

TABLE 3 Cumulative ring adherence per group.

Cumulative number of hours during the study ^a	Participants		Cumulative number of days during the study	Participants	
Study group	Inter. use (n = 60)	Cont. use (n = 60)	Study Group	Inter. Use (n = 60)	Cont. use (n = 60)
Perfect adherence (Ring never out)	37 (61.7%)	32 (54.3%)	Perfect adherence (ring inserted 100% of days)	37 (61.7%)	32 (53.3%)
High adherence (Ring out < 1 h)	3 (5.0%)	9 (15.3%)	Ring inserted 80–99% of days	19 (31.7%)	26 (43.4%)
Mid-High adherence (Ring out between 1 and 3 h)	6 (10.0%)	4 (6.8%)	Ring inserted 50–79% of days	0	0
Mid-Low adherence (Ring out between 3 and 12 h)	7 (11.7%)	6 (10.2%)	Non-adherent (ring inserted 0–49% of days)	4 ^b (6.6%)	2 ^b (3.3%)
Low adherence (Ring out between 12 and 24 h)	2 (3.3%)	3 (5.1%)			
Non-adherent (Ring out > 24 h)	5 ^b (8.3%)	6 ^b (8.5%)			

^aStudy duration = 3 × 21 days (63 days) for the continuous use group and 4 × 21 days (84 days) for the intermittent use group.
^b4 unknown for the intermittent use group, 1 unknown for the continuous use group.

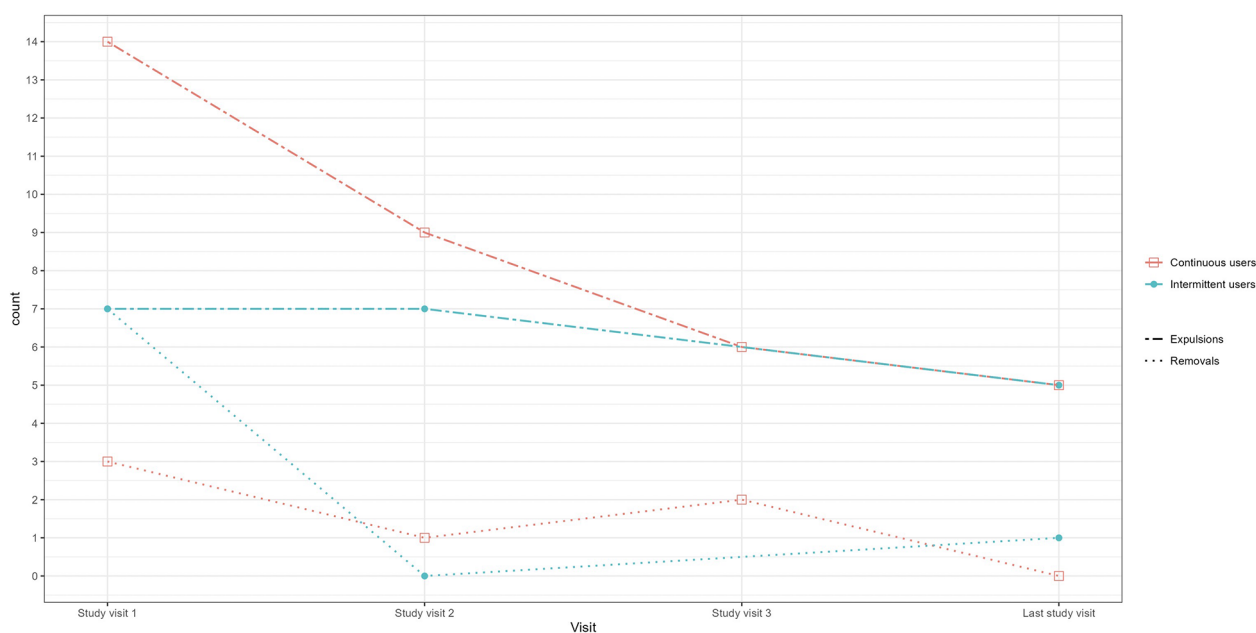


FIGURE 4

Self-reported ring removals and expulsions by study group and visit. Legend: Count = The number of times the ring was removed or expelled between two study visits. For example for study visit 1, the number of times the ring was removed or expelled since the enrolment visit. For study visit 2, the number of times the ring was removed or expelled since study visit 1, et.

Eventhough the study team clarified our understanding of “adherence” at several time points during the study, we still found that several women stressed the fact that they were responsible in following all study procedures and appointments given ($n = 51$) and had provided accurate information during the study.

P: “My adherence to the ring over the entire study was perfect, I managed to use the ring correctly as instructed and all information that I have given for the ring are true.” (21, not legally married, 1 child)

P: “I have liked the ring from the beginning that’s why I said that it was my responsibility to use it well as instructed and I have made it.” (33, not legally married, 3 children)

Triangulated data

A first phase of triangulation where data from different data collection tools were compared showed that 15 intermittent users provided discrepant reports on the CRF vs. the IAQ at 15/180 (8.33%) of all scheduled visits and nine continuous users at 10/240 (4.17%) of scheduled visits (Table 4). One participant reported discrepancies at two different visits. All discrepancies consisted of participants mentioning the ring was not out on the CRF but stating the ring was out (including answering all follow-up questions) on the IAQ. These inconsistencies were resolved internally by the study team based on the assumption that the IAQs provided more accurate information as the forms were less

standardized and more extensive with in-depth follow-up questions about ring removals and expulsions. Additionally, more time was allocated to completion of the IAQ which was conducted by the study nurses whereas the CRFs were completed by the study physicians.

According to the IAQ data, 12 women in the intermittent use group and 14 women in the continuous use group (a total of 26 women) reported expulsions and/or removals longer than 3 h. These results indicate that seven women who ticked “YES” on the ballot box, did not report the ring being out for more than three hours on the IAQ (Table 4). On the ballot box form, we also asked participants to self-rate their overall adherence throughout the trial on the self-rating scale. The median self-reported adherence value was 9.6 (five missing values). Two women scored themselves below 5, two below 7, three 8.8, and 108 (90%) between 9 and 10.

When we compared these findings (self-rated adherence scale results) to other self-reported adherence data collected through the IAQs and CRFs across study visits, we found 21 participants with inconsistent data of which 9 findings related to inconsistent adherence data and addressed these in the comparison forms. One example is of a participant who stated that she had been perfectly adherent throughout the study. However, she marked her adherence on the self-rating scale as 7.3 (visit 1), 6.2 (visit 2) and 9.8 (last study visit). We asked the participant to explain in her own words about her ring use experience and adherence over the entire trial. She answered:

P: “I found that there are no negative effects of using the ring, it is easy to wear the ring, I did not feel it during my routine

TABLE 4 Overview of discrepant adherence results across entire study duration.

Case report forms (CRF) data stating “NO” but interviewer-administered questionnaire (IAQ) data stating “YES” for removals and expulsions				
Study Visit	Study Group			
	Group A <i>n</i> = 180		Group B <i>n</i> = 240	
Ring Visit 1				
	4 discrepancies	All follow-up questions are answered in the IAQ	2 discrepancies	All follow-up questions are answered in the IAQ
	1 discrepancy	IAQ mentions flushed down toilet		
	5		2	
Ring Visit 2				
	2 discrepancies	All follow-up questions are answered in the IAQ	1 discrepancy	In a dirty place
	1 discrepancy	She came to the clinic with the ring	1 discrepancy	In the toilet
	1 discrepancy	IAQ mentions flushed down toilet		
	4		2	
Ring Visit 3				
	none		2 discrepancies	IAQ mentions flushed down toilet
	0		2	
Last Ring Visit				
	2 discrepancies	All follow-up questions are answered in the IAQ	4 discrepancies	IAQ mentions flushed down toilet
	4 discrepancies	IAQ mentions flushed down toilet		
	6		4	
	15 discrepant results (8.33%)		10 discrepant results (4.17%) *same participant had 2 discrepancies	
Total 25 discrepant results (5.95%)				
IAQ data stating “NO” but ballot box stating “YES” for Expulsions and/or removals longer than 3 h				
Study Visit	Study Group			
	Group A&B <i>n</i> = 120			
Last Ring Visit	26 vs. 33			
Total 7 discrepant results (5.83%)				

Bold values show the total amount of discrepant results between CRF and IAQ for all study participants across the whole study duration n=25 (5.95%). The total amount of discrepant results between IAQ and Ballot box for all study participants across the whole study duration n=7 (5.83%).

activities, I did not get any discomfort from ring. I respected all instructions & appointments so, no bad experience I got from using ring.” (33, married, 3 children)

When we probed further about the marking of the adherence scales, she told the team that she had included adherence with study procedures in her overall adherence assessment, such as the time (of day) that she had completed the diary card and whether she had made mistakes (overwriting) on the forms. This is in line with our prior mention about adherence being understood as adherence with all study procedures despite acknowledging this challenge early on.

Even though the diary card was not considered a data collection tool but rather a support for the participants to minimize recall bias when answering the IAQ at their scheduled visits, the team did revise them and documented any inconsistencies found between the IAQ and the diary card. We probed about this during the comparison form discussions, and participants had reasonable explanations revealing most of the inconsistencies were around a misunderstanding of the diary card completion instructions.

At study completion, the team proceeded with the second phase of the broader triangulation where all available self-reported adherence data was analysed across the entire study. By doing so, the team noticed very similar, almost identical responses given by different participants for some ring expulsions; the ring being flushed down the toilet due to defecation and women coming back to the clinic for a new ring to be inserted. We found potential links between most of these participants, either they were living in the same house or in the same neighbourhood, or had been invited on the same day and hence had spent time together in the waiting area. After deliberation, the team decided to invite those women for a focus group discussion to delicately probe into possible explanations. Not only were the answers too similar but the number of expulsions was exceeding what would have been expected based on the available Nuvaring® leaflet expulsion data. We shared with the women what we had found in the data, the importance of accurate data collection in research, and explained these results were not in line with other findings. We explained the participants were selected due to their ring expulsions experiences and we wanted to better understand what had happened. Women shared that the ring would come out mainly because of either not paying attention or because of illness.

P: “My ring came out, but I felt that it was coming out, I had diarrhoea, but if I was paying attention, I would save it and get it before it fall down.” (FGD 15Feb2014)

The participants stressed that they thought that the design of the ring was not problematic.

P: “You cannot blame this ring for anything, it is a nice method of contraception, I give an example of mine, I tried all other FP methods, and I failed due to side effects...” (FGD 15Feb2014)

We shared with the participants that ring expulsion rates in this study were higher than we had anticipated based on data from other studies and we wanted to know if the participants had heard of women coming to the clinic for unnecessary unscheduled visits to obtain a new ring. Whilst most of the discussions centred around “other” women, and the gossip they heard in the waiting area, some women did confess to providing false information and did express their regret about that (although in a general sense not specific to ring expulsions).

P: “Shame on us, shame on us to give bad information!” (FGD 15Feb2014)

One of them expressed regret of not having given the correct information by saying:

P: “Yoooo, shame on us by giving false information! Is it too late, can't you hold a bit to give out the report and we start from zero? So that we will give you the new information? This ring has no problem, it is just us who...” (FGD 15Feb2014)
Silence, she looked down, seemed to hide something else she wanted to say.

We asked all participants who did not reinsert their rings during the study due to flushing it down the toilet or dropping it on a dirty surface/place if they were willing to be part of a FGD to provide more information. For the intermittent use group, seven participants were invited and for the continuous use group, eight participants were invited; total $n=15$ or 12.6% of study population. We did not invite the participant who was lost to follow-up as she had already explained at her last study visit that she was not completely honest about the reasons for flushing her ring down the toilet. Six participants (40% of invited women) came for the FGD, and we asked these women if they wanted to come back afterwards to discuss some issues further with the team. Four of them came (about 25% of all invited women) and some even brought back the “lost” ring and admitted to having provided false information. We learned from the informal discussions at these extra visits that some women came for unnecessary unscheduled visits to receive transport reimbursement, and not because they had actually lost their ring, or because they wanted additional rings for future use or to give to others.

Discussion

Self-reported ring adherence at each study visit was high across the two study groups with around 80% of participants reporting perfect adherence at the first study visit increasing to around 90% at the last study visit. These findings are in line with previous studies showing very similar data on self-reported adherence to the Nuvaring[®] with adherence ranging from 80% to 91% as well as more recent data of 92% self-reported adherence to novel multidrug vaginal rings (46–48). Of interest is that self-reported adherence was not significantly different between the two study groups indicating that continuous users did not seem to have more adherence challenges. Unfortunately the reliability of self reported data on contraceptive adherence is often questioned although no golden standard is currently available (49, 50). Literature on self-reported adherence measurements indicates general over-reporting of adherence due to social desirability bias and overreporting is also linked to socio-demographic variables such as age and social determinants such as relationship dynamics (26, 47, 51–53). As our study findings rely on participant self-report, similar limitations should be highlighted in terms of social desirability and recall bias. Additionally, researchers assume that clinical trial patterns differ from “real world” behaviours and that adherence in clinical trials usually is as good or greater than “real life” adherence (16, 18, 23, 54, 55).

Based on prior research and literature on over-reporting, the team tried to minimize incorrect reporting by developing a robust study design including triangulation, appropriate counselling, and support tools like diary cards (56–58). Our triangulated study results suggest a low discrepancy rate overall. However, the team did find some overreporting of expulsions/removals fuelled by socio-economic motivators, and underreporting of adherence due to the widely held perception that adherence includes adherence to all study procedures. However, both of these led to underreporting of ring use adherence as opposed to overreporting. Based on the collected data and our extensive triangulation, over-reporting of adherence seems a less important challenge in our study population than previously assumed. Whilst some previous cited publications indicate a tendency to over-report adherence, other studies using adherence biomarkers like Chen et al. (2015) report good correlation between self-report and residual drugs levels in returned vaginal rings (59). Our findings indicate that behaviour and reporting related to adherence are complex and do not always lead to over-reporting of good adherence or “perfect” use in a clinical trial setting.

Perfect self-reported cumulative adherence across the entire study period was 61.7% for intermittent users and 54.3% for continuous users. These results show that whilst a large group of women were perfectly adherent at each visit, not all of these women were perfectly adherent for each single visit throughout the study. This in itself is not unexpected as potential for expulsions and/or removals will increase with longer duration of contraceptive use but it does indicate that eventhough most

published data indicates that adherence seems to increase with ring use, maintaining “perfect use” over a longer period of time is challenging in our population (27, 47)

Interestingly, even with periods of the ring being out, participants still represented themselves as being perfectly adherent. As opposed to our findings on underreporting of perfect adherence, this finding of perceived good adherence is in line with a vast majority of other publications echoing the idea of being a responsible, good study participant, highlighting the participant’s moral integrity framed within determining social and contextual factors (24, 54, 58–60). In his publication “Adherence and the Lie in a HIV Prevention Clinical Trial”, Stadler et al. argued for a more nuanced perception of perceiving non-adherent participants not solely as liars or purposely deceiving the study team but as actors in something far more complex, impacted by the context of structural factors like poverty, social inequalities and limited or inequitable health care systems (54, 60, 61). Equally important to note, is that imperfect adherence does not always equal increased risk of pregnancy.

Whilst the Nuvaring[®] manufacturer’s instructions indicate a higher risk of pregnancy if the ring is out of the vagina for a single time for three hours or more, other user instructions such as Planned Parenthood, WHO or the Center for Disease Control refer to increased risk after 48 h of the ring being out or in case of the Sexual Health Victoria website 24 h (during the first three weeks of use) (40, 43–45). Based on the Nuvaring[®] leaflet instructions, our data indicates that 21.6% of the intermittent users and 23.8% of the continuous users were at risk of getting pregnant during the study period. None of our participants became pregnant during the study which could indicate the Nuvaring[®] manufacturers user instructions might be conservative estimates. However only four women in the continuous use group had completely unprotected sexual intercourse without the ring and without a condom. These low numbers might be partly explained by the counselling, testing and treatment, and free condoms participants received in the study. In real word settings, especially for women in stable relationships, condom use might differ (62).

Finally, we experienced that throughout the study the nurses developed a different rapport and a deeper relationship with the study participants as compared to the study physicians. This was highlighted on several occasions where the participants confided to the study nurses about challenges they were facing in daily life which were not asked about in the context of our study as well as the nurses trying to help the participants on different occasions with problems outside of the research centre’s remit. The impact of staff characteristics and attitudes on honest reporting has been mentioned by other researchers like Van der Straten et al. and Montgomery et al. who stated that: “*There was no clear consensus about many of these issues, though participants often preferred female staff and those who were “nice” and not rushed or harsh*” (16, 54). Interestingly Stadler’s research also showed that the deeper relationship developed with the study nurses led to increased desirability bias where the participants did not want to disappoint the study nurses (61). When reviewing the triangulated self-reported adherence data,

inconsistencies were found between the CRF, the IAQ (the self-rating adherence VAS) and the diary cards. Although some researchers like Toley et al. state that responses collected at the last study visit are more honest or accurate (42), there is no general consensus, and more recently researchers like Mensch et al. have found that disclosure of non-adherence did not increase at last visit compared to adherence reporting throughout the study (51). Our study team’s view was that whether non-adherence reporting would increase or not, they did not want to jeopardize the rapport developed with the participants or risk losing their trust, and hence avoiding any change in reporting due to an increase in desirability bias or loss of trust. Therefore, they did not address inconsistencies whilst the study was ongoing but they addressed them at the last study visit using individual comparison forms once all data collection was completed.

When asked about internal discrepancies between the IAQ answers including open-ended questions and the self-rating adherence VAS, it became clear that the concept of adherence had different meanings to different participants. Even though the study team had piloted the concept of adherence during data collection tool development, the participants shared different conceptualizations of “consistent use” and “adherence” as has been reported by several other researchers including Montgomery et al. (26). Additionally, the same adherence levels were assessed differently by different participants as also noted by Mensch et al. reporting that in HIV trials, “*the question asking participants to rate their ability to keep the vaginal ring inserted as instructed is subject to varying interpretations such that the same level of adherence might be assessed differently by different participant.*” (55). The study team decided to report the data as was shared by the participants during the study. Development of adherence biomarkers or other biological/surrogate markers has progressed, and whilst they provide crucial data on product (non)use, all remain user dependent to a degree and do not assess or clarify adherence and behaviour patterns (17, 59). Context specific, simple adherence measures and data collection procedures should remain priorities because they provide a deeper understanding of context-driven behaviour that shapes adherence patterns and challenges (17, 49, 56–58, 61–62). Our findings highlight the importance of in-depth qualitative work in parallel with the development of more accurate biomarkers for adherence measurements.

Conclusion

Self-reported adherence to the Nuvaring[®] over the entire study duration was high in both the intermittent and continuous first-time vaginal ring users. Rwandan policy makers should consider the Nuvaring[®] as a valuable addition to the current family planning package. In this manuscript, we highlight the importance of having a well-designed study and we demonstrate that using mixed methods and triangulation in particular allows for better understanding of adherence and the possibility of addressing inconsistencies in an appropriate and relevant manner. Despite advances in the development of biomarkers and

other biological/surrogate markers in contraception and HIV prevention research, self-reported adherence measures will always play a crucial role. Research into context specific, simple adherence measures remains important to the ongoing development of the pipeline of new female-initiated drug-delivery methods. Future ring adherence studies might opt for a more pragmatic design including a strong qualitative component with our data categorisation and triangulation approach to better account for real-world non-adherence.

Limitations

This manuscript focusses on adherence measurements and adherence data captured in the Ring Plus study. The importance of broader socio-cultural and structural factors that influence adherence, even though very important, are outside of the scope of this manuscript. Our study findings rely on participant self-report and as such are prone to social desirability and recall bias. The study team mitigated this through a robust study design but it is not possible to eliminate all biases completely and should therefore be mentioned as a limitation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The study was approved by the Rwandan Ministry of Health and the Rwandan National Ethics Committee (approval number 481/RNEC/2013), the institutional review board of the Institute of Tropical Medicine (ITM) in Antwerp (approval number 864/13), the ethics committee of the University Hospital in Antwerp, Belgium (approval number 13/7/85) and the University of Liverpool in Liverpool, UK (approval number RETG000639IREC). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

EK: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. JV: Conceptualization, Formal Analysis, Methodology, Supervision, Writing – review & editing. MMU: Investigation, Project administration, Supervision, Writing – review & editing. GU: Formal Analysis, Investigation, Writing – review & editing. AU:

Formal Analysis, Investigation, Writing – review & editing. ID: Data curation, Investigation, Methodology, Project administration, Writing – review & editing. MU: Formal Analysis, Investigation, Writing – review & editing. SA: Investigation, Supervision, Writing – review & editing. TC: Conceptualization, Data curation, Funding acquisition, Methodology, Project administration, Resources, Supervision, Writing – review & editing. TD: Conceptualization, Funding acquisition, Methodology, Supervision, Writing – review & editing. JW: Conceptualization, Formal Analysis, Funding acquisition, Methodology, Project administration, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fgwh.2024.1278981/full#supplementary-material>

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Predictors of long-acting contraceptive utilization hot spots in Ethiopia: using geographical weighted regression analysis

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Background: The use of long-acting contraceptives is a common health challenge in Ethiopia. Therefore, the current study aimed to assess the determinants of using long-acting contraceptive hot spots in Ethiopia using data from the Ethiopian Mini Demographic and Health Survey for 2019.

Methods: This study used data from the Ethiopia Mini Demographic and Health Survey 2019 and included a total weighted sample of 8,885 women in the analysis. The geographical variation of long-acting contraceptive usage was initially observed using hot spot analysis. Arc GIS version 10.7 was used for geographically weighted regression. Ordinarily, least squares regression was performed to identify predictors that explain the geographical variation in the use of long-acting contraceptives. Geographic weighted regression was used to predict the hot spot area of long-acting contraceptive methods.

Results: The overall prevalence of long-acting contraceptive utilization use was 6.9% (95% confidence interval: 6.4–7.45). Most of the statistically significant hot spots for long-acting contraceptives were found in lactated areas of the Oromia part of Amhara and Dire Dawa. Primary education, followers of the Muslim religion, marital status, and women with >4 children were the determinants of spatial variation use of hot spot areas for long-acting contraceptive methods.

Conclusions: A detailed map of long-acting contraceptive use hot spots and their determinants will enable decisions to target their sociodemographic-related predictors of women.

KEYWORDS

long-acting contraceptive, geographically weighted regression, predictors, contraceptive, Ethiopia

Introduction

The long-acting contraceptive (LAC) method is among the most suitable and effective modern contraceptive methods that can prevent pregnancy and save money for families and the country as a whole (1). Long-acting contraceptives can be reversible or non-reversible. The reversible type of contraceptive can be hormonal (implants that prevent pregnancy for 3–5 years) and non-hormonal [an intrauterine device (IUD) that prevents pregnancy for 12 years]. The permanent type of contraceptive (vasectomy/

sterilization of the man and tubal ligation of the woman) can prevent pregnancy for life (1).

In addition to the prevention of pregnancy, contraceptives have other uses, such as for adjusting the menstrual cycle, controlling premenstrual mood disturbances, and preventing endometrial cancer (1–3).

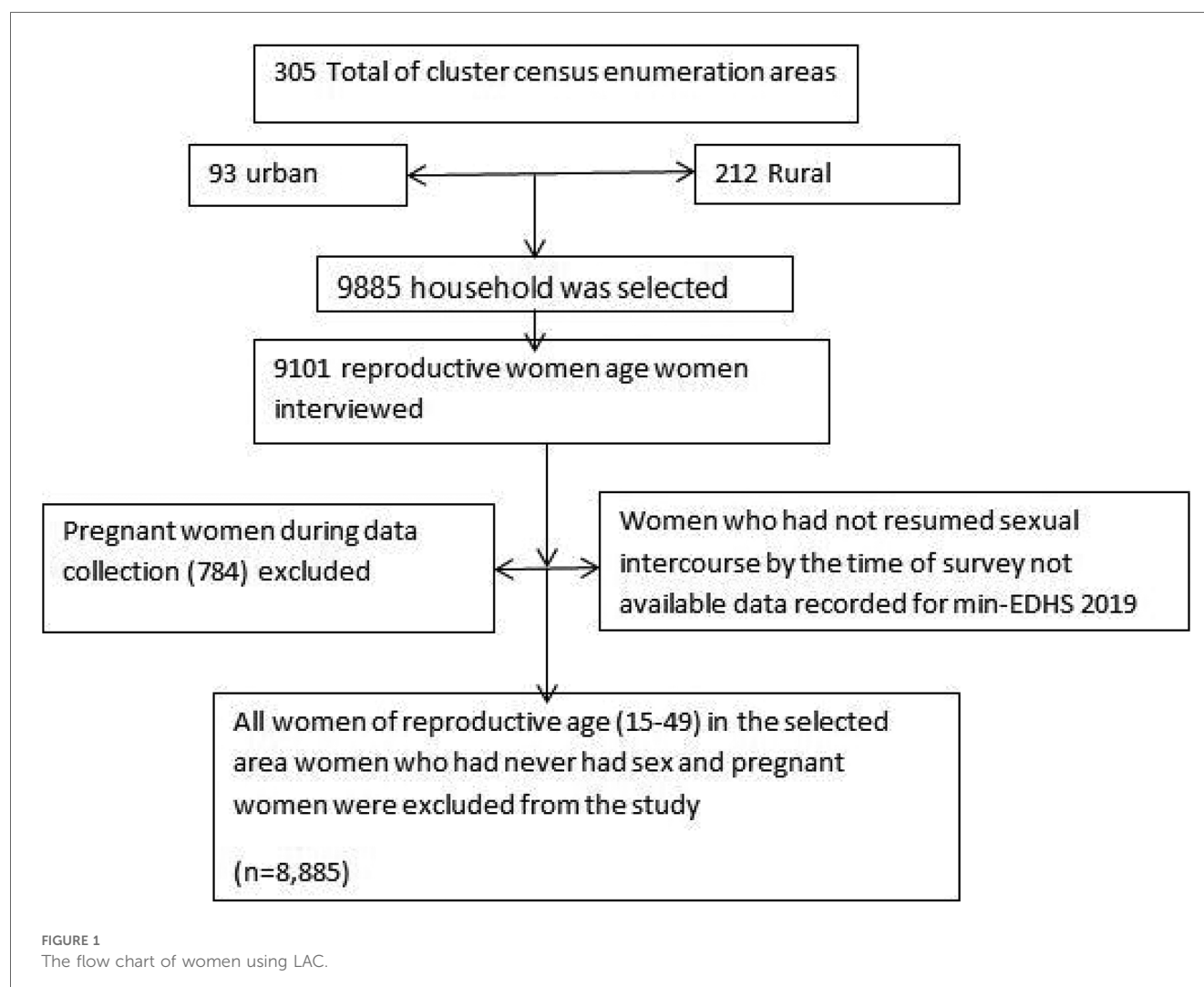
In developing countries, approximately 214 million women of reproductive age lack access to modern contraception techniques, including LAC methods. As a result, nearly half of pregnancies are unintended (4). In addition, one in three unwanted pregnancies is the consequence of contraceptive failure, which is more common with traditional and short-acting techniques than with long-acting ones (5).

Ethiopia is one of the countries with the fastest population growth, next to Nigeria (6). According to evidence from the Ethiopia Demographic Health Survey (EDHS) of 2016, 22% of women still lack access to contraceptive methods (7). Providing appropriate, accessible, and inexpensive contraceptive options is crucial to prevent unwanted pregnancies and help families achieve their desired health goals (5). Globally, 64% of women of reproductive age used different methods of contraception, of which approximately 45.2% of women in developed countries used long-acting contraceptive methods. Of them, 5.1% were in

sub-Saharan Africa (8, 9). In Ethiopia, most women of reproductive age used short-acting contraceptive methods and only 10% of the women used LACs (10, 11).

To expand the lack of access to contraceptive methods, the Ethiopian Ministry of Health must plan to distribute LAC to prevent unintended pregnancy at all healthcare levels (12). Despite these attempts to increase contraceptive utilization, there was still a low level of contraceptive utilization (11).

Studies conducted on long-acting contraceptives in Ethiopia showed the simple prevalence of the utilization of long-acting contraceptives and its associated factors. As research evidence, the age of the women (13, 14), marital status, level of education (15, 16), wealth index (16, 17), number of children (18–20), and residency were factors in the use of long-acting contraceptives (17, 21). Studies were conducted on the geographical variation of modern contraceptives among reproductive age groups using data from the 2019 EDHS (22, 23). However, no studies were conducted on the determinants of long-acting contraceptive utilization hot spot analysis using 2019 mini-EDHS data applying geographic weight regression. Therefore, the current study aimed to assess the determinants of the utilization of long-acting contraceptive hot spot analysis in Ethiopia using 2019 mini-EDHS data.



Methods

Study setting, data source, and study period

The study was carried out in Ethiopia, which is located in the Horn of Africa, 3° to 14° N and 33° to 48° E. The Ethiopia Mini Demographic Health Survey (EMDHS) 2019 data were used as a data source for this study (24). According to EMDHS 2019, there are nine administrative regions [Tigray, Afar, Amhara, Oromia, Benishangul-Gumuz, Gambela, Southern Nations, Nationalities and People's Region (SNNPR), Harari, and Somali] and two city administrations (Addis Ababa and Dire Dawa). EMDHS 2019 was the second mini-demographic survey conducted in Ethiopia. The sample was stratified into two stages and selected. A total of 305 cluster census enumeration areas (EA) stratified into urban and rural (93 urban and 212 rural) areas were selected (Figure 1).

Study population, eligibility criteria, and study period

The study was carried out between 21 March 2019 and 28 June 2019. All women of reproductive age in their late 20s were the source population, while those selected reproductive-age women who were in their late 20s were the study population. All women of reproductive age in the selected area were included in the study, while women who had never had sex and pregnant women were excluded.

Sampling procedures

In total, 8,885 women were included in the study. The dataset used to analyze this manuscript was an individual record (IR). The detailed sampling procedure is illustrated in the 2019 EMDHS report.

Study variables

Dependent variable

The dependent variable of this study was the use of one of the long-acting contraceptives (used/not used) (25).

Independent variables

The individual-level factors included were age, marital status, religion, educational status, wealth index, number of living children, and age at first birth, while community-level factors included community wealth index, residency, region, and community education (26, 27).

Operational definition

Long-acting contraceptive method

Women who are considered to be using long-acting contraceptives use one of the following long-acting contraceptive methods: IUD, implants, and male/female sterilization (25).

TABLE 1 The weighted proportion of sociodemographic factors in the use of long-acting contraceptive methods ($n = 8,885$).

Variables	Categories	Utilization of long-acting contraceptive		Total
		Used, N (%)	Not used, N (%)	
Religion	Orthodox	459 (13.60)	3,074 (86.40)	3,374
	Catholic	4 (6.41)	74 (93.59)	78
	Protestant	126 (7.36)	1,585 (92.63)	1,711
	Muslim	180 (4.95)	3,455 (95.05)	3,635
	Other	4 (4.60)	83 (95.4)	87
Marital status	Married	568 (10.12)	5,045 (89.88)	5,613
	Not married	46 (1.41)	3,226 (98.59)	3,272
Educational level	No education	212 (5.82)	3,428 (94.18)	3,640
	Primary	255 (7.62)	3,090 (92.38)	3,345
	Secondary	73 (6.35)	1,076 (93.65)	1,149
	Higher	74 (9.85)	677 (90.15)	751
Age of respondent at first birth (years)	<20	416 (9.69)	3,878 (90.31)	4,294
	≥20	157 (10.12)	1,395 (89.88)	1,552
Wealth status	Poor	149 (4.42)	3,223 (95.58)	3,372
	Middle	107 (8.44)	1,161 (91.56)	1,268
	Rich	358 (8.43)	3,887 (91.57)	4,245
Number of living children	None	43 (1.38)	3,070 (98.2)	3,113
	1–2	274 (11.82)	2,045 (88.18)	2,319
	3–4	160 (9.73)	1,485 (90.27)	1,645
	>4	137(7.58)	1,671(92.42)	1,808

Community wealth index

The community wealth index is calculated by generating the combined wealth index with its cluster number. Then, it was leveled as high community poverty and low community poverty by computing the median of the proportion (0.2777778) of the wealth index of women.

Community education level

The educational level of the participants that is considered a high-level educational status of the community is generated

TABLE 2 The weighted proportion of long-acting contraceptive use by place of residence and region, EMDHS 2019.

Variables	Utilization of long-acting contraceptive		Total	P-value
	Used, N (%)	Not used, N (%)		
Residency				
Urban	459 (7.60)	5,565 (92.40)	6,024	<0.01
Rural	190 (6.64)	2,671 (93.36)	2,861	
Region				
Tigray	69 (10.97)	560 (89.03)	629	<0.01
Afar	2 (2.35)	83 (97.65)	85	
Amhara	171 (8.40)	1,856 (91.60)	2,026	
Oromia	232 (6.93)	3,115 (93.07)	3,347	
Somali	2 (0.48)	419 (99.52)	421	
Benishangul-Gumuz	13 (13.13)	86 (86.87)	99	
SNNPR	112 (6.57)	1,593 (93.43)	1,705	
Gambela	1 (2.49)	40 (97.51)	41	
Harari	2 (7.40)	25 (92.60)	27	
Addis Ababa	41 (9.28)	401 (90.72)	442	
Dire Dawa	5 (7.70)	60 (92.30)	65	

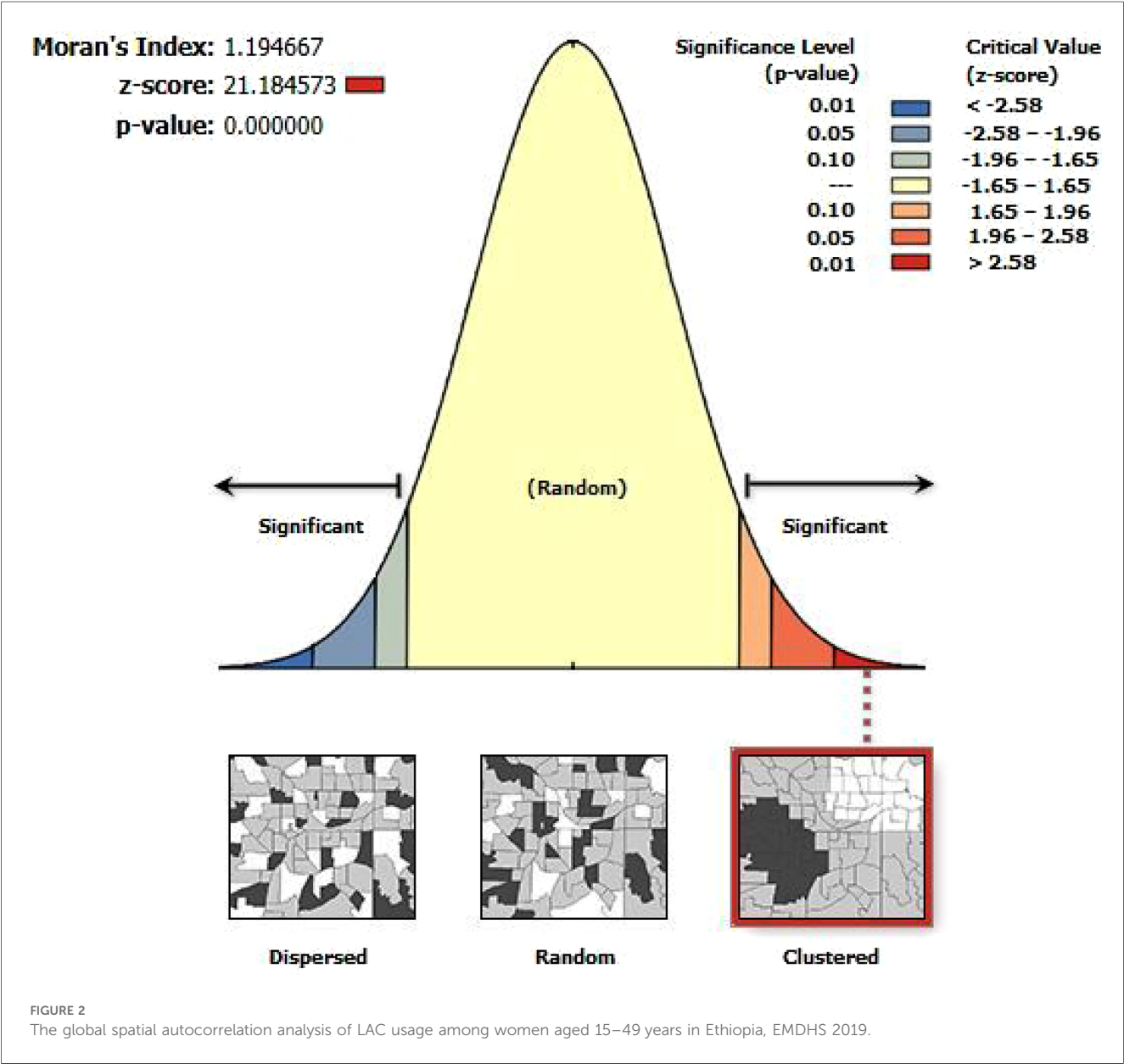
using the media proportion of the highest educational status (0.9220659) of the participants.

Data management and analysis

Microsoft Excel was used to clean up the data. The data were further processed, cleaned, recoded, and analyzed using STATA version 14/MP. Before spatial analysis, the sample waiting for the outcome variable and the explanatory variable was performed to ensure the representativeness of the DHS data sample and to obtain reliable estimates and standard errors (28). Descriptive data were analyzed using STATA and presented in tables to describe the use of long-acting contraceptives by sociodemographic factors and maternal characteristics. STATA version 14/MP and Arc GIS v.10.8 were used for the data analysis.

Spatial analysis

The spatial autocorrelation of Global Moran’s I measure was computed to assess the spatial heterogeneity of the use of long-acting contraceptives. Moran’s I values close to negative 1 indicate dispersed, close to positive clustered, and 0 values indicate random use of long-acting contraceptives (29). A significant statistical Moran I value ($p < 0.05$) led to the rejection of the null hypothesis, which indicated the presence of spatial autocorrelation. The hot spot analysis (Getis–Ord statistics) of the z scores with significant p-values gave the characteristics with hot spot or cold spot values for the clusters. The Getis–Ord statistic z score near zero indicates that there is no clustering, the positive z score indicates a cluster of high value (hot spot), and the negative z score indicates a cluster of low value (cold spot) (30).



Spatial regression

Ordinary least squares (OLS) regression is a global statistical model that uses a single equation to estimate the relation between the outcome and explanatory variables. The equation is given as $\gamma_i = \beta_i + \sum_{k=1}^p \beta_k x_{ik} + \varepsilon_i$ where $i = 1, 2, \dots, n$, $\beta_0, \beta_1, \beta_2, \dots, \beta_p$ are the model parameters, Y_i is the outcome variable for the observation i , x_{ik} is the explanatory variable, and $\varepsilon_1, \varepsilon_2, \varepsilon_3, \dots, \varepsilon_n$ are the error term/residuals with zero mean and with homogenous variance σ^2 .

After identifying long-acting contraceptive hot spots, spatial regression modeling was performed to identify predictors of spatial patterns of long-acting contraceptives. The ordinary least squares finding is only reliable if the regression model satisfies all the assumptions that are required by this method (31). All OLS assumptions, such as multicollinearity using the variance inflation factor (VIF), the Koenker test for non-stationarity, Moran's I statistics for residual spatial autocorrelation, and statistically non-significant Jarque–Bera statistics for model bias, were checked before preceding the geographically weighted regression (GWR).

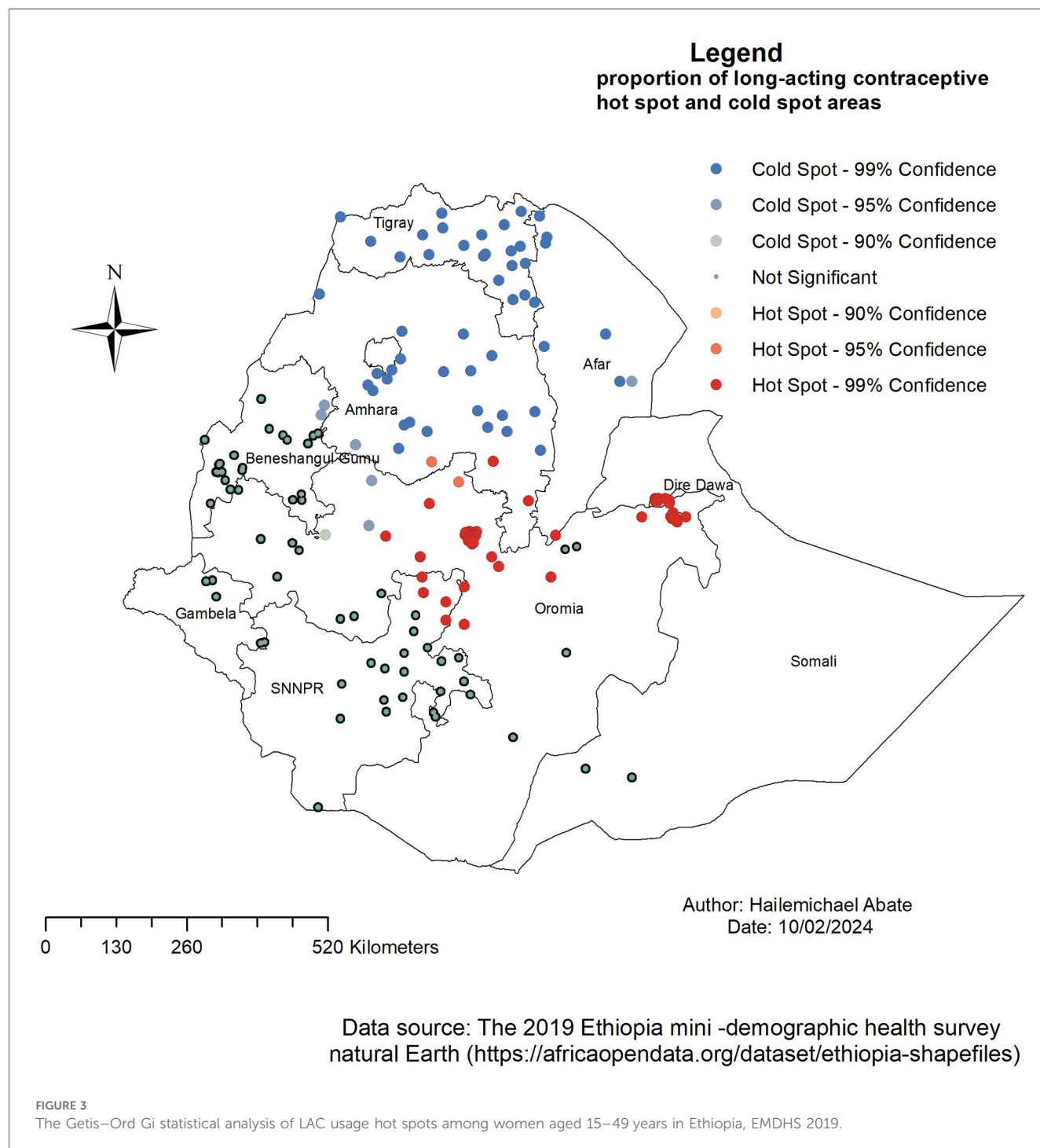


TABLE 3 Model summary of OLS for significant variables of LAC utilization in Ethiopia, EMDHS 2019.

OLS diagnostics			
Number of observations	202	AIC	1,395.28
Multiple R ² (d)	0.17	Adjusted R ²	0.16
Joint F-statistic	4.74	Prob(>F), (8,193) degrees of freedom	0.000025*
Joint Wald statistic	41.01	Prob(>chi-squared), (8) degrees of freedom	0.000002*
Koenker (BP) statistic	22.13	Prob(>chi-squared), (8) degrees of freedom	0.004670*
Jarque–Bera statistic	84.52	Prob(>chi-squared), (2) degrees of freedom	0.08

* $p < 0.05$, statistically significant.

GWR is a local statistical regression model that assumes cluster variation (non-stationarity) in the relationship or heterogeneity in the relationship between the dependent and independent variables in different cluster areas. In contrast, OLS fits a single linear static equation to all data in the study area, while GWR enables an equation for each enumeration clustered area (32, 33). Therefore, the GWR coefficient assumes various values for each cluster. The coefficients were associated with each explanatory variable in the maps that were generated using the GWR. The equation of GWR was given as $\gamma_i = \beta_0(u_i, v_i) + \sum_{k=1}^p \beta_k(u_i, v_i)x_{ik} + \mathcal{E}$, where γ_i is the observation's response γ , (u_i, v_i) are the geographical points of latitude and altitude, $\beta_k(u_i, v_i)$ ($k = 0, 1, 2, \dots, p$) is the unknown function of geographic location (u_i, v_i) , X_{ik} is the explanatory variable at location u_i, v_i , $i = 1, 2, 3, \dots, n$, and $\mathcal{E}_i$ is an error terms with zero mean and homogenous variance. To minimize potential confounders' variable with p -value > 0.2 in OLS had to be excluded for GWR analysis.

Ethical approval

Permission to access the data was obtained from a Demographic Health Survey (DHS) through an online request at <https://dhsprogram.com/data/available-datasets.cfm>. The data used for this study were freely available on request online. This study was based on secondary data from the EDHS, and we obtained a permission letter from the main Demographic Health Survey.

Results

Among the total study participants, the majority (95.05%) of Muslim women did not use long-acting contraceptives. Among

TABLE 5 Analysis result of significant explanatory variables using the GWR model for LAC in Ethiopia, EMDHS 2019.

Explanatory variables	Women with primary education, Muslim religion, richest wealth quartiles, women having >4 children
Residual squares	10,428.71
Effective number	12.20
Sigma	7.41
AIC	1,394.93
Multiple R ²	0.18
Adjusted R ²	0.17

women who had not used long-acting contraceptives, the majority (98.59% and 94.18%) were not married and had no educational level, respectively. The age of respondents at first delivery (98.2%) and participants who have no living children (90.31%) did not use long-acting contraceptive methods (Table 1).

Table 2 illustrates the weighted proportion of long-acting contraceptive use according to region and place of residence. Among women who had not used long-acting contraceptives, 93.4% were rural residents of the country. Similarly, most of the participants (99.52%) in the Somali region and 96.7% in the far region do not use the long-acting contraceptive method (Table 2). The overall prevalence of long-acting contraceptive use was 6.9% (95% confidence interval: 6.4–7.45).

Spatial autocorrelation and significant hot spots of long-acting contraceptive utilization

The spatial autocorrelation analysis showed a significant spatial autocorrelation of the use of long-acting contraceptives throughout the country with the Global Moran I value of 1.19 (p -value < 0.01) (Figure 2).

The significant hot spots for long-acting contraceptive use were lactated in the Oromia part of Amhara, Dire Dawa, and SNNPR (Figure 3).

Factors affecting the spatial variation of LAC utilization

The result of the OLS model showed that 16% of the variation in LAC utilization (adjusted $R^2 = 0.16$) was explained by the model and met all assumptions of the OLS statistical model (34). There was no multicollinearity between the independent variables, that is, the VIF was less than 10. The

TABLE 4 Analysis results of OLS for LAC utilization in Ethiopia, EMDHS 2019.

Variable	Coefficient	Standard error	t-statistics	Probability	Robust standard error	Robust t-statistics	Robust probability	VIF
Intercept	0.35	0.52	0.068	0.049	0.48	0.073	0.046	—
Muslim religion	−0.047	0.013	−3.46	<0.01	0.012	−3.69	<0.01	1.08
Mother with primary education	0.122	0.038	3.21	<0.01	0.043	2.80	<0.01	1.12
Married status	0.16	0.044	3.646	<0.01	0.043	3.70	<0.01	1.81
Women having >4 children	−0.09	0.042	−2.140	0.033	0.036	−2.51	0.012	1.31

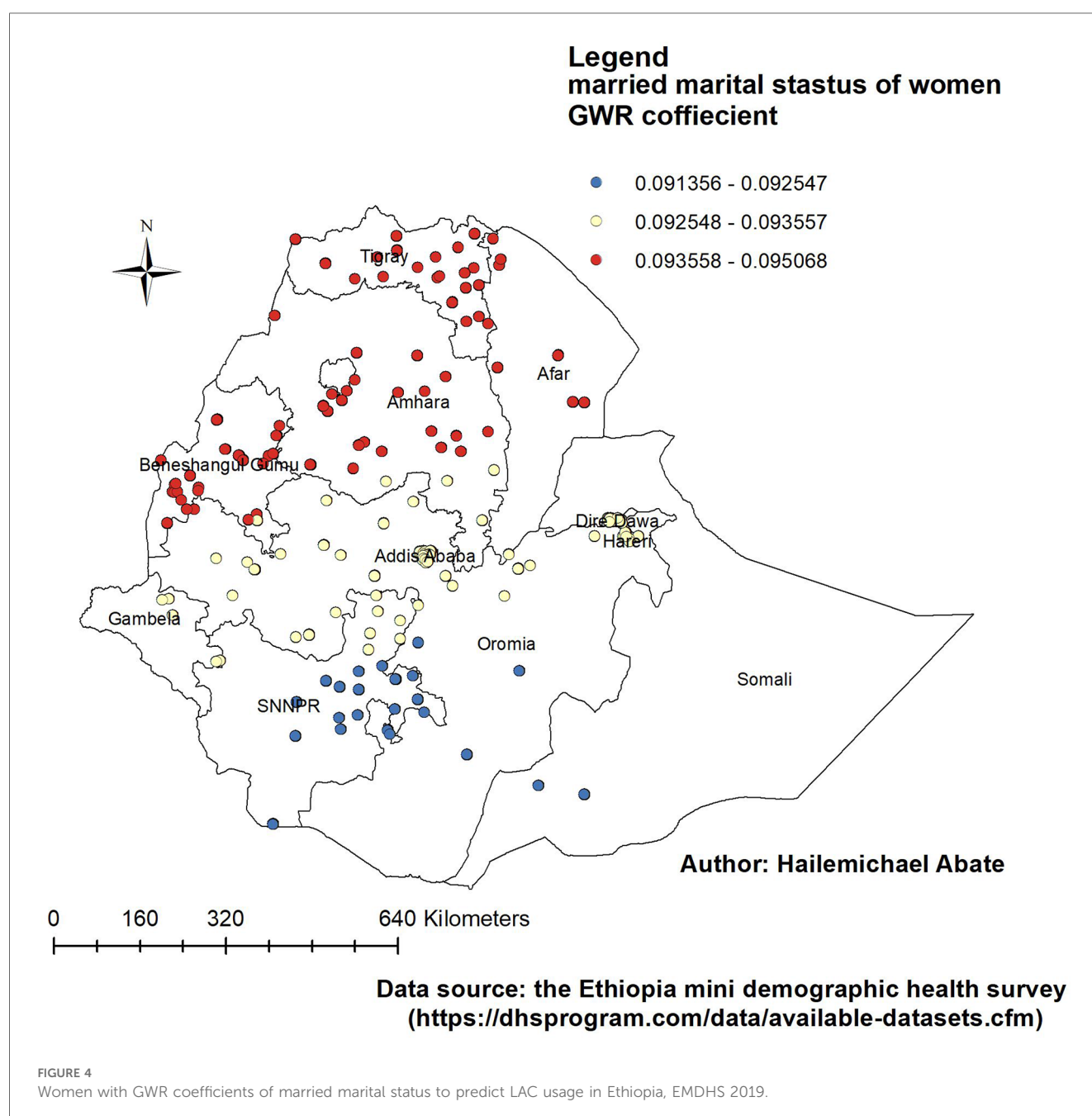
Koenker test for non-stationarity was statistically significant (p -value < 0.01); therefore, it is recommended to perform a geographical weight regression. Since the Jarque–Bera statistic was non-significant (p -value > 0.01), the residual was assumed to be normally distributed. Furthermore, the combined Wald statistic was statistically significant (p -value < 0.01), which indicates that the overall model was significant. As a result of the meeting of all the OLS assumptions, GWR had to be run to obtain the local coefficient of explanatory variables of the hot spot areas (Table 3).

The proportion of followers of the Muslim religion, mothers with a primary education, married women, and women with >4 children had a significant influence on the distribution of the use of LAC. A unit increase for respondents with a primary

education and marital status increases the use of long-acting contraceptives by 0.122 and 0.16, respectively. However, there was a unit decrease in followers of the Muslim religion and women with >4 children by -0.047 and -0.09 in the use of LACs, respectively (Table 4).

Geographical weighted regression analysis

The OLS statistical regression model showed the LAC factors in the geographical hot spot area. However, it was a global model that showed that the relationship between each explanatory variable and LAC is stationary in the study area. The results of the GWR indicated that there was a



significant improvement compared to OLS. In Table 4, the adjusted R^2 (0.16) and Akaike's Information Criterion (AIC) (1,395.28) obtained in OLS were increased in GWR to 0.17 and 1,394.93, respectively. Based on this analysis, the GWR result is better than the result generated using the OLS model (Table 5).

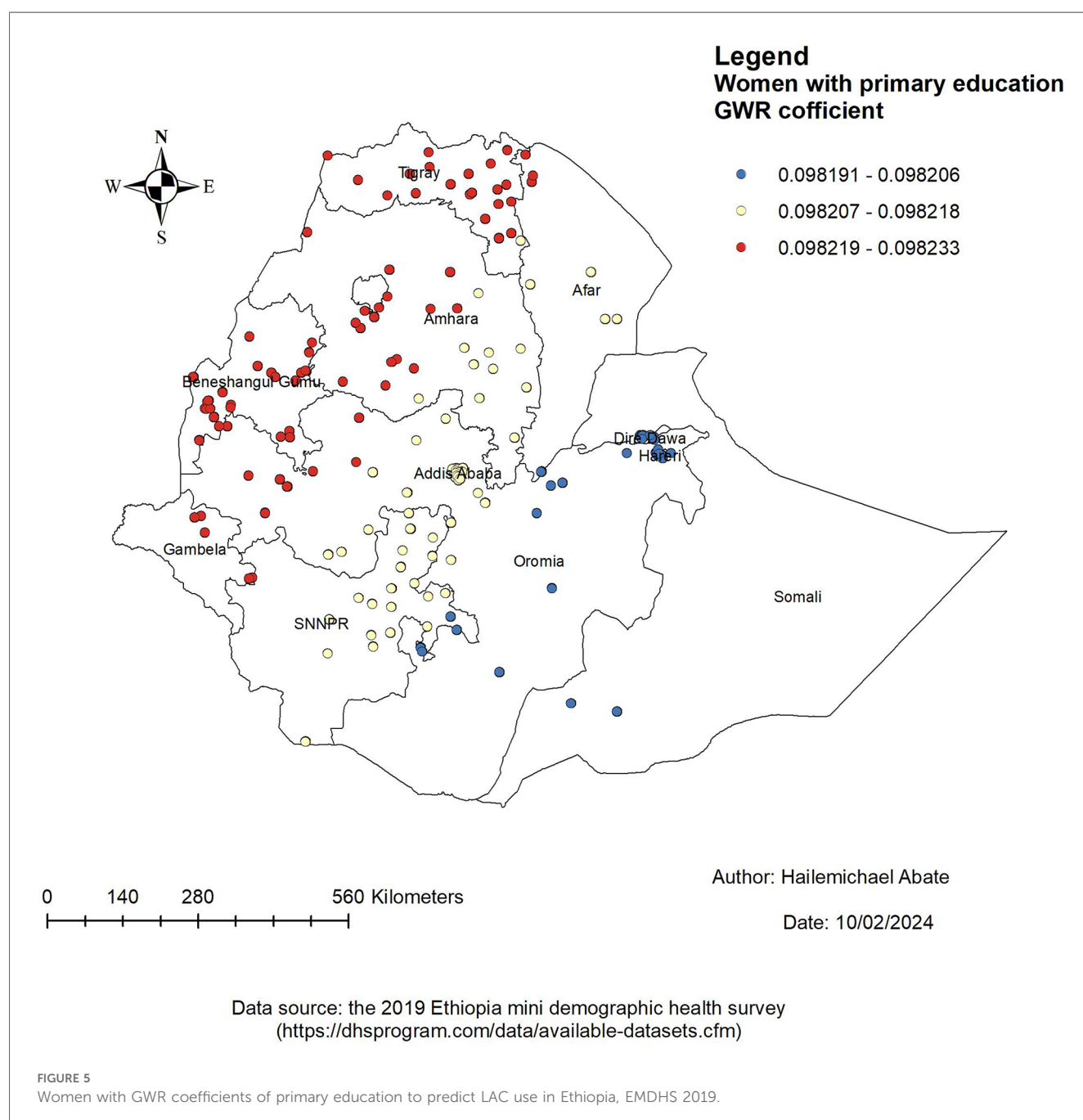
The GWR analysis results showed that the explanatory variables were weak and had a strong relationship with the use of LAC.

Figures 4–7 show that the proportion of explanatory variables of LAC in the geographical areas was strong and weak predictors. The geographical area with clustered red points indicates the largest coefficient of the predictors and strong predictors in the hot spot areas in the use of long-acting contraceptives. Therefore, the largest

coefficient of the predictor in the hot spot areas indicates a strong predictor in the use of LAC. Women who were married had strong and positive predictors of LAC. As the proportion of women who were married increased, the incidence of LAC usage in Tigray, Amhara, Benishangul-Gumuz, and parts of Afar increased (Figure 4).

Women with a primary education had a positive and weak predictor of LAC. As the proportion of women with a primary education increased, the existence of LAC in Tigray, Amhara, Benishangul-Gumuz, Gambela, west Oromia, and the northern part of Afar increased (Figure 5).

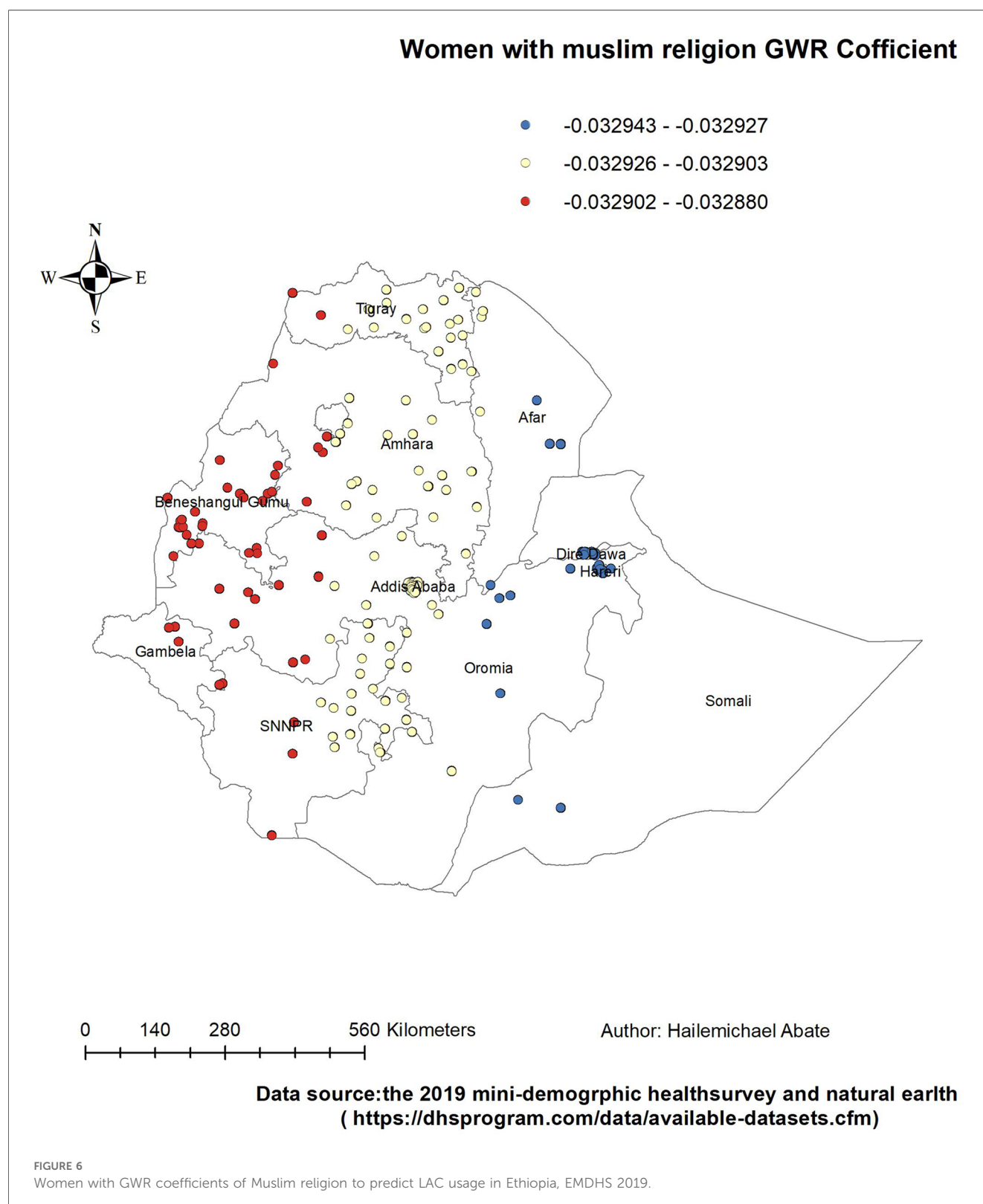
Women who were followers of the Muslim religion had a negative and weak relationship with the use of LAC. Therefore, the Muslim religion was a protective factor in the use of LAC hot spot areas.



The proportion of Muslim women decreased in the LAC hot spot areas of West Amhara and Oromia; in the entire Benishangul-Gumuz; and in parts of Tigray, Gambela, and SNNPR (Figure 6).

In the same way, women with >4 children had a negative and weak relationship with the use of LAC. Therefore, the factor of

women with >4 children was protective in the use of LAC hot spot areas. The proportion of women with >4 children decreased in the LAC hot spot areas of Tigray, Amhara, Gambela, Benishangul-Gumuz, northwest Tigray, southwest Amhara, and parts of Gambela (Figure 7).



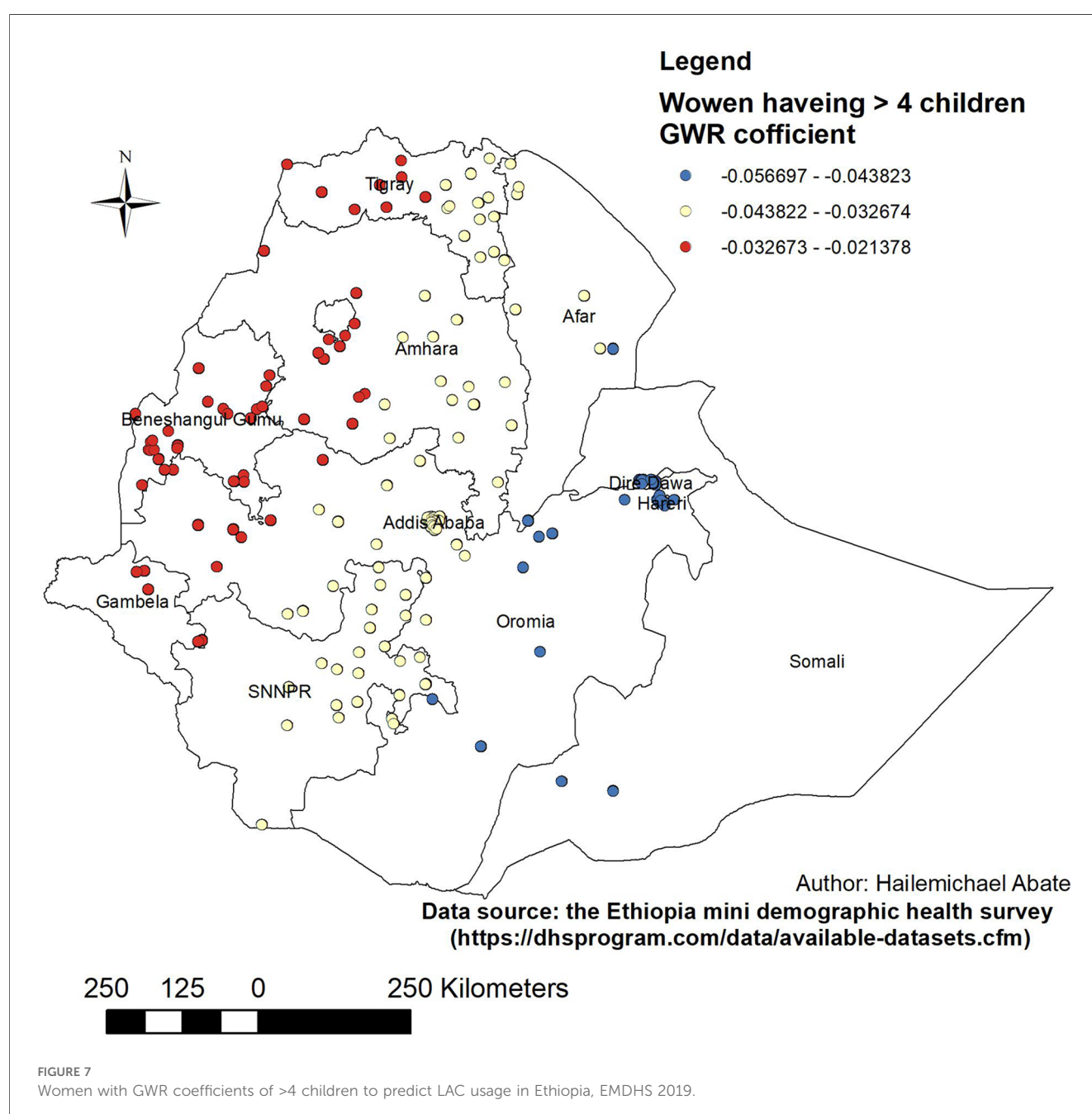
Discussion

This baseline study shows the geographical variation of LACs and their associated factors in Ethiopia. LAC hot spots were located in Tigray, Amhara, Benishangul-Gumuz, Afar, Tigray, Oromia, SNNPR, and Gambela. Based on the findings of this study, the potential disparity in the use of LACs across the region could be due to different sociodemographic factors. In the GWR analysis, statistically significant determinant factors are identified that had strong and weak relationships with the use of LACs.

The proportion of women who were married, who had a primary education, who were Muslim, and who had >4 children were the predictors of the geographic areas of the LAC hot spots. From these predictors, the GWR coefficient of primary education relatively

indicated that strong predictors of LAC were in the range of 0.098219–0.098233. The findings of this study can be used to emphasize the distribution use of LAC in the least used area of Ethiopia by addressing the predictors in the use of LAC.

The GWR coefficient of those women who were married varied from region to region in the range of 0.0938558–0.095068. The proportion of women who were married in the state increased the incidence of LAC use in Tigray, Amhara, Benishangul-Gumuz, and parts of Afar. This study's findings differed from the studies conducted in the 2016 EDHS (27, 35) in Ghana (36). A possible justification might be because of the difference in use of the dataset and method of analysis. Furthermore, participants in the current study might have knowledge in the use of LAC during pregnancy follow-up visits, the exchange of information



with their couples, and the participation of husbands in reproductive services (37, 38).

The finding of this study also indicated that the proportion of women who had a primary education had a positive relationship and increased the prevalence of LAC use in Tigray, Amhara, Benishangul-Gumuz, Gambela West, and the northern part of Afar. This finding was supported by studies conducted in Ethiopia (39–41), Nigeria (42), and sub-Saharan Africa (43). A possible explanation might be that educated women would have information about the importance of the use of LAC through different social media and reading different articles (44, 45).

However, religious Muslim women had a negative and weak relationship with the use of LAC. Therefore, the Muslim religion was a protective factor in the use of LAC hot spot areas. The proportion of religious Muslim women decreased in the use of LAC hot spot areas of West Amhara and Oromia, in the entire Benishangul-Gumuz, and in some parts of Tigray, Gambela, and SNNPR. The finding in this study is consistent with studies conducted in Ethiopia (46), Nigeria (47), and Nepal (48). A possible justification could be that religious opposition to contraceptive use may be more problematic for Muslim women (49).

Similarly, women who had >4 children had a negative and weak relationship with the use of LAC. Therefore, the factor of women who had >4 children was protective in the use of LAC hot spot areas. The proportion of women who had >4 children decreased in the use of LAC hot spot areas of Tigray, Amhara, Gambela, Benishangul-Gumuz, northwest Tigray, southwest Amhara, and parts of Gambela. This finding is supported by the study conducted in sub-Saharan Africa (50). This could be because women who had more children could be approaching physiological menopause and thus experience decreased sexual desire so there is no need for the use of long-acting contraceptives (51).

The present study has some limitations. The geographical coordinate cluster area was displaced by 2 km in urban areas, 10 km for 1% of the clusters in rural areas, and 5 km for most of the clusters in rural areas to avoid anonymized respondents of the community. This may influence the estimated cluster effects in the spatial analysis. Furthermore, in the two EMDHS 2019, some maternal factors were not available; this could be a potential determinant of LAC. However, despite these limitations, the study also had its strengths. The study used a nationally representative dataset that covers all regions of the country. In addition, the spatial regression modeling analysis using GWR was the strength of this study.

Conclusions

The study showed that there was spatial variation in the use of long-acting contraceptives among women in Ethiopia. Significant hot spot areas of long-acting contraceptive use were lactated in Oromia, part of Amhara, Dire Dawa, and SNNPR.

Women who were married and had a primary education had a positive predictor of LAC. On the other hand, religious Muslim

women and women with >4 children had a negative relationship with the use of LAC.

Decision makers and the government should emphasize in women's health information about the use of contraceptives and cooperate with religious and community leaders as strategies to improve the use of long-acting contraceptives. Organizing campaigns with religious leaders on the use of contraceptives is a good strategy to improve the use of contraceptives by women. In addition, education about the factors that influence the negative attitude toward the use of contraceptives is another effective means to increase the use of contraceptives. Furthermore, researchers should investigate other cultural and social factors that hinder the geographical variation of the use of long-acting contraceptives.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary Material](#), further inquiries can be directed to the corresponding author.

Author contributions

HA: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. AA: Formal Analysis, Investigation, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing. CK: Formal Analysis, Project administration, Validation, Writing – original draft, Writing – review & editing. MW: Data curation, Formal Analysis, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing. CM: Data curation, Formal Analysis, Investigation, Methodology, Project administration, Software, Validation, Writing – original draft, Writing – review & editing. YW: Data curation, Investigation, Methodology, Project administration, Software, Validation, Writing – original draft, Writing – review & editing. AZ: Data curation, Formal Analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fgwh.2024.1420476/full#supplementary-material>

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Determinants of DMPA-SC self-care/self-injectable contraceptive uptake among modern contraceptive users in Burkina Faso: findings from the 2021 demographic and health survey

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Introduction: This study aimed to identify the determinants that influence the use of DMPA-SC/Sayana Press among women who use modern contraceptive methods in Burkina Faso.

Methods: This study used secondary data obtained from the 2021 Burkina Faso Demographic and Health Survey (EDSBF). The dependent variable is the use of DMPA-SC among women aged 15–49 who employ modern contraceptive methods. The descriptive analysis used percentages to describe the study variables. The Pearson chi-square test was used to assess the associations between the explanatory variables and the study variable of interest. Bivariate logistic regression was used to examine the crude odds ratios of each explanatory variable with respect to the dependent variable. The multivariate model was used to determine the net effect of each independent variable on the dependent variable. The significance levels were defined at $p < 0.05$, with corresponding confidence intervals.

Results: The study revealed significant differences in the use of DMPA-SC according to age, marital status, region of residence, level of education, number of children, and involvement in contraceptive decision-making within the couple. Younger women (aged 15–29 aOR = 2.12, $p < 0.001$) and women aged 30–39 (aOR = 1.51, $p = 0.02$) are also more likely to use DMPA-SC compared to those aged 40–49. Married women or those living with a partner [aOR = 1.93 (1.22, 3.05)] are more likely to use DMPA-SC. Women with 1–3 children are twice as likely to use DMPA-SC as those without children (aOR = 1.97, $p = 0.02$). Region and Wealth Index were significantly associated with DMPA-SC use. The Boucle du Mouhoun region showed a significantly higher likelihood of DMPA-SC use (aOR = 8.10) and women in the highest wealth group are significantly less likely to use DMPA-SC (aOR = 0.59, $p = 0.001$).

Conclusion: These results demonstrated the importance of adapting interventions to account for socio-demographic, regional, and cultural differences. This will enable the provision of services to the entire female population in a fair and equitable manner, while also addressing the limitations and enhancing the understanding of the underlying factors influencing the use of DMPA-SC.

KEYWORDS

determinants, DMPA-SC, contraception, DHS, Burkina Faso

1 Introduction

Adopting a modern contraceptive method reduces maternal morbidity and mortality rates (1, 2). Pregnancies that occur too early, too late, too frequently, and too closely spaced are primary causes of direct obstetric complications, which account for over 70% of maternal deaths in low-income countries (3). Consequently, family planning is crucial for reducing fertility rates and maternal mortality by avoiding high-risk pregnancies and decreasing the need for abortions, thereby helping to increase women's life expectancy (4). Central to achieving the 2030 Sustainable Development Goals (SDGs), family planning has major implications in areas such as gender, employment, poverty reduction, and health (5).

Despite these benefits, contraceptives remain underused in many developing regions (6, 7). Typically, women from favourable backgrounds and living conditions exhibit higher contraceptive use, whereas women from impoverished households, who are in greater need of contraceptives, often have limited access to them (4).

The global sexual and reproductive health and rights (SRHR) agenda now prioritizes the right of women to freely choose the number and timing of their children (8). A number of recent initiatives call for the gaps in access to modern contraception to be filled, particularly when women wish to avoid pregnancy but do not have the means or use traditional methods (9). One of the flagship initiatives in this area is Family Planning 2020, a global partnership launched in 2012. It aims to add 120 million new modern contraceptive users in the world's 69 least-developed countries by 2020 (9).

For family planning to be effective, it is essential to ensure continuity in the use of contraception. However, many factors, such as cost, convenience, satisfaction with the method, side effects, partner disagreement, and limited method options, lead many women to abandon contraception, resulting in higher unwanted pregnancies and a higher total fertility rate (10).

Injectable contraceptives, widely used for preventing pregnancy, particularly in sub-Saharan Africa (11–13), represent a major advance. Subcutaneous injectable contraception based on medroxyprogesterone acetate (DMPA-SC) (brand name Sayana® Press) represents a major advance, enabling self-administration and considerably widening access to contraception (14). It is an effective method, rivalling intrauterine devices, implants, and sterilisation. Moreover, the discreet nature of DMPA-SC is crucial, particularly for women living in rural communities who seek confidential family planning (15).

Self-care approaches, such as self-injection of contraceptives, have the potential to revolutionise healthcare systems and contribute to the achievement of universal public health. When integrated into primary healthcare, these self-care practices can significantly impact health and well-being (16). Self-injection of DMPA-SC or other injectable contraceptives could remove barriers and enhance contraception accessibility, facilitating its continued use, particularly for women who have difficulty gaining regular access to health facilities or where the availability of providers is limited (14, 17). Kim et al. found that self-administration of

injectable contraceptives improves contraceptive compliance by eliminating the requirement of clinic visits for each injection (18).

Studies conducted in Burkina Faso, Niger, Senegal, and Uganda have demonstrated the favourable reception of DMPA-SC, paving the way for increased access to family planning for women who already use contraceptive methods, as well as new users and young women (16, 19–21). Economic analyses conducted in Senegal and Uganda suggest that self-injection can result in significant savings for women and health systems (16).

With a total fertility rate of 4.4 children per woman (22), Burkina Faso remains one of the countries with the highest fertility rate in the world. Despite an improvement in contraceptive prevalence, rising from 10% in 2010 (23) to 30.1% in 2021 (22), the most recent DHS data reveals that 13% of women still have unmet needs, and total demand for family planning remains low, with only 43% expressing a need for it (34% for birth spacing and 9% for contraception). Numerous barriers hinder the use of contraception, including poor access to services, women's marginalised status, high illiteracy rates among women, the patriarchal structure of society, and opposition from men (24, 25).

Increasing the supply of contraceptive methods through the introduction of DMPA-SC in 2014 and rapidly scaling up within public health facilities was a strategy implemented by the Ministry of Health to reduce barriers to women's access to family planning (26).

Since the introduction of self-administered injectable contraception, which offers the potential to address unmet family planning needs in developing countries, including Burkina Faso, numerous studies have been conducted. However, the main limitation of these studies lies in the use of samples that are not representative of the population of women of childbearing age who use contraceptive methods (27–28). Some studies recruited samples of women from health centres (29–31), which is not necessarily representative of the diversity of women nationwide. Others have used a cohort of women recruited during family planning campaigns organised in specific areas (32). Our study benefits from utilizing data sourced from the Demographic and Health Survey (DHS), ensuring the attainment of a nationally representative sample.

This study aims to understand the determinants that influence the use of DMPA-SC/Sayana Press among women who use modern contraceptive methods in Burkina Faso.

2 Methods

2.1 Study area

Burkina Faso is a landlocked country in the Sahel region, with a total area of approximately 272,969 km². It shares borders with Mali to the northwest, Niger to the northeast, Benin to the southeast, and Côte d'Ivoire, Ghana, and Togo to the south. Administratively, Burkina Faso is divided into thirteen (13) regions and forty-five (33) provinces, which are, in turn, subdivided into 351 departments and 8,228 villages.

According to the results of the 5th General Census of Population and Housing (RGPH) in 2019, Burkina Faso had a total population of 20,505,155. This population breaks down into 9,900,847 men and 10,604,308 women, equivalent to a sex ratio of 107.1 women for every 100 men (34).

Women of childbearing age, i.e., those aged between 15 and 49, will represent 44.0% of the female population and 22.7% of the total population in 2019. Despite a downward trend in recent years, Burkina Faso has high fertility levels, comparable to other countries in sub-Saharan Africa.

2.2 Data source

This study uses secondary data obtained from the 2021 Burkina Faso Demographic and Health Survey (EDSBF). The survey employed a two-stage stratified sampling technique. In the first stage, clusters/enumeration areas (EAs) were selected from the national sampling frame, derived from the 2019 census. Details of the EDSBF methodology are described in detail in the EDSBF final report (22). The EDSBF sampling process is designed to ensure representativeness at the national level, considering the place of residence (urban, rural) and the regions of Burkina Faso.

The Demographic and Health Survey collects data on various health and social issues, including fertility, mortality, family planning, women's health, children's health, and men's health (35–37). This study focussed on a sample of women aged 15–49 who use modern contraceptive methods.

2.3 Study variables

2.3.1 Dependent variable

The dependent variable was the use of DMPA-SC among women aged 15–49 who use modern contraceptive methods. Users of modern contraceptive methods are defined as women who use pills, intrauterine devices (IUDs), implants, injectable contraceptives, including DMPA/Sayana Press, male or female condoms, emergency contraception, female or male sterilisation, and other modern contraceptive methods. The dependent variable was coded as follows: 1 if the woman used DMPA-SC/Sayana Press, and 0 if she used any other modern contraceptive method.

2.3.2 Independent variables

The explanatory variables used were selected in the light of the literature review (38–43) and include the woman's age, marital status, level of education, occupation, religion, parity, region and area of residence, media exposure, and her husband's level of education. In addition, variables such as discussion within the couple about family planning were considered in the analysis. Wealth quintiles and the question of distance to the health centre were also included in the analyses.

2.4 Data analysis

This study used both descriptive statistics and logistic regression models to analyse the data. The descriptive analysis used percentages to describe the study variables. Pearson's chi-square test was used to assess the associations between the explanatory variables and the study variable of interest. Bivariate logistic regression was used to examine the crude odds ratios of each explanatory variable to the dependent variable. The multivariate model was used to determine the net effect of each independent variable on the dependent variable. Significance levels were defined at $p < 0.05$, with corresponding confidence intervals. The results were presented in tabular form. Analysis was performed using Stata version 18 software.

2.5 Ethical considerations

This study is based on the analysis of secondary data without the use of any information enabling participants to be identified. The EDS survey was approved by ICF International and by a national ethics committee, and it received all the necessary authorisations to collect household data. All participants gave written informed consent before taking part in the survey. Although no additional ethical approval was required for this study, we obtained written permission from the DHS programme to use the data.

3 Results

In total, this study used a sample of 5112 women who use modern contraceptive methods. Table 1 presents the characteristics of the women according to the variables used in the study. DMPA-SC was used by 10.1% of women. The majority of the women included were aged between 15 and 29 (49.7%), followed by those aged between 30 and 39 (34.3%) and those aged between 40 and 49 (16.0%) and most women were Muslim (62.8%). The breakdown by marital status shows that a large proportion of women were married or living with a partner (82.2%), while 17.8% were not living with a partner.

More than half of the women have no formal education (56.5%). Most women have between 1 and 3 children (45.0%), while 13.1% have no children yet. A significant proportion of women (40.2%) do not discuss family planning with their partner. The women have a variety of occupations, with a high proportion of farmers (30.6%) and shopkeepers (21.6%). For some women, the distance to a health centre is a significant problem (31.5%), which may have an impact on their ability to obtain contraceptive services.

Table 2 examines the associations between different explanatory variables and using DMPA-SC (Subcutaneous Depot of Medroxyprogesterone Acetate) in Burkina Faso. The results indicate significant associations with several demographic, socio-economic, and behavioural factors.

TABLE 1 Socio-demographic characteristics of women using modern contraceptive methods.

Variables	<i>n</i>	%
Use DMPA-SC/Sayana		
Don't use DMPA-SC	4,618	90.3
Use DMPA-SC	494	9.7
Total	5,112	100
Age		
15–29	2,538	49.6
30–39	1,745	34.1
40–49	829	16.2
Total	5,112	100
Religion		
Muslim	3,184	62.3
Christian	1,696	33.2
Traditionnal	232	4.5
Total	5,112	100
Marital status		
Married/with partner	4,178	81.7
Not living with partner	934	18.3
Total	5,112	100
Type of residence		
Urban	2,063	40.36
Rural	3,049	59.64
Total	5,112	100
Administrative regions		
Boucle du Mouhoun	464	9.1
Cascades	312	6.1
Centre	612	12
Centre Est	451	8.8
Centre Nord	283	5.5
Centre Ouest	430	8.4
Centre Sud	378	7.4
Est	207	4
Hauts-Bassins	666	13
Nord	380	7.4
Plateau central	365	7.1
Sahel	178	3.5
Sud-Ouest	386	7.6
Total	5,112	100
Education attainment		
No education	2,841	55.6
Primary	768	15
Secondary or above	1,503	29.4
Total	5,112	100
Number of children		
No child	648	12.7
1–3	2,294	44.9
4–5	1,322	25.9
6 and above	848	16.6
Total	5,112	100
Discussion within the couple about FP and the number of children		
Yes	1,809	35.4
No	2,065	40.4
Not applicable	1,238	24.2
Total	5,112	100
Frequency on media (radio, tv, magazines)		
Not at all	1,178	23
Often or regularly	3,934	77

(Continued)

TABLE 1 Continued

Variables	<i>n</i>	%
Total	5,112	100
Wealth index		
Poorest	623	12.2
Poorer	812	15.9
Middle	1,061	20.8
Richer	1,196	23.4
Richest	1,420	27.8
Total	5,112	100
Husband education level		
No education	2,798	54.7
Primary	613	12
Secondary/higher	767	15
Not applicable	934	18.3
Total	5,112	100
Women's occupation		
Inactives	1,546	30.2
Managers/employees	271	5.3
Female traders	1,166	22.8
Women farmers	1,602	31.3
Manual workers/housewives/domestic workers	527	10.3
Total	5,112	100
Problem of distance to get to a health centre		
Big problem	1,565	30.6
Not a big problem	3,547	69.4
Total	5,112	100

Table 2 examines the associations between different explanatory variables and the use of DMPA-SC (Subcutaneous Medroxyprogesterone Acetate Depot) in Burkina Faso. The results show significant associations with several demographic, socio-economic and behavioural factors.

The difference in DMPA-SC use between age groups was statistically significant ($p = 0.018$). The proportion of DMPA-SC users was higher among women aged 15–29 (10.2%) and 30–39 (10.2%) than among women aged 40–49 (7.0%). Marital status was associated with DMPA-SC use ($p = 0.001$). Women who were married or living with a partner (10.9%) had a significantly higher rate of use than those not living with a partner (4.3%).

There were also significant variations in the use of DMPA-SC according to administrative region ($p = 0.001$) and place of residence. The results show geographical disparities, with higher rates of use in some regions than in others. Women's level of education was another factor associated with the use of DMPA-SC ($p = 0.046$). The results show that women with secondary or higher education have a lower rate of use than those with no education or primary education ($p = 0.046$). The number of children already born was significantly associated with the use of DMPA-SC ($p = 0.000$). Women without children or with a higher number of children had a lower rate of DMPA-SC use. Women who discuss family planning within the couple are more likely to use DMPA-SC ($p = 0.001$). Wealth was significantly associated with DMPA-SC use ($p = 0.001$). The spouse's level of education was significantly associated with the use of DMPA-SC ($p = 0.001$).

TABLE 2 Associations between explanatory variables and the use of DMPA-SC in Burkina Faso.

Variables	Use DMPA-SC/Sayana				P-value
	Don't use	use	Total	n	
Age					0.018
15–29	89.8	10.2	100	2,538	
30–39	89.8	10.2	100	1,745	
40–49	93.0	7.0	100	829	
Total	90.3	9.7	100	5,112	
Religion					0.647
Muslim	90.1	9.9	100	3,184	
Christian	90.6	9.4	100	1,696	
Traditionnal	91.8	8.2	100	232	
Total	90.3	9.7	100	5,112	
Marital status					0.001
Married/with partner	89.1	10.9	100	4,178	
Not living with partner	95.7	4.3	100	934	
Total	90.3	9.7	100	5,112	
Type of residence					0.001
Urban	92.29	7.71	100	2,063	
Rural	89.01	10.99	100	3,049	
Total	90.34	9.66	100	5,112	
Administrative regions					0.001
Boucle du Mouhoun	83.8	16.2	100	464	
Cascades	94.9	5.1	100	312	
Centre	89.1	10.9	100	612	
Centre Est	91.6	8.4	100	451	
Centre Nord	97.5	2.5	100	283	
Centre Ouest	90.5	9.5	100	430	
Centre Sud	93.7	6.3	100	378	
Est	91.3	8.7	100	207	
Hauts-Bassins	82.9	17.1	100	666	
Nord	90.0	10.0	100	380	
Plateau central	94.2	5.8	100	365	
Sahel	93.3	6.7	100	178	
Sud-Ouest	94.0	6.0	100	386	
Total	90.3	9.7	100	5,112	
Education attainment					0.046
No education	90.0	10.0	100	2,841	
Primary	88.7	11.3	100	768	
Secondary or above	91.7	8.3	100	1,503	
Total	90.3	9.7	100	5,112	
Number of children					0.001
No child	96.6	3.4	100	648	
1–3	89.1	10.9	100	2,294	
4–5	89.4	10.6	100	1,322	
6 and above	90.4	9.6	100	848	
Total	90.3	9.7	100	5,112	
Discussion within the couple about FP and the number of children					0.001
Yes	86.7	13.3	100	1,809	
No	91.0	9.0	100	2,065	
Not applicable	94.5	5.5	100	1,238	
Total	90.3	9.7	100	5,112	
Frequency on media (radio, tv, magazines)					0.421
Not at all	89.7	10.3	100	1,178	
Often or regularly	90.5	9.5	100	3,934	
Total	90.3	9.7	100	5,112	
Wealth index					0.001
Poorest	89.6	10.4	100	623	
Poorer	90	10	100	812	

(Continued)

TABLE 2 Continued

Variables	Use DMPA-SC/Sayana				P-value
	Don't use	use	Total	n	
Middle	89	11	100	1,061	
Richer	88.3	11.7	100	1,196	
Richest	93.6	6.4	100	1,420	
Total	90.3	9.7	100	5,112	
Husband education level					0.001
No education	89.2	10.8	100	2,798	
Primary	87.4	12.6	100	613	
Secondary/higher	90.4	9.6	100	767	
Not applicable	95.7	4.3	100	934	
Total	90.3	9.7	100	5,112	
Women's occupation					0.058
Inactive	89.7	10.3	100	1,546	
Managers/employees	91.9	8.1	100	271	
Female traders	90.8	9.2	100	1,166	
Women farmers	89.3	10.7	100	1,602	
Manual workers/housewives/ domestic workers	93.4	6.6	100	527	
Total	90.3	9.7	100	5,112	
Problem of distance to get to a health centre					0.269
Big problem	89.6	10.4	100	1,565	
Not a big problem	90.6	9.4	100	3,547	
Total	90.3	9.7	100	5,112	

Religion, place of residence, frequency of listening to the media, occupation of the woman, and the problem of distance to the health centre were not significantly associated with the use of DMPA.

Table 3 presents the results of the multivariate logistic regression analysis. The results of the logistic regression present the adjusted odds ratios (aOR) and 95% confidence intervals (95% CI) for different explanatory variables concerning the use of DMPA-SC. The age of the woman was significantly associated with the use of DMPA-SC. Women aged between 15 and 29 were twice as likely to use DMPA-SC as those between 40 and 49 (aOR = 2.12, $p = 0.000$). Women aged 30 to 39 were also more likely to use DMPA-SC than the reference group (aOR = 1.51, $p = 0.02$).

Several regions showed a strong association with the use of DMPA-SC. For example, the Boucle du Mouhoun region had a high aOR of 8.10, which means that women in this region are significantly more likely to use DMPA-SC. Married women or those living with a partner [aOR = 1.93 (1.22, 3.05)] are more likely to use DMPA-SC. Women's level of education showed no significant association with the use of DMPA-SC.

Concerning the number of children the woman has, women with 1–3 children are approximately twice as likely to use DMPA-SC compared with those without children (aOR = 1.97, $p = 0.02$). Similarly, women with 4 to 5 children or 6 or more children were also significantly more likely to use DMPA-SC.

Women who discussed family planning within the couple were 1.45 times more likely to use DMPA-SC (aOR = 1.45, $p = 0.001$). Women for whom this discussion was not applicable were less likely to use it. The results show that women in the highest

TABLE 3 Results of multivariate analysis of DMPA-SC use and explanatory variables among women using modern contraceptive methods in Burkina Faso.

Variables	Crude odds ratios (OR)		Adjusted odds ratios (aOR)	
	OR [95% CI]	P-value	aOR [95% CI]	P-value
Age				
15–29	1.50 [1.12, 2.02]	0,010	2.12 [1.42, 3.16]	0,001
30–39	1.51 [1.11, 2.06]	0,010	1.51 [1.08, 2.11]	0,020
40–49	1		1	
Religion				
Muslim	1		1	
Christian	0.95 [0.78, 1.16]	0,610	1.00 [0.80, 1.26]	0,970
Traditionnal	0.81 [0.50, 1.32]	0,400	0.93 [0.54, 1.60]	0,790
Marital status				
Married/with partner	2.72 [1.96, 3.80]	0,001	1.93 [1.22, 3.05]	0,010
Not living with partner	1		1	
Type of residence				
Urban	1		1	
Rural	1.48 [1.21, 1.80]	0,001	1.12 [0.85, 1.49]	0,420
Administrative regions				
Boule du Mouhoun	7.60 [3.45, 16.75]	0,001	8.10 [3.64, 18.02]	0,001
Cascades	2.13 [0.86, 5.26]	0,100	2.82 [1.13, 7.04]	0,030
Centre	4.85 [2.20, 10.70]	0,001	7.78 [3.45, 17.53]	0,001
Centre Est	3.63 [1.60, 8.24]	0,001	3.56 [1.55, 8.14]	0,001
Centre Nord	1		1	
Centre Ouest	4.16 [1.84, 9.40]	0,001	4.47 [1.96, 10.20]	0,001
Centre Sud	2.67 [1.14, 6.29]	0,020	2.99 [1.26, 7.12]	0,010
Est	3.76 [1.54, 9.17]	0,001	3.17 [1.28, 7.87]	0,010
Hauts-Bassins	8.14 [3.74, 17.71]	0,001	10.49 [4.77, 23.06]	0,001
Nord	4.38 [1.93, 9.96]	0,001	4.62 [2.01, 10.59]	0,001
Plateau central	2.41 [1.01, 5.74]	0,050	2.46 [1.02, 5.91]	0,040
Sahel	2.85 [1.10, 7.38]	0,030	3.07 [1.16, 8.11]	0,020
Sud-Ouest	2.50 [1.06, 5.91]	0,040	2.60 [1.07, 6.34]	0,030
Education attainment				
No Education	1		1	
Primary	1.15 [0.90, 1.49]	0,270	1.20 [0.91, 1.58]	0,190
Secondary or above	0.81 [0.65, 1.01]	0,070	1.26 [0.94, 1.68]	0,120
Number of children				
No child	1		1	
1–3	3.50 [2.24, 5.45]	0,001	1.97 [1.09, 3.54]	0,020
4–5	3.37 [2.13, 5.34]	0,001	2.37 [1.23, 4.56]	0,010
6 children & above	3.00 [1.85, 4.87]	0,001	2.44 [1.21, 4.93]	0,010
Discussion within the couple about FP and the number of children				
Yes	1.56 [1.27, 1.91]	0,001	1.45 [1.17, 1.80]	0,001
No	1		1	
Not applicable	0.59 [0.44, 0.79]	0,001	0.71 [0.53, 0.96]	0,030
Frequency on media (radio, tv, magazines)				
Not at all	1		1	
Often or regularly	0.92 [0.74, 1.14]	0,420	1.10 [0.86, 1.39]	0,460
Wealth index				
Poorest	1		1	
Poorer	0.95 [0.67, 1.34]	0,780	0.93 [0.65, 1.34]	0,710
Middle	1.06 [0.77, 1.47]	0,700	0.97 [0.69, 1.37]	0,860
Richer	1.14 [0.83, 1.55]	0,420	1.01 [0.70, 1.47]	0,950
Richest	0.59 [0.42, 0.82]	0,001	0.47 [0.29, 0.76]	0,001

(Continued)

TABLE 3 Continued

Variables	Crude odds ratios (OR)		Adjusted odds ratios (aOR)	
	OR [95% CI]	P-value	aOR [95% CI]	P-value
Women's occupation				
Inactive	1		1	
Managers/employees	0.77 [0.48, 1.23]	0,270	1.16 [0.69, 1.95]	0,580
Female traders	0.88 [0.68, 1.14]	0,340	1.03 [0.77, 1.37]	0,850
Women farmers	1.04 [0.83, 1.31]	0,720	0.94 [0.72, 1.21]	0,610
Manual workers/housewives/domestic workers	0.62 [0.42, 0.91]	0,010	0.69 [0.46, 1.03]	0,070
Problem of distance to get to a health centre				
Big problem	1		1	
Not a big problem	0.89 [0.73, 1.09]	0,270	0.95 [0.76, 1.18]	0,650
Constant			0.007 [0.001, 0.01]	0,001
N	5,112		5,112	

CI, confidence interval, OR, crude odds ratio, aOR, Adjusted odds Ratio, 1 = Reference.

wealth group are significantly less likely to use DMPA-SC (aOR = 0.59, $p = 0.001$).

Women's occupations and problem of distance to get to a health centre showed no significant association with the use of DMPA-SC among women.

4 Discussion

This study aimed to understand the determinants influencing the use of DMPA-SC/Sayana Press among women who use modern contraceptive methods in Burkina Faso. The results show several significant associations between different explanatory variables and DMPA-SC use. These results provide crucial information to guide public health policies and awareness programmes aimed at improving access to this contraceptive method and promoting family planning in the country.

The studies showed that DMPA-SC users were more numerous among women aged 15–29 and those aged 30–39 than among women aged 40 and over. This result appears to be consistent with findings elsewhere. In a study in Uganda, Cornelie et al. found that, compared with adult women, adolescents were more likely to use a modern contraceptive method for the first time when they opted for self-injection (44). Also, in Uganda and the DRC, results showed that young women (15–19 years) were more likely to use DMPA-SC compared to those aged 45–49 years, which could result from DMPA-SC programmes targeting younger women in these contexts (33). Also, many current DMPA-SC users are first-time contraceptive users, suggesting that DMPA-SC is reaching new populations and potentially increasing the overall prevalence of modern contraceptives in some settings (33, 45). In addition, the fact that self-infection allows great discretion and fewer visits to health centres makes DMPA-SC an attractive method for young women and married and unmarried teenagers, particularly those in need of secret contraception (46). In addition, community distribution of

DMPA-SC appears to be an effective service delivery model for hard-to-reach populations, those most at risk of unmet need for FP, and key populations such as young people and unmarried users (47) and aids in decreasing the discontinuation and abandonment of contraception usage (19, 48, 49).

Our results also showed that marital status is significantly associated with the use of DMPA-SC. Married women were more likely to use the Sayana press than women who were not in a union. This result is also consistent with previous research. In a study conducted in Burkina Faso, the Democratic Republic of Congo, and Uganda, the results showed that never-married women were more likely to use male condoms than DMPA-SC, which is consistent with research conducted elsewhere showing that never-married women were less likely to use DMPA-SC than all other modern methods combined. This may be because condoms are not generally used in marriage in sub-Saharan Africa (33).

The region of residence and the number of children per woman also play a role in the use of the DMPA-SC. Use of the DMPA-SC varies considerably from one region to another, with women living in the Hauts-Bassins, Boucle du Mouhoun, Centre, Centre West, and North being more likely to use the DMPA-SC than those living in other regions of the country. This variation between regions could be linked to the strategy for moving to the DMPA-SC in the health districts at the national level. Indeed, prior to the scale-up, the DMPA-SC was only available in four pilot health districts in Burkina Faso before being gradually extended to all health districts nationwide (26). Furthermore, Angliewicz et al., in their study, found that stocks of DMPA-SC varied according to context, with more regular stocks in private establishments in the DRC and public establishments in Burkina Faso and Nigeria (45). Also, persistent stock-outs and limited method options can disrupt contraceptive use and increase discontinuation (45).

This study emphasised the significance of parity (number of children per woman) in the use of DMPA-SC. Women with children were more likely to choose DMPA-SC than those without children. This result is consistent with the findings of Angliewicz et al. in both Uganda and the DRC, who found that women with two or more children (compared with no children or a single birth) were more likely to choose implants over DMPA-SC in both Uganda and the DRC (33).

The main strength of this study lies in its use of nationally representative data. However, several limitations were also identified. The cross-sectional nature of the study design prevents us from establishing a causal link between variables. In addition, the use of secondary data limited the integration of other determinants, such as quality of care, including advice on side effects, accessibility of services, and cultural factors, which were not considered in the models.

The results of the study serve as a starting point for further debate. In light of the results of this study, there are many crucial policy implications for improving access to and use of

modern contraceptive methods in Burkina Faso. Policies should aim to increase education and awareness of contraceptive methods, with a focus on demographic groups least likely to use DMPA-SC, such as women aged 40–49. Specific information campaigns need to be developed for these groups. Also, the geographical disparities observed in the use of DMPA-SC require interventions to ensure equitable access to family planning services in all regions of the country. This could involve expanding services in regions where their use is less widespread.

5 Conclusion

Research into the use of DMPA-SC among women who use modern contraceptive methods in Burkina Faso has produced significant and informative results. The study, based on a representative sample of 5,112 women, revealed striking associations between several socio-demographic and behavioural variables and the use of this contraceptive method. The results of the study highlight significant differences in the use of DMPA-SC according to age, marital status, region of residence, level of education, number of children, and contraceptive discussion within the couple. Younger women are more likely to use DMPA-SC, as are those who are married or living with a partner. Geographical disparities and differences in the number of children a woman has are also significant factors in contraceptive use.

These results underline the need to adapt interventions to take account of socio-demographic, regional, and cultural differences to ensure an adapted and equitable service offer for the entire female population while addressing limitations and deepening understanding of the underlying determinants of DMPA-SC use. It is crucial to expand the distribution and enhance the accessibility of DMPA-SC to guarantee equal access to this family planning method in all regions. Additionally, we suggest intensifying awareness campaigns regarding this method, which would facilitate outreach to and enable marginalised women (rural, poor economic and social conditions) and young women to conveniently obtain DMPA-SC.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: <http://dhsprogram.com/data/available-datasets.cfm>.

Author contributions

AB: Conceptualization, Formal Analysis, Writing – original draft, Writing – review & editing.

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Less than one in five teenage women in Ethiopia know about emergency contraception

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Background: Teenage women's fertility health faces significant challenges from unintended pregnancies and unsafe abortions. Using an emergency contraception within a defined time period could prevent unintended pregnancy and its damaging consequences, like unintended childbirth and unsafe abortion. Despite it being an appropriate contraception, the knowledge of teenage women about emergency contraception is lower among women in developing countries. Therefore, this study aimed to examine the magnitude of emergency contraception knowledge and its associated factors among teenage women in Ethiopia.

Methods: Data for this study was obtained from the recent Demographic and Health Surveys. A total weighted sample of 3,381 teenage reproductive women were included. The significant associated factors with emergency contraception knowledge among teenage reproductive women were determined by fitting a multilevel mixed-effect binary logistic regression model. Finally, Adjusted Odds Ratio (AOR) with a 95% confidence interval and a *P* value of less than 0.05 was used to declare statistical significance.

Results: In Ethiopia, the magnitude of teenage women who knew about emergency contraception was 19.47% (95%CI: 18.17, 20.84). Age 17 years (AOR = 1.76, 95%CI, 1.24, 2.48) and age 19 years (AOR = 2.18, 95%CI, 1.47, 3.22), primary education level (AOR = 2.76, 95%CI, 1.60, 4.76), secondary and above educational level (AOR = 4.70, 95%CI, 2.62, 8.44), being protestant followers (AOR = 0.63, 95%CI, 0.45, 0.87), being muslim followers (AOR = 0.68, 95%CI, 0.49, 0.93), media exposure (AOR = 3.36, 95%CI, 2.59, 4.34), rural residence (AOR = 0.45; 95%CI: 0.22, 0.86), and high community level education (AOR = 140, 95%CI: 1.32, 2.00) were factors significantly associated with knowledge of emergency contraception among teenage women.

Conclusions: This finding concluded that less than one in five teenage women knew about emergency contraception in Ethiopia. The knowledge of emergency contraception among teenage women in Ethiopia was substantially associated with women's age, education level, religion, media exposure, residency and community-level education. Hence, there is a need to implement comprehensive awareness programs and promotion of emergency contraception as a way of curbing cases of unintended pregnancies among teenage women. Government and non-governmental organizations should design targeted educational initiatives and media campaigns to improve emergency contraception knowledge among young teenagers, women with lower educational backgrounds, and rural teenagers.

KEYWORDS

teenage women, EC, factors, multilevel analysis, Ethiopia

Background

Emergency contraception (EC) is a method of contraception utilized post-sexual activity but before possible implantation (1). It offers women a last opportunity to avoid getting pregnant after unprotected intercourse (2). EC is indicated when no contraception has been used when there has been a contraceptive accident or misuse, and sexual assault of a woman (3). EC methods are safe, effective, relatively inexpensive and can prevent pregnancies by up to 95% if they are timely taken i.e., especially within 72 h of unprotected sexual intercourse (4).

The mechanisms of action of emergency contraception are: inhibiting ovulation or blocking the implantation of a fertilized egg, however, will not terminate or interfere with a pregnancy once it is established (5). Sexual behaviors that are not planned or premarital are becoming more common among teenagers (6). Teenagers in underdeveloped nations continue to face significant obstacles related to unintended pregnancy, which compromises their reproductive health. Therefore, increasing their awareness and use of contraception is imperative (7). Many young individuals have irregular and unplanned sex, but few of them are aware that emergency contraception and contraceptives are options following unprotected sexual activity (8).

Compared to other regions, Africa has the highest percentage of women aged 15–19 who have undergone an unsafe abortion (9). According to estimates from the World Health Organization, women under the age of 20 make up at least 33% of those seeking hospital care for complications arising from abortions (10). Over 16 million teenage females between the ages of 15 and 19 give birth each year, accounting for 11% of all births globally, with 95% of these births taking place in poor nations (10). Unintended pregnancy is a global concern with far-reaching implications (11). In Ethiopia, teenage women rarely utilize EC to avoid unintended pregnancies because of a lack of knowledge. Lack of knowledge prevents clients from choosing a timely, appropriate, and well-informed type of birth control (12). Teenage girls face a high risk of unintended pregnancies and

unsafe abortions with devastating consequences on their health and life (13).

For many years, the government and NGOs have advocated to improve access and use of EC across the country. These efforts have been successful only in some urban areas, where EC is available (14). Even though a wide range of effective contraceptive options are available, women's awareness and use of these options especially in developing countries is still lagging. Specific developing countries have studied the knowledge of EC method among reproductive-age women, including Ethiopia (15, 16), Cameroon (17), Nigeria (18), Kenya (19), Ghana (20) and Tanzania (21). However, knowledge of EC among teenage women, the most important population group has not been thoroughly investigated using the national EDHS representative data in Ethiopia. Furthermore, these previous studies failed to take in to account community-level factors and their interaction with individual-level factors. Multilevel methods will provide an understanding of factors influencing EC knowledge at both the individual and community levels. Therefore, this study aimed to assess the magnitude of EC knowledge and its determinants among teenage women in Ethiopia.

Methods

Study settings and data source

A secondary data set from the recent Ethiopian Demographic Health Survey (EDHS) 2016 was used in this population-based cross-sectional research approach. The 2016 Ethiopian Demographic Health Survey (EDHS) is the most recent standardized data available in Ethiopia, despite the fact that Demographic Health Surveys (DHS) are carried out every 5 years (22, 23). The EDHS is a household survey that is nationally representative and is carried out through in-person interviews with a variety of population groups. The EDHS was conducted between January 18, 2016, and June 27, 2016.

Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; EC, emergency contraception; EDHS, Ethiopian demographic and health survey; ICC, intra-class correlation coefficient; MOR, median odds ratio; PCV, proportional change in variance; WHO, World Health Organization.

Ethiopia is the second most populous country in Africa and the twelfth in the world with a total population of 114.96 million and extensive agro-ecological and ethnic diversity, with over 85 ethno-linguistic groups (24, 25). There are nine regional states and two administrative cities in Ethiopia which are organized into three based on their geopolitical features: large central, small peripherals and metropolis (26). The EDHS program's official database, www.measuredhs.com, provided the data after authorization was obtained through an online request by explaining the study's objectives. The woman record (IR file) was used to extract the dependent and independent variables. A two-stage stratified sampling procedure was used to select the study participants.

Enumeration areas (EAs) were randomly selected in the first stage, then households were selected in the second stage. The data used in this analysis were weighted to adjust for non-response and variations in the probability of selection (27). A total weighted sample of 3,381 teenage women aged 15–19 years were included in this study. The data management and cleaning process was carried out from April 15 to 30, 2024.

Eligibility identification

Reproductive teenage women aged 15–19 years were included in this study.

Variables and measurements

Dependent variable

The outcome variable in this study was “knowledge of emergency contraception (EC)” among reproductive-age women aged 15–19 years which was recoded and dichotomized. “Do you know emergency contraception?” was a question posed to the women when data was being gathered. There were two replies: “no” and “yes.” The EDHS provided this variable coding (28).

Therefore, in the current study, a woman was considered as knowledgeable on emergency contraception if her response was “yes”, otherwise considered as not knowledgeable on emergency contraception if her response was “no”.

Explanatory (independent) variables

Both individual and community-level factors were taken into account as explanatory variables in the current study. The individual-level variables include the following: age, educational status of the women, marital status, occupation of the women, religion, family size, wealth index, mass media exposure and contraceptive use. The community-level variables were residence, community-level women's education, community-level media exposure, community-level poverty, and region. In DHS, all variables were collected at the individual level except for residence and region. Hence, we generate three community-level factors such as community-level women's education, community-level media exposure, and community-level poverty, by aggregating the individual-level factors at the cluster level and categorizing them depending on the median value, as high and low. The aggregated

variable was not normally distributed and the median value was used as a cut-off point for the categorization (29).

In this study, region was re-categorized into three categories; metropolis (Harari, Dire Dawa, and Addis Ababa), large central (Tigray, Amhara, Oromia, and Southern Nations Nationalities and Peoples Region), and small peripherals (Afar, Somali, Benishangul, and Gambela), based on their geopolitical features (30).

Media exposure was calculated by aggregating radio listening, TV watching, and reading newspapers and women who had exposure to either of the media sources were categorized as having media exposure and the rest were considered as having no media exposure (31). The variable wealth index was re-categorized as “poor”, “middle”, and “rich” categories by merging poorest with poorer and richest with richer (32).

Data management and analysis

Data analysis was performed using Stata version 14 Software. The data were weighted (v005/1,000,000) through the analysis to ensure the representativeness of the DHS sample and get reliable estimates and standard errors. Descriptive statistics were described using frequencies, percentages, median, and interquartile range, and were presented through narratives, tables and figures. We examined the interclass correlation coefficient (ICC), median odds ratio (MOR), and deviation (-2 LLR) to assess and compare the fitness of nested models.

This study fitted four models: The null model, which had no independent variables, model I (individual-level factors), model II (community-level factors), and model III (individual and community-level components).

To evaluate the model's fitness, the model with the lower deviation was taken into account. Model III was the best-fitting model due to its lowest deviance. Variables having a p -value of less than 0.2 in bivariable were used for multivariable analysis.

Finally, in the multivariable analysis, adjusted odds ratios with 95% confidence intervals and a p -value of less than 0.05 were considered statistically significant.

Results

Individual level factors

A total of 3,381 weighted teenage women were included in this study. About a quarter (27.01%) of the women were aged 18 years and the mean age of the respondents was 16.89 years. The majority (83.18%) were unmarried. Nearly two-thirds (63.53%) of respondents were with primary education level. Three-fourths (75.67%) were not employed and 42.18% of the respondents were orthodox by religion. About 54.15% were with a family size of >5 . Moreover, 92.48% of the respondents were not utilizing any contraceptive. About their economic status, 30.64% of the respondents were from the poor wealth quintiles, and nearly two-thirds (65.97%) of the respondents had no media exposure (Table 1).

TABLE 1 Individual level characteristics of respondents in Ethiopia ($n = 3,381$).

Variables	Category	Frequency	Percent (%)
Current age in year	15	708	20.93
	16	701	20.75
	17	642	18.97
	18	913	27.01
	19	417	12.34
Marital status	Unmarried	2,812	83.18
	Married	569	16.82
Educational status of respondents	No formal education	468	13.84
	Primary education	2,148	63.53
	Secondary and higher	765	22.63
Occupation of respondents	Not working	2,558	75.67
	Working	823	24.33
Religion	Orthodox	1,426	42.18
	Protestant	847	25.05
	Muslim	1,108	32.77
Family size	<3	675	19.98
	3–5	875	25.87
	>5	1,831	54.15
Contraceptive use	No	3,127	92.48
	Yes	254	7.52
Wealth status	Poor	1,036	30.64
	Middle	637	18.84
	Rich	1,708	5.52
Mass media exposure	No	2,231	65.97
	Yes	1,150	34.03

TABLE 2 Community-level characteristics of respondents ($n = 3,381$).

Variables	Category	Frequency	Percent (%)
Residence	Urban	805	23.80
	Rural	2,576	76.20
Community education status	Low	1,327	39.26
	High	2,054	60.74
Community media exposure	Low	1,666	49.28
	High	1,715	50.72
Community wealth status	Low	1,715	50.72
	High	1,666	49.28
Region	Metropolis	245	7.25
	Large central	2,958	87.48
	Small peripherals	178	5.27

comparison to 46.67% in Model I. This suggests that Model III is the most accurate model in describing the variability of EC variables among teenage women (Table 3).

Magnitude of emergency contraception knowledge among teenage women in Ethiopia

The overall prevalence of EC knowledge among teenage women in Ethiopia was 19.47% (95%CI, 18.17, 20.84). The lowest magnitude of EC knowledge among teenage women was in small peripherals (9.45%) whereas, metropolitan accounts for the highest magnitude of (38.61%) (Figure 1).

Community-level factors

Of the study participants, more than three-fourths (76.20%) were rural dwellers. About 60% (60.74%) of the women were from communities with a high proportion of community-level education. About half (50.72%) were with high community media exposure. Of the respondents, about half (50.72%) were in a high-poverty level community. Moreover, (87.48%) respondents were from large central parts of Ethiopia (Table 2).

Random effects (measures of variation) and model fitness

The intra-class correlation coefficient (ICC) in the null model was 31% which indicates that variations in knowledge of EC among teenage women were due to differences between clusters.

The median odds ratio (MOR) for EC knowledge among teenage women in the null model was 3.17 indicating that the teenage women's knowledge of EC varied between clusters. This explains that if we randomly picked individuals from different clusters, those women in the highest cluster of women's knowledge of EC had a 3.17 times higher chance to have EC knowledge than those in the lowest cluster of women's knowledge of EC. Model III, which incorporates both individual and community variables, had a higher proportionate change in variance (PCV) of 47.33 in

Factors associated with emergency contraception knowledge among teenage women

In the final model, age, women's education status, religion, media exposure residence and community-level education appeared to be significant determinants of knowledge of EC among teenage women.

In this study, the odds of EC knowledge among teenage women aged 17 and 19 years was 1.76 (AOR = 1.76, 95%CI, 1.24, 2.48) and 2.18 (AOR = 2.18, 95%CI, 1.47, 3.22) times higher as compared to teenage women aged 15 years respectively.

The odds of EC knowledge among teenage women with the educational level of primary and (secondary and above) was 2.76 (AOR = 2.76, 95%CI, 1.60, 4.76) and 4.70 (AOR = 4.70, 95%CI, 2.62, 8.44) times higher than women who have no formal education respectively.

Moreover, the likelihood of EC knowledge among women with protestant and Muslim followers was 0.63 (AOR = 0.63, 95%CI, 0.45, 0.87) and 0.68 (AOR = 0.68, 95%CI, 0.49, 0.93) times higher than those of orthodox followers respectively.

Furthermore, the odds of women's knowledge of EC among women who had media exposure was 3.36 (AOR = 3.36, 95%CI, 2.59, 4.34) times higher than their counterparts.

TABLE 3 Multivariable analysis of factors associated with EC knowledge among teenage women in Ethiopia ($n = 3,381$).

Variables	Null model	Model 1 AOR (95% CI)	Model 2 AOR (95%CI)	Model 3 AOR (95%CI)
Individual level Characteristics				
Age				
15		1		1
16		1.12 (0.79, 1.59)		1.11 (0.78, 1.58)
17		1.77 (1.25, 2.50)		1.76 (1.24, 2.48)*
18		1.37 (0.98, 1.91)		1.36 (0.97, 1.90)
19		2.14 (1.45, 3.17)		2.18 (1.47, 3.22)*
Current marital status				
Not married		1		1
Married		0.78 (0.53, 1.16)		0.83 (0.56, 1.24)
Educational status of participants				
No formal education		1		1
Primary education		3.23 (1.91, 5.45)		2.76 (1.60, 4.76)*
Secondary and higher		5.77 (3.29, 10.11)		4.70 (2.62, 8.44)*
Occupation				
Not working		1		1
Working		1.12 (0.87, 1.49)		1.08 (0.84, 1.40)
Wealth index				
Poor		1		1
Middle		0.80 (0.55, 1.17)		0.79 (0.54, 1.17)
Rich		1.23 (0.93, 1.72)		1.14 (0.80, 1.63)
Religion				
Orthodox		1		1
Protestant		0.62 (0.44, 0.86)		0.63 (0.45, 0.87)*
Muslim		0.65 (0.48, 0.89)		0.68 (0.49, 0.93)*
Family size				
<3		1		1
3–5		1.27 (0.93, 1.74)		1.32 (0.96, 1.81)
>5		0.80 (0.59, 1.09)		0.85 (0.62, 1.17)
Contraceptive use				
No		1		1
Yes		1.53 (0.98, 2.38)		1.50 (0.96, 4.34)
Media exposure				
No		1		1
Yes		3.74 (2.95, 4.76)		3.36 (2.59, 4.34)*
Community level variables				
Community level poverty				
Low			1	1
High			0.93 (0.65, 1.33)	1.18 (0.79, 1.75)
Community media exposure				
Low			1	1
High			2.29 (1.59, 3.30)	1.20 (0.82, 1.77)
Residency				
Urban			1	1
Rural			0.40 (0.26, 0.63)	0.45 (0.22, 0.86)*
Community level education				
Low			1	1
High			1.91 (1.37, 2.68)	1.40 (1.32, 2.00)*
Region				
Metropolis			1	1
Lager central			0.97 (0.60, 1.59)	0.97 (0.59, 1.60)
Small peripherals			0.59 (0.28, 1.21)	0.73 (0.34, 1.56)

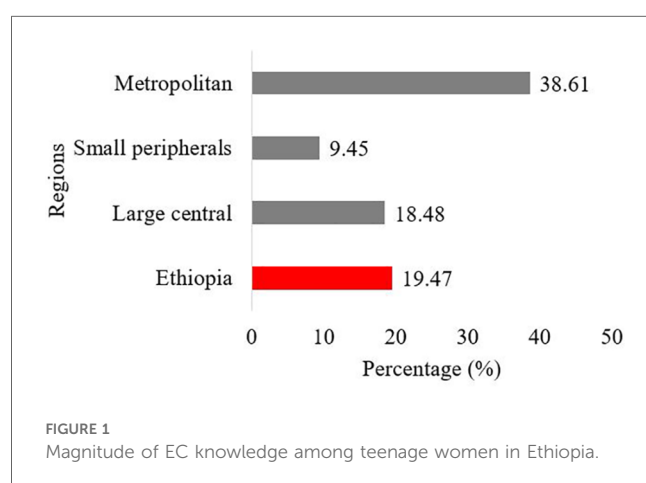
(Continued)

TABLE 3 Continued

Variables	Null model	Model 1 AOR (95% CI)	Model 2 AOR (95%CI)	Model 3 AOR (95%CI)
Random effect				
Variance	1.50	0.80	0.86	0.79
ICC (%)	31.0	20.0	20.66	19.0
MOR	3.17	2.31	2.40	2.30
PCV (%)	Ref	46.67	42.67	47.33
Model fitness				
Deviance	3,043.50	2,683.0	2,901.14	2,671.74

*Statistically significant at p -value < 0.05, AOR, adjusted odds ratio; COR, crude odds ratio.

Model 1: adjusted for individual-level characteristics, Model 2: adjusted for community-level characteristics, Model 3: adjusted for both individual and community-level characteristics.



With regard to community-level factors, women who resided in rural areas were 55% less likely to know EC as compared to urban residences 0.45 (AOR = 0.45; 95%CI: 0.22, 0.86).

In this study, the odds of women's knowledge of EC among teenagers from high community level education was 1.40 (AOR = 1.40, 95%CI: 1.32, 2.00) times higher as compared to their low community level education counterparts (Table 3).

Discussion

This study found low knowledge of EC among teenage women in Ethiopia. In this study, the magnitude of EC knowledge was only 19.47% (95%CI, 18.17, 20.84). This finding was lower than another study conducted in Iran (29%) (33), Brazil (82.4%) (34), Thailand (30.4%) (35), Nigeria (27.8) (36), Democratic Republic of Congo (59.1%) (37), Kenya (72.9%) (38), Tigray, (40.4%) (15), Ghana (65.0%) (39), Oromia (42.3%) (40), Southern Ethiopia (58.4%) (37), Harar (70%) (41), Gondar (69.4%) (42) but higher than the study conducted in Bangladesh (14%) (43), Mali (18.2%) (44), Egypt (16.4%) (45), and Jimma (14.4%) (46).

This discrepancy may arise from the multilevel methodology used in the study or from variations in the socio-cultural parameters of the nations. Moreover, variations could arise from differences in study design, sample size, and awareness regarding contraceptive options among different nations.

In this study, the odds of EC knowledge among teenage women aged 17 and 19 years was 1.76 and 2.18 times higher, respectively,

compared to teenage women aged 15 years. This finding was consistency with the study conducted in Arsi (16), Deberemarkos (47) and Mekele (48). Possibly, the justification is that women are probably exposed to more information on EC as they get older. This finding implies that there is a need to review and potentially enhance sexual health education curricula for younger teenagers. However, this finding was inconsistency with the study done in Bangladesh which revealed that women's knowledge of emergency contraception was decreased as the age of the women increase (49). This inconsistency might be due to differences in the socio-cultural diversity of the nations.

The likelihood of EC knowledge was found to be increased as the level of education of the study participants increased. Compared to women with no formal education, those with secondary education or above were more likely to know about EC. The odds of EC knowledge among teenage women with the educational level of primary and (secondary and above) was 2.76 and 4.70 times higher than women who have no formal education respectively. This finding was supported by the study conducted in Lebanon (50), Bangladesh (49), Berlin (51) and Botswana (52), where women with more than secondary education had eight times higher knowledge of EC as compared to women who have no formal education. This might be because women with more educational attainment have better access to information regarding various contraceptive options. This implies that education plays a crucial role in helping women understand reproductive health issues and choose the most appropriate contraceptive methods for their individual needs. Educational opportunities should be accessible to all teenagers, with a particular focus on those from underserved or marginalized communities.

There are significant differences in how various religions view contraception. Compared to teenage women with orthodox followers, teenage women of protestant and muslim followers were found to be knowledgeable. The odds of women's knowledge of EC among women with protestant and muslim followers was 0.63 and 0.68 times respectively lower than those of orthodox followers. This finding contrasts the study conducted in Malawi where muslims were knowledgeable as compared to christians (49). This might be due to differences in religious teachings and principles.

This study also revealed that access to information through the media (radio, television, newspaper, or magazine) was found to be positively associated with EC knowledge among teenage women. The odds of women's knowledge of EC among women who had media exposure was 3.36 times higher than their counterparts. This finding is in line with the study conducted in Bangladesh which demonstrated that women who had access to media were more

likely to know about EC (43). A possible explanation could be that women's awareness of EC is increased by the media's potent ability to explain various methods, their advantages, and the locations where they are accessible to them. This demonstrates that media campaigns addressing issues related to sexual and reproductive health, particularly EC should be developed and promoted.

Regarding community-level factors, there was residence heterogeneity of knowledge of EC among teenage women. Women who resided in rural areas were 55% less likely to have knowledge of EC than teenage women in urban residences. This finding was consistent with a similar study conducted in Jimma (46). Issues like poor socioeconomic status, women's lower access to information, and lower educational status in rural areas can come here as explanations behind this. This suggests a need to implement targeted educational initiatives and outreach programs in rural areas to improve knowledge of EC. This could include mobile health units, community workshops, and partnerships with local organizations to ensure that rural teens have access to vital information and resources.

In this study, the odds of teenage women's knowledge of EC among teenage women from high community-level education was 1.40 times higher as compared to their low community-level education. This might be because teenage women with high community-level education might have better opportunities for accessing information related to sexual and reproductive health issues. This finding implies that enhancing community-level education can improve teenage women's knowledge of EC, suggesting that investing in higher educational standards at the community level could lead to better-informed and healthier teenagers.

Strengths and limitations of the study

This study's primary strength was the use of nationally representative survey data. The study also employed multilevel analysis (advanced model) which took into account both individual-level and community-level variables. Furthermore, the DHS used validated tools for its appraisals of the datasets, and employed a large sample size and well-designed methods. Despite these advantages, the survey was cross-sectional and was impossible to establish causality for the findings.

Conclusion

Overall there was a limited knowledge of EC among teenage women in this study. The finding concluded that less than one in five teenage women were knowledgeable about EC in Ethiopia. Women's age, women's education status, religion, and media exposure from the individual level factors, whereas residence and community level education from the community level factors were significantly associated with EC knowledge among teenage women in Ethiopia.

Thus, comprehensive educational programs and the promotion of EC are needed to ensure that teenage women are well-informed about EC and to reduce unintended pregnancies. It is recommended that both government and non-governmental organizations design targeted educational initiatives and media

campaigns to improve knowledge of EC among young girls, individuals with lower educational backgrounds, and teenagers in rural areas. Moreover, healthcare providers should be encouraged to offer tailored reproductive health counselling during consultations, taking into account the nation's specific characteristics, including societal norms and religious beliefs. These efforts can collectively enhance teenage women's knowledge of EC, leading to improved reproductive health outcomes.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: <https://dhsprogram.com>.

Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and the institutional requirements.

Author contributions

TT: Conceptualization, Methodology, Software, Writing – original draft. GT: Software, Validation, Writing – review & editing. MJ: Investigation, Methodology, Writing – review & editing. KD: Investigation, Software, Validation, Writing – review & editing. LB: Data curation, Investigation, Writing – review & editing. DG: Methodology, Resources, Supervision, Writing – review & editing. MT: Formal Analysis, Investigation, Writing – original draft. AH: Conceptualization, Data curation, Formal Analysis, Methodology, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Aya Contigo: evaluation of a digital intervention to support self-managed medication abortion in Venezuela

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Background: Venezuela continues to face a humanitarian crisis, where healthcare is difficult to access and abortion is legally restricted. In response to a growing need for life-saving abortion and sexual and reproductive health (SRH) services, a digital application called Aya Contigo was co-developed with local partners to support self-managed medication abortion. We sought to evaluate this digital health tool among pregnant people seeking abortion in Venezuela.

Methods: This is a mixed-methods pilot evaluation of Aya Contigo, a digital tool for pregnant people seeking abortion in Venezuela. From April to June of 2021, people in the first trimester of pregnancy were recruited via passive sampling. Once enrolled, participants accessed information and resources on the application and were supported by study team members over an encrypted chat. Following medication abortion, participants completed an online survey and a semi-structured interview. Descriptive statistics were used to evaluate the survey responses. Interviews were coded thematically and analyzed qualitatively with NVivo.

Results: Forty participants seeking medication abortion in Venezuela were recruited to the study and given access to Aya Contigo. Seventeen completed the online survey (42.5%), with all participants identifying as women and a mean age of 28 (range 19–38; SD 5.55). Participants expressed confidence in Aya Contigo; 53% (9/17) felt “very supported” and the remaining 47% (8/17) felt “somewhat supported” by the app throughout the self-managed abortion process. The app was rated as highly usable, with an overall System Usability Scale score of 83.4/100. Thirteen respondents participated in a semi-structured phone interview, and qualitative analysis identified key themes relating to the experience of seeking abortion in Venezuela, the user experience with Aya Contigo, and the app's role in the existing ecosystem of abortion and contraceptive care in Venezuela.

Discussion: This mixed-methods pilot study demonstrates that the Aya Contigo mobile application may support pregnant people seeking medication abortion and post-abortion contraceptive services in Venezuela. Participants valued the provision of evidence-based information, virtual accompaniment services, and locally-available sexual and reproductive health resources via the digital tool. Further research and interventions are needed to ensure that all pregnant people in Venezuela can access safe abortion and contraceptive resources.

KEYWORDS

medication abortion, contraception, sexual and reproductive health (SRH), global women's health, digital health, human-centered design

Introduction

For over a decade, the population of the Bolivarian Republic of Venezuela has faced a humanitarian crisis stemming from highly precarious political and socio-economic conditions (1). While Venezuela was once an oil-rich economy, the succession of authoritarian socialist governments and foreign sanctions provoked financial collapse in 2012, and the country has not recovered since (2). In fact, severe hyperinflation and plummeting wages have resulted in crippling poverty for nearly ninety percent of citizens (1). Though the Venezuelan government has not disclosed epidemiologic data since 2017, the 2022–2023 United Nations Humanitarian Response Plan for Venezuela estimates that over 5.2 million people face difficulty accessing basic necessities such as food, clean drinking water, and health services (3). This has resulted in the migration of over seven million Venezuelans to nearby Latin American countries and beyond. In the midst of a massive refugee crisis facing the region, those who remain in Venezuela are often overlooked (1).

Girls, women, and people who can become pregnant are disproportionately affected by humanitarian crises, where access to sexual and reproductive health (SRH) services is often limited or non-existent (4, 5). In Venezuela, there is an extreme scarcity of available SRH resources, including contraceptive options and abortion services. Access to medical and surgical abortion is highly restricted and stigmatized as abortion is illegal in Venezuela except to save the life of the pregnant woman (6–8). In addition to the legal restrictions, medications such as mifepristone and misoprostol that can induce abortion are prohibitively expensive (7, 9). In this context, abortions still occur regularly, often through unsafe means (9–11). Maternal mortality rates are rising in Venezuela, having increased from 126 maternal deaths per 100,000 live births in 2015 to 259 maternal deaths in 2020 as estimated by the World Health Organization (WHO) (12). Venezuela has the highest maternal mortality rate in the Americas by a significant margin, with likely over ten percent of maternal deaths associated with unsafe abortions (13).

Self-managed medication abortion is a safe and effective means of terminating pregnancy in the first trimester (14–16). As the WHO describes, self-managed medication abortion is managed by the pregnant person either partially or completely outside of a healthcare facility (17). In many Latin American countries with legal restrictions around abortion, local organizations have supported pregnant people in self-managed medication abortion for over two decades (18). In this harm-reduction focused approach, organizations may offer evidence-based information, emotional and medical support, and essential abortion medication to pregnant people. Often, this involves the direct support of “accompaniers,” who are trained to guide people through the medication abortion process (19). Self-managed medication abortion may be the preferred choice for abortion for pregnant people, as the process enables discretion and can empower individuals to be active agents in their own healthcare (20, 21). In legally restrictive and low-resource settings such as Venezuela, this method may be the only viable option for termination of a pregnancy.

Feminist and activist-led organizations in Latin America have been foundational in the sexual and reproductive rights movement in the region, crucially offering access to safe and effective abortion care (19, 22, 23). In Venezuela, sexual and reproductive health organizations continue to provide life-saving services despite limited resources and the risks of facing legal repercussions (9). Given ongoing structural challenges, there is a need for innovative solutions to expand access to self-managed medication abortion services amidst the Venezuelan humanitarian crisis, particularly for those facing socioeconomic precarity and/or living in rural or remote regions.

Digital health interventions including mobile applications, web-based tools, and telemedicine hold the potential to promote sexual and reproductive healthcare in under-resourced settings (24–28). In collaboration with local SRH organizations in Venezuela, a mobile application called Aya Contigo was developed with the goal of facilitating self-managed medication abortion and contraceptive care. The development process involved an in-depth contextual analysis that employed a human-centered design (HCD) approach (9). Venezuelan citizens, reproductive health experts, and key local and international abortion harm-reduction organizations were consulted during the tool’s design and implementation phases. To our knowledge, this is the first digital health intervention for abortion and SRH in South America that utilizes an HCD approach (29).

As part of Aya Contigo’s implementation in Venezuela, we conducted a mixed-methods evaluation of the application’s ability to support self-managed medication abortion and post-abortion care in the first trimester. Our primary study objective is focused on evaluating Aya Contigo as a mobile application for medication abortion and contraceptive care within the Venezuelan context. Specifically, this study assesses the acceptability, safety, and efficacy of Aya Contigo among pregnant people seeking abortion services within a legally-restrictive and humanitarian setting. Our secondary objectives will support the study’s primary aim by (1) describing the local context for people seeking abortion in Venezuela and (2) determining how Aya Contigo fits within the already-existing ecosystem of abortion care in Venezuela. Our findings will inform the iterative development of Aya Contigo and offer insights into digital solutions designed to improve access to abortion care in legally-restrictive and humanitarian settings.

Materials and methods

Overview

We present a mixed-methods pilot study to evaluate Aya Contigo, a mobile application developed by Vitala Global Foundation in partnership with local organizations and stakeholders in Venezuela. Vitala Global is a Canadian non-profit that co-creates and implements digital tools to support SRH needs (30). The application was developed with the principles of HCD, a method to create acceptable and feasible digital interventions with the potential to be scaled up

sustainably (31–33). This model involves a participatory process that focuses on the needs and desires of end-users and relies on their input throughout the entire development cycle (31). A design-thinking approach holds the potential to reshape healthcare provision, particularly in contexts in need of innovative solutions (33). While HCD has been used to develop global health interventions such as clinical decision-making tools and patient-facing websites, few studies have adequately reported the methodologies and impacts of such interventions (32).

In order to understand the local needs of individuals seeking abortion in Venezuela, a contextual analysis was conducted to inform the development of Aya Contigo. As described elsewhere, this involved an in-depth desk review and stakeholder interviews focused on the legislation, policies, and practices that create barriers to abortion and SRH care in Venezuela (9, 11, 27). This user-centred process formed the basis for Aya Contigo, which was developed iteratively with community stakeholder involvement throughout (8).

Aya Contigo is a digital application that guides users through steps to self-manage their abortion and offers a personalized contraception decision-making tool. In order to protect privacy and security, each user is provided with a privacy statement that includes information on managing data stored on personal devices. The application's securitized back-end never collects any personally-identifiable user information and the limited aggregate data collected is stored on an encrypted and remote server and deleted permanently after a 3-month period. Data is collected for the purpose of periodic quality and impact assessments. Information collected is limited to the number of application downloads, the number of participants who opt-in to notifications, time spent engaging with the tool, and the most visited sites within the tool (i.e., the contraceptive method guide, the abortion completion checklist). This data is never sold to third parties.

Application users respond to questions that assess eligibility for medication abortion, including a gestational age calculation (based on last menstrual period and/or ultrasound dating calculations) and any contraindications to the abortion medication(s). The subsequent sections in the mobile application provide clear and evidence-based information on medication selection, dosage, and timing. Aya Contigo educates users on common medication abortion side effects and how to manage them, outlining self-care options and offering guidance on when to present to a healthcare facility. Once the user has followed the abortion medication regimen, the app offers a self-assessment tool for abortion completion based on current symptoms ([Supplement A: Abortion Completion Checklist](#)). It also includes a section on contraception that asks users about their sexual health preferences and possible contraindications to certain types of contraceptives. Based on the user's responses, Aya Contigo then provides an individualized set of evidence-based contraceptive methods.

Participants

Study participants were recruited passively through online advertisements, sexual health and reproductive health clinics in

Venezuela, and local and international abortion harm-reduction organizations. Participants aged 14 years and older who were located in Venezuela, pregnant and in the first trimester, interested in medication abortion, literate in Spanish (including the ability to read and understand the mobile application and study information), and who could access a functioning smartphone were included. Individuals were included if they were within the first trimester of pregnancy, defined as up to 12 weeks of gestation. If a person's pregnancy was beyond the first trimester, they were excluded from the study, in order to align with the current WHO guidelines and evidence base that supports the safety and efficacy of self-managed medical abortion within the first trimester (16, 34). Those who were unable to provide informed consent or participate in the study procedures were also excluded.

Study design

In this mixed-methods study, we conducted online quantitative surveys and qualitative semi-structured telephone interviews from April 1st to June 15th, 2021. There is a need for descriptive data in the context of people seeking abortion in Venezuela, where little research has been possible in recent years due to the ongoing crisis. The study objectives are well-suited to include a qualitative component, as this approach enables an in-depth assessment of both local context and stakeholders' individual perceptions and unique experiences (35). The online survey and qualitative interview guide were developed with multiple rounds of feedback from a multidisciplinary team of local and international experts and stakeholders. Interviews were conducted by IP and GL, two female and Spanish-speaking study team members from Venezuela with qualitative research training. To ensure high-quality research methods and data analysis, we adhered to the guidelines of the Consolidated Criteria for Reporting Qualitative Research (CORE-Q) checklist (36). While participant involvement in the dissemination of results was originally planned, security protocols limited communication with participants after study completion due to the legal restrictions and risks to those who choose to pursue abortion in Venezuela.

Data collection

Individuals interested in study participation contacted the research team over WhatsApp via the number provided through partner organizations and online advertisements. Eligible participants reviewed information on the mobile health intervention and provided written informed consent via a signed digital form sent through the encrypted WhatsApp chat for the quantitative component of the study. Once enrolled, participants received a link and instructions to access and utilize the Aya Contigo application. The research team checked in with participants daily over WhatsApp for at least the first two days after enrollment to ensure they were equipped for the medication abortion process if they chose to proceed. Research team members who provided support to participants throughout

the study were of Venezuelan origin, native Spanish speakers, and were trained and experienced in providing abortion accompaniment services. Participants were asked to indicate when their abortion was complete by filling out an in-app checklist within fourteen days of finishing the medication regimen and also by contacting the research team within this timeframe. Those who required additional resources or direct medical care were referred to appropriate external organizations.

When participants reported completion of a medication abortion to the study team, they were sent the quantitative research survey link over WhatsApp to be completed on SurveyMonkey. The anonymized survey included questions regarding the participant's basic demographic information, abortion and post-abortion contraception process, and experience using Aya Contigo, including how the mobile application impacted feelings of confidence, preparedness and support and its usability using a validated System Usability Scale (SUS) (37). The SUS questions were slightly adapted to fit the context of a mobile app for self-managed abortion (e.g., "I think that I would like to use this system frequently" was adapted to "If I imagine I was redoing the process, I would use Aya again"). The adapted SUS is available in [Supplement B: Adapted System Usability Scale \(SUS\)](#).

Those who opted to participate in the qualitative interview provided additional written informed consent after discussing the study procedures with a local researcher. Verbal consent was obtained to audio-record the interviews for transcription purposes and both parties confirmed that they had access to a private space with no one else present. Participants were scheduled for a 45–60-min virtual phone interview with a trained research team member. The interviewers asked in-depth questions about participants' experiences with Aya Contigo and the abortion process. No repeat interviews took place. Participants were compensated \$10 USD for completion of the online survey and received an additional \$10 USD for the telephone interview. This incentive was transferred to participants over WhatsApp through a Venezuelan partner organization.

The recruitment target for the quantitative survey was set at 15 participants or greater, given that this descriptive data was collected for exploratory purposes and coupled with rich qualitative interview data. We sought to better understand the experiences of people seeking abortion within Venezuela's sociopolitical context, where the voices and narratives of pregnant people have been repressed for decades. In recent years, it has been exceedingly difficult to conduct research around sexual and reproductive health given governmental restrictions on data collection and reporting (3, 5, 38). Therefore, we deemed that even a small sample size would offer important insights on a historically under-represented population. The relatively small sample size target was set acknowledging that the survey sample cannot speak to the experiences of all people in Venezuela seeking abortion care. Taken together, the unique study population, the descriptive aim of our quantitative data, and its pairing with qualitative data justified a smaller survey sample size (39).

The recruitment target for the in-depth interviews was initially set flexibly, based on the concept of information power, a model

introduced by Malterud and colleagues in 2016 (40). The study's aims and underlying theory, along with the specificity of experiences among included participants, the strength of interview dialogues, and our analysis framework were considered throughout the study period in order to determine an adequate sample size (40). We applied a human-centred design theory and defined a relatively narrow primary aim focused on evaluating Aya Contigo as an abortion and contraceptive care tool. The initial participant interviews elicited rich dialogue, and the restriction of participants to pregnant people seeking abortion amidst Venezuela's humanitarian crisis reflected a specific population with many common experiences. Taken together, our study design and participant characteristics increased the information power which enabled rich data from a relatively small sample. We deemed that a sample of 10–15 participants would yield sufficient information power.

Data analysis

Descriptive analysis of the online survey was done in SPSS. Each outcome was reported as a mean (standard deviation) for continuous variables and count (%) for categorical variables.

The qualitative interviews were recorded, de-identified, transcribed in Spanish, and then translated into English for analysis. The transcribed data was thematically analyzed in NVivo 11. Two researchers trained in qualitative analysis methods, RG and KC, analyzed several transcripts to identify themes and to create codes and sub codes, organized into categories. This coding framework was applied to all transcripts by both researchers and modified through an iterative process.

Divergent participant views or opinions were reported as part of the results.

Ethical considerations

The study received ethics approval from the Allendale Institutional Review Board. Participants were recruited passively to try and avoid any feelings of pressure to consent. Only basic, non-identifying, demographic information was collected to ensure participant confidentiality. Participants were informed throughout the study that they could withdraw at any time and could choose not to answer any questions on the online survey or telephone interview. If participants required support or care beyond the capabilities of the research team, they were referred to established trusted organizations in Venezuela or internationally, including Women Help Women, Safe2Choose, and Women on Web.

Results

Process overview

The context surrounding abortion in Venezuela greatly affected the implementation of the study. Recruitment into the study was initially challenging, as partner organizations that

had planned to engage with potential participants faced increasing risks of government reprisal. The online recruitment ads targeted with relevant demographics were not effective, possibly due to lack of reach and/or trust. In order to navigate the increasingly challenging situation, the study team developed a Whatsapp chat line to recruit and connect with participants privately. Initially, this resource acted as a help desk to troubleshoot technical issues, but as participants vocalized a desire for additional support, the study team provided virtual personal support over Whatsapp.

The study also faced implementation difficulties due to participants' lack of access to abortion medication or sufficient medication. Further, the guidelines of some local SRH support services differed from the WHO guidelines on medication abortion. It is important to acknowledge that these organizations offer safe and trusted means of SRH support to people in Venezuela. The Aya Contigo research team worked alongside other community allies in order to offer clarity around medication abortion guidelines. Despite the challenges faced, the study was able to continue thanks to the support of the local reproductive rights community and the trust that was built through the formation of long-term relationships with local stakeholders.

Quantitative survey results

A total of 40 participants were recruited into the study between April and June 2021. Seventeen (42.5%) completed the online survey via SurveyMonkey. **Table 1** displays the demographic characteristics of participants who completed the survey. All participants identified as women, with age ranging from 19 to 38 and a mean of 28 (SD 5.55). All women had at least completed some secondary education and 88.2% (15/17) reported at least some university training. While 70.6% (12/17) reported that they were actively employed, income was widely spread with 23.5% (4/17) reporting no income, 23.5% (4/17) earning minimum wage, 35.3% (6/17) earning double the minimum wage or more, and 17.6% (3/17) declining to respond. More than half of participants (9/17; 52.9%) lived in the Capital District or state of Miranda, while the others were spread across Barinas, Carabobo, La Guairá, Portuguesa, Yaracuy, and Zulia.

The medication abortion process is detailed in **Table 2**. Gestational age at the time of initiating medication abortion ranged from four to twelve weeks, with 70.6% (12/17) of participants between six to nine weeks gestation. Mifepristone plus misoprostol was the regimen used by 76.5% (13/17) of participants while the remaining 23.5% (4/17) took misoprostol alone. When compared with a regular menstrual period, 76.5% (13/17) of women reported that their bleeding was heavier and 88.2% (15/17) experienced more severe pain during the abortion process. The most common side effects reported were diarrhea (64.7%; 11/17), dizziness (64.7%; 11/17) and nausea (52.9%; 9/17).

Abortion completion was assessed both through the survey results and based on communications with the study team via WhatsApp. After taking their medication regimen with the guidance of Aya Contigo and the virtual support chat, 82.4% of women (14/17)

completed abortion without additional intervention. Based on self-assessment, 64.7% (11/17) reported that they knew when the pregnancy was expelled and 52.9% (9/17) utilized the Aya Contigo checklist for completed abortion. Five (29.4%) participants sought medical care to determine if the abortion was complete; one required additional medication to complete the abortion, two underwent surgical abortion, and the remaining two were reassured that the abortion was complete. All participants eventually completed abortion with no significant complications reported.

In the post-abortion stage, 58.8% (10/17) of participants were interested in contraceptive options (**Table 3**). Oral contraceptive pills and implant devices were the most desirable options. However, only two women were able to access contraception by the time of survey with both having obtained condoms. The most frequently reported barriers to obtaining contraception were cost (40.0%; 4/10) and insufficient time to obtain their preferred contraceptive option (30.0%; 3/10).

Participants responded to Likert scale questions focused on their experiences with Aya Contigo as a medication abortion

TABLE 1 Baseline demographics.

Total <i>n</i> = 17	<i>N</i> (%)
Gender	
Woman	17 (100)
Age	
≤20	2 (11.8)
21–25	3 (17.7)
26–30	6 (35.3)
31–35	4 (23.5)
>35	2 (11.8)
State	
Barinas	1 (5.9)
Capital District	4 (23.5)
Carabobo	1 (5.9)
La Guaira	1 (5.9)
Miranda	5 (29.4)
Portuguesa	1 (5.9)
Yaracuy	1 (5.9)
Zulia	1 (5.9)
Other	1 (5.9)
Highest level of education	
Some secondary education	1 (5.9)
Secondary education complete	1 (5.9)
Some university education	6 (35.3)
University complete	9 (52.9)
Employment	
Employed full-time	6 (35.3)
Employed part-time	2 (11.8)
Self-employed	4 (23.5)
Unemployed—looking for work	4 (23.5)
Unemployed—not looking for work	1 (5.9)
Income	
Minimum wage	4 (23.5)
Double minimum wage	3 (17.7)
More than double minimum wage	3 (17.7)
No income	4 (23.5)
No answer	3 (17.7)

TABLE 2 Self-Managed medication abortion.

Total <i>n</i> = 17	N (%)
Gestational age (weeks) at time of abortion	
≤5	3 (17.7)
6–9	12 (70.6)
10–12	2 (11.8)
Abortion medication regimen	
Misoprostol only	4 (23.5)
Misoprostol and Mifepristone	13 (76.5)
Doses of misoprostol	
1	5 (29.4)
2–4	10 (58.8)
≥5	2 (11.8)
Symptom severity	
Bleeding compared with menstrual period	
Lighter bleeding	2 (11.8)
Similar to normal	2 (11.8)
Heavier bleeding	7 (41.2)
Much heavier bleeding	6 (35.3)
Pain compared with menstrual period	
Less than normal	1 (5.9)
Similar to normal	1 (5.9)
Stronger	5 (29.4)
Much Stronger	10 (58.8)
Side effects ^a	
Yes to any side effects	15/17 (88.2)
Nausea	9 (52.9)
Subjective Fever	5 (29.4)
Diarrhea	11 (64.7)
Vomiting	6 (35.3)
Dizziness	11 (64.7)
Itchiness	1 (5.9)
Diaphoresis	4 (23.5)
Abortion completion ^b	
Complete with no additional intervention	14 (82.4)
Complete with additional medication	1 (5.9)
Complete after surgical abortion	2 (11.8)
Time to pregnancy expulsion	
<12 h	10 (58.8)
36–48 h	1 (5.9)
Unsure or unaware of expulsion	6 (35.3)
Method(s) used to determine completion of abortion ^a	
Saw products expel	8 (47.1)
Aya Contigo checklist	9 (52.9)
Symptoms stopped	11 (64.7)
Counsellor or accompanier	3 (17.6)
Sought medical attention/ultrasound	5 (29.4)

^aParticipants could select more than one answer.
^bSome participants completed the abortion completion survey too early in their course, and others did not complete this survey, so abortion completion was determined based on the study team’s follow-up with participants 10 days after completing the regimen.

support tool (Table 4). All participants expressed that the mobile application supported them during the abortion process, with 52.9% (9/17) feeling “very supported” and the remaining 47.0% (8/17) feeling “somewhat supported.” Overall, participants felt prepared for common abortion symptoms, with 87.5% (14/16) and 94.1% (16/17) “somewhat prepared” or “very prepared” for

TABLE 3 Contraceptive uptake and methods.

	N (%)
Sought contraception	
Yes	10/17 (58.8)
Preferred contraceptive method(s) for those interested ^a	
Oral contraceptive pill	6/10 (60.0)
Implant	6/10 (60.0)
Intrauterine device	3/10 (30.0)
Depot Injection	2/10 (20.0)
Condom	2/10 (20.0)
Method obtained for those interested	
Condom	2/10 (20.0)
Unable to post-abortion access	8/10 (80.0)
Barriers preventing access	
– Cost	4
– Unsure where to find	1
– Still waiting for preferred option to arrive	3
Source(s) used to select preferred contraceptive ^a	
Aya Contigo	8/10 (80.0)
Friend or relative	3/10 (30.0)
Healthcare provider	5/10 (50.0)
Internet	3/10 (30.0)

^aParticipants could select more than one answer.

the respective pain and bleeding they experienced. All participants (17/17; 100%) reported that Aya Contigo contributed to their knowledge of the abortion process. For both determining abortion completion and choosing a contraceptive method with Aya Contigo, 41.2% (7/17) participants reported that they felt “very” confident, while 52.9% (9/17) reported that they were “somewhat” confident, and one participant reported “little” confidence. On the SUS, Aya Contigo scored 83.38 (out of 100), which corresponds to an “A” grade in the top 10% of scores (37).

Qualitative results

Thirteen of the 17 participants who completed the survey completed the semi-structured phone interview after providing additional informed consent. The analysis of the interviews explored themes within three overarching categories: (1) abortion experience in Venezuela, (2) participant experiences with Aya Contigo, and (3) role of Aya Contigo within the existing ecosystem of safe abortion care in Venezuela. Seven sub-themes were identified iteratively during the coding process and are detailed in Table 5.

Abortion experience and decision making in the Venezuelan context

Legal context

When describing their perceptions of abortion, many participants discussed the implications of the legally restrictive

TABLE 4 Experiences with Aya contigo.

Likert scale (total <i>n</i> = 17)	Not at all	A little	Somewhat	Very	Missing
<i>In general, how supported did Aya Contigo make you feel during your abortion process?</i>	–	–	8 (47.1)	9 (52.9)	0
<i>To what extent did Aya Contigo contribute to increasing your knowledge about the abortion process?</i>	–	–	1 (5.9)	16 (94.1)	0
<i>How confident were you determining your gestational age with Aya Contigo?</i>	–	3 (17.6)	6 (35.3)	8 (47.1)	0
<i>How helpful was Aya Contigo in determining you were taking the right kind of pills?</i>	–	1 (6.3)	5 (31.3)	10 (62.5)	1
<i>How confident were you using Aya Contigo to make sure you took the correct dose of pills at the correct time?</i>	–	1 (6.3)	4 (25.0)	11 (68.8)	1
<i>How prepared did Aya Contigo make you feel for the pain/cramping that you experienced?</i>	–	2 (12.5)	7 (43.8)	7 (43.8)	1
<i>How prepared did Aya Contigo make you feel for the bleeding that you experienced?</i>	–	1 (5.9)	10 (58.8)	6 (35.3)	0
<i>How confident were you in determining your abortion was complete with Aya Contigo?</i>	–	1 (5.9)	9 (52.9)	7 (41.2)	0
<i>To what extent did Aya Contigo contribute to increasing your knowledge about contraceptive methods?</i>	–	–	8 (50.0)	8 (50.0)	1
<i>How confident did you feel choosing a contraceptive method with Aya Contigo?</i>	–	1 (5.9)	9 (52.9)	7 (41.2)	0

TABLE 5 Qualitative themes, organized by relevant codes and sub-codes.

1. Abortion experience in Venezuela a) Local context impacts abortion experience and decision making • Social, economic, humanitarian context in Venezuela ◦ Difficulty finding/accessing resources and seeking medical care ◦ Fear of legal retribution around abortion and associated services • Lack of personal support and perceived stigma • Strong desire for privacy and security with the abortion process b) Accessing abortion pills markets presents numerous challenges • Difficulty accessing mediation abortion regimens that are safe and trusted ◦ Access routes: clandestine/informal market vs. via trusted partners • High cost of mediation abortion can be prohibitive • Misinformation around type of pills and the correct dosing regimen 2. Participant experiences with Aya Contigo a) Acceptability and comfort with Aya Contigo • Aya Contigo is highly usable and offers appealing design features • User concerns ◦ Privacy and security ◦ App glitches b) Aya Contigo can support self-managed medication abortion • Supported preparedness and confidence around the abortion process • Steps of self-managed abortion with Aya Contigo ◦ Relatively straightforward self-assessment for eligibility ◦ Confusion around self-assessment for completion • Experience with the abortion process itself ◦ Increased readiness and knowledge around abortion symptoms and their management c) People wanted contraceptive guidance after self-managed abortion • Women interested in learning about contraceptive options with Aya Contigo • Desire to avoid an unexpected pregnancy after undergoing the abortion process • Access to contraception remains very difficult and expensive d) Virtual chat support positively impacted the abortion experience • Women wanted additional support and someone to ask for help • Added security and confidence with access to virtual support • Virtual accompaniment not the same as having someone in-person to provide support 3. Role of Aya Contigo (the mobile app and virtual chat) in existing ecosystem a) Aya Contigo can play an important role within the existing Venezuelan ecosystem of self-managed abortion and contraception care • Connecting women to other services • Filling a gap in terms of self-managed abortion support and information
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setting in Venezuela. The fact that abortion is illegal in Venezuela in almost all circumstances increased the level of fear and anxiety associated with choosing to pursue an abortion. In this context, people described difficulty seeking out support due to the risk of penalization. Participants were often wary to disclose their interest in abortion or history of abortion to community members, including healthcare providers. As one participant explained:

“[The legal context] influenced a lot because ... everybody is afraid. In fact, in December they imprisoned [an activist]

who helped a girl who had been raped... from then on, many people never again gave those pills and so on.”— Participant 6

This quote refers to an event that occurred a few months prior to the study period, where a Venezuelan feminist advocate and educator was arrested and charged after helping a 13-year-old girl to end a pregnancy after being raped (41). As a result of this widely publicized arrest, many feminist organizations and activists halted their abortion support services, including the

provision of medication for self-managed abortion. Many agreed that the legal restrictions had limited access to resources for abortion:

“I wish they could legalize abortion here in Venezuela... because I think there are many people who think the same as I do right now, and maybe they do not have the knowledge and do not know where to turn to, or where to ask, because they think it is illegal, so they do not ask, they do not do it, I think it is worse.”—Participant 29

In this legally-repressive environment, participants did not have a clear means of asking for help or seeking support. All participants faced significant barriers in accessing medical, psychological, and educational services. As a result, most resorted to finding information online, but were unsure which sites they could trust.

Humanitarian/economic context

The economic instability and broader humanitarian crisis in Venezuela played an important role in participants' decisions to seek abortion. Many felt that they could not provide for a child, or that a child would not be able to thrive in their current environment. This sentiment was captured by a participant who considered the multifaceted issues that many people in the country continue to face:

“It is such a complicated situation [in Venezuela] that [makes having] a child a bit more uphill. Because of the economic situation, the social situation, the political situation..there are many difficulties, including the health system and the transportation situation. It is a level of complexity so high that ... you could not even fantasize about everything that happens here.”—Participant 34

As articulated in the above quote, many felt that the challenges in their day-to-day lives in Venezuela would be unimaginable to people elsewhere. Many of these challenges were exacerbated by hyperinflation and relatively low incomes, which often made basic services difficult to afford. The COVID-19 pandemic exacerbated the economic difficulties of all participants; several had lost their means of employment and income. All participants felt they were struggling financially, including those who remained employed and earned above the average income level. Some acknowledged that despite their difficulties, others had been hit even harder by the economic crisis:

“My economic situation is very vulnerable right now, really, it is very critical. But there are women who are worse off than me.”—Participant 25

As the protracted economic collapse in Venezuela reduced the number and capacity of healthcare provision services, many participants described that even basic health services were extremely limited. Private care was prohibitively expensive and public clinics had long wait times. In this context, participants

also reported difficulty accessing and affording sexual health services. As one participant described, some contraceptive options were no longer available, and costs associated with accessing contraceptives continued to rise:

“Contraceptives as they used to come, they don't come anymore...lately the consultations are very expensive...to get the pill you have to go for a consultation and the consultation has gone up to \$20 [USD].”—Participant 18

Overall, participants described that they did not feel equipped to support a child, yet they were often unable to prevent pregnancies with reliable contraceptive options. In this fraught ecosystem, many were stripped of their reproductive health autonomy while struggling to provide for themselves and their families.

Personal context

In addition to the socioeconomic and legal context in Venezuela, participants' personal lives and relationships impacted their experience with abortion. All restricted the disclosure of their abortion to a select few, if any, others:

“Only three people knew, my husband, my mom and me.”—Participant 38

For many participants, disclosure to one or two trustworthy confidants acted as a means of support during a difficult time. All pregnant people interviewed expressed concern that others might find out, and wanted their abortions to occur as discreetly as possible. Some reported that this was due to the legal risks while others perceived a social stigma around abortion. As one participant described, abortions often happen covertly due to sociocultural disapproval:

“[Abortion] is a taboo, people are very religious, moralistic, there are many prejudices, the subject is taboo. So, you have to do everything on the sly, it's like that. So, it is very difficult to do that.”—Participant 3

The secrecy surrounding the abortion process led many to feel alone, even if they had disclosed this to a friend or family member. Several participants highlighted the contrast between the isolation of the abortion process and the community support received during a continuing pregnancy. In addition, many reported that the stigma surrounding abortion created guilt and anxiety about their decision. Despite this, most were resolved that abortion was a necessary decision. The conflicting emotions that many participants experienced were summarized by one participant:

“I felt very ugly. I felt a lot of guilt, that's what it was. Still. I think it's something I have to get over...in the end, that was what I wanted, and it was the best decision I could make.”—Participant 3

When participants decided to go through with an abortion, the emotional distress that many experienced was often heightened by cultural perceptions of abortion as immoral or wrong. There was a shared motivation among participants to keep the process secret for both legal and cultural reasons, which prevented several participants from seeking additional support.

Abortion pills are difficult to access

The Venezuelan legal restrictions, economic precarity, and significant gaps in healthcare provision posed challenges when participants attempted to obtain medication abortion pills. Some said that misoprostol was available in local pharmacies, but the medication requires a prescription, and cannot be prescribed for abortion. Given that abortion medications are not easily obtained from healthcare institutions, participants reported that they had searched for medication through clandestine online marketplaces or by word of mouth. Some were connected with pharmacies that sold prescription abortion medication covertly, as one participant explained:

“...I looked for them on the internet, because that’s the only way here to get them, but a friend of mine who is a doctor recommended me to a pharmacy... it gave me more security to buy them there, than to buy them from any person in the street, you don’t know where those pills come from.”—Participant 29

While some participants felt a sense of security that their medications were dispensed by organizations affiliated with medical pharmacies, others obtained their abortion medications from non-regulated sources. When medications were purchased online or through other clandestine means, participants were concerned about the safety of the pills. Some participants had heard rumors or knew someone that had been harmed by abortion pills acquired in this manner:

“...they also said that it could be fake or that some were modified and that many people had died because of that.”—Participant 6

The interviews reflected the precarity of buying abortion pills from the unregulated market in Venezuela. In addition to causing potential harm, many participants were concerned that the pills would be ineffective in terminating their pregnancies.

Many participants also faced challenges related to the cost of abortion pills: participants reported that prices per misoprostol pill ranged from \$3–\$35 USD, most commonly around \$20 USD. Given that a proper regimen consists of several pills, the total cost often exceeds \$100 USD. Some participants were able to purchase enough pills, but for others, the cost prohibited the purchase of a full regimen. As one participant explained,

“...Each pill costs me 35[US] dollars, imagine 12 pills and as I said I am low income.”—Participant 37

The high expense of abortion pills added to the financial concerns of each participant. While all participants were able to acquire some medication, those who could not afford a full regimen were at risk of an ineffective termination.

Acceptability and comfort with Aya Contigo

All participants reported feeling comfortable using Aya Contigo and trusted the information that the app provided. The educational tools and checklists for self-managed abortion were described as detailed and clear. Every participant reported that they would recommend Aya Contigo to others in need of abortion care. As one participant shared:

“If a person I know needs that help I will recommend [Aya Contigo], of course. You are very safe, you give a lot of security, and all the questions are answered.”—Participant 6

Many participants similarly reported that they could buy-in to Aya Contigo because of its security and discretion in the self-managed abortion process. They appreciated that its name was vague and would not attract attention, and that the application could be easily deleted with no remaining data stored on their personal devices. However, some participants wished that a login passcode was required in order to open Aya Contigo for additional digital security:

“The application gave me security...As an application, perhaps the way to log in with a code, would [increase security].”—Participant 2

Some participants were fearful that a friend or family member would find the application on their phone and discover that they were pursuing abortion. In contrast, others felt their phones were already private, and that the only person who might see the app (e.g., a partner) was already aware they were having an abortion. In the context of a highly restricted legal and social setting, the clear portrayal of relevant abortion-specific information, and the inclusion of security features within Aya Contigo’s design were key factors for its acceptability among participants.

Participants found that Aya Contigo was user-friendly and aesthetically pleasing; the overall design and color scheme was described as attractive, feminine, and calming. Participants were all Spanish-speaking and were able to understand the language used in the application. Several participants found that the images embedded in the app helped clarify some of the medical information included. As one participant explained:

“Maybe with the word you don’t understand ... but then with the image you associate the issue and you understand it.”—Participant 6

A few participants suggested including more illustrations for this reason. Despite the need to include some medical

terminology, the information provided in the application was frequently described as “easy” to navigate and understand.

There were some usability aspects of the application that led to initial difficulty for some participants, though most were resolved with troubleshooting or small adjustments. For example, the app froze for a few participants, but this was resolved with support from the research team on how to clear and re-download it. The ability to solve problems in real-time with the study team members was described as reassuring by some participants.

Aya Contigo can support self-managed abortion

Participants overall expressed that Aya Contigo had created a feasible means to facilitate self-managed abortion, by including comprehensive self-assessment tools for medication abortion eligibility, the abortion process itself, and the determination of abortion completion. As participants describe of their overall experience with Aya Contigo:

“I followed the steps just as the application told me, even though I have friends around me who suddenly told me that I had to do the procedure in a different way...I felt that what I was doing was right, that I was following the steps as they told me there, I didn’t need to look on the internet or anything like that... And it was fine, I felt pretty confident.”—Participant 10

I felt comfortable ... because I felt that [Aya Contigo] was there, “look, it’s your turn now, the time has come,” and I really liked it.”—Participant 34

The resources and information provided by Aya Contigo supported participant confidence and preparedness for the medication abortion process. Some participants used Aya Contigo as their sole source of information, and most felt it successfully guided them.

The initial self-assessment for medication abortion eligibility was straightforward for most participants and included an assessment of gestational age based on menstrual period. Most participants had already obtained an obstetrical ultrasound, and there were a few cases where the application’s calculation differed from the dating ultrasound. Most participants continued to use the dates based on the ultrasound but still appreciated the idea of the gestational age calculation within the app. Once eligibility to proceed with self-managed abortion was confirmed, many expressed that Aya Contigo was useful in preparing them for the medication regimen and abortion process itself. Some were confused about the dosing schedule because it differed from information that they had received from other sources, or because they had already taken some abortion pills obtained from the informal market. In the few cases where additional clarification was required, participants communicated with study team members through the WhatsApp chat which was effective in resolving their queries.

Participants expressed that Aya Contigo was useful for managing symptoms of the abortion. The ability to review the difference between normal symptoms and warning signs that would require medical attention in the app allowed many to identify that their symptoms were to be expected. In order to tailor the information to the individual user, the application provided different information on possible symptoms and side effects depending on whether the participant was taking the mifepristone plus misoprostol regimen or the misoprostol regimen alone. By knowing to anticipate symptoms such as moderate to heavy bleeding and cramping, many felt reassured. However, some participants had hoped the application would provide more information about other known side effects:

“Obviously the process of diarrhea is normal...But it would be good to be alerted so that there is no doubt about it...”—Participant 34

Each person experiences the abortion process uniquely. Because of this, the app’s description of symptoms and the timeline of the abortion process aligned more closely with some participants’ experiences than others. Overall, participants reported feeling prepared for the abortion process when using Aya Contigo, especially around common symptoms of pain and bleeding.

After the medication regimen was complete, participants were asked to complete Aya Contigo’s checklist for abortion completion. The self-assessment for abortion completion was generally found to be useful but was more complicated than the other steps of the process. Based on their responses, many participants were alerted that they could still be pregnant (often because they responded “yes” to questions about ongoing symptoms such as vaginal bleeding). This created anxiety and confusion, as they had otherwise believed that the abortion had been successful. This was likely because they completed the assessment too early in the process, instead of the 7–14 days recommended in the app. One participant explains that this could have been made clearer:

“This [step] should be very specific, whether it is going to be filled in one or two weeks or after 10 days, because a week’s difference is quite a lot for this process, so it should be available only after a certain time..”—Participant 30

In order to reduce the risks of confusion and anxiety that the pregnancy may not have been terminated, one participant suggested that the checklist only become available 7 days after completion of the medication regimen. They also recommended that the reporting of minor symptoms in the app’s completion checklist should not immediately trigger the app to raise the concern of incomplete abortion. A few participants had no concerns with the completion self-assessment and reported that it increased their confidence that the abortion was complete:

“The next day what I did was complete an [assessment] asking me if my abortion was completed. There I put all my experience, all the options that were integrated by what I had

gone through. It made me feel a little more confident about what I had done, and everything went well.”—Participant 3

Aya Contigo offered support for individuals undergoing the process of self-managed medication abortion. Several participants utilized the abortion completion checklist to determine whether their abortion was complete. This was viewed as useful to some, while others feared they might still be pregnant due to ongoing symptoms such as vaginal bleeding. This led participants to seek additional advice from the study team or a medical provider.

People wanted contraceptive guidance after self-managed abortion

The contraceptive portion of the app was described as helpful and comprehensive, enabling participants to make informed decisions about their reproductive health. All of the participants thought that the section was particularly useful in the post-abortion period, as one woman highlighted:

“I think it is necessary to have [the section on contraception], and it was good to see it because after you go through [an abortion], you think, well, I hope I don’t have to go through something like this again, so you have to be more careful, be aware of or evaluate other contraceptive methods that work well for the body, so it is necessary to have that information.”—Participant 29

Learning about contraception through Aya Contigo reinforced and nuanced participants’ existing knowledge about the different types of birth control options, including their effectiveness and side effects. After using Aya Contigo’s contraceptive tool, several participants identified the option that would best suit them, most commonly expressing interest in a long-acting reversible contraceptive. However, some were unsure that they would be able to access their preferred option. Some participants also had ongoing misconceptions or fears about certain contraceptive methods. For example, one woman reported:

“I [knew] one who used [a copper IUD], I don’t know if she didn’t take care of herself, didn’t go to the doctor, and that caused her to get a tumor down there and as a result she died, so I don’t like them.”—Participant 18

For the few with specific preconceived negative impressions, it was unclear if the application’s contraception tool shifted their views. Overall, despite the legitimate concern that contraceptive options may be difficult to access, Aya Contigo’s contraceptive tool enabled participants to feel prepared and confident to pursue an evidence-based method for the prevention of future pregnancy if they wished.

Pivoting to virtual chat support positively impacted the abortion experience

A virtual help desk over WhatsApp was created to facilitate study recruitment and research-related consent processes. This chat enabled the research team to communicate with participants over a familiar platform in a safeguarded manner. When participants were enrolled and began undergoing the medication abortion process, it became clear that they required support beyond Aya Contigo alone. While the WhatsApp chat was initially created as a research help desk, this communication channel became a component of the self-managed abortion process itself. Study team members staffed the line 24/7 and responded to questions and concerns throughout the process. The team also provided emotional support when participants reached out and acknowledged that they were struggling.

Once established, real-time virtual WhatsApp chat was considered valuable by all participants. Some found the way Aya Contigo and the chat support guided them through each step was akin to having a counsellor helping them with the abortion process, as one participant described of the app:

“I had a support, a friend, a trusted person.”—Participant 2

The chat was reassuring and calming for many participants. The ability to confirm information in the app alongside the presence of someone checking in with them made them feel more supported during an otherwise isolating process. All participants felt more confident knowing there was a real person available and attentive to them, highlighted by one participant:

“I was always on the app and talking to someone ... through WhatsApp, I didn’t feel uncomfortable with the app because anything that appeared on the app that generated any kind of concern I could then solve it through WhatsApp...the responses so in the moment, so active, so present...really it was a very good experience.”—Participant 34

The trust and support provided by the research team gave participants more confidence in their ability to self-manage the abortion process. Several participants noted that they would have preferred the chat to exist in the app itself instead of over WhatsApp.

Aya Contigo can play an important role within the existing Venezuelan SRH ecosystem

At the time of the pilot study, there were already existing humanitarian organizations in Venezuela working to try and improve access to reproductive healthcare and abortion services. Given the country’s oppressive environment, many participants reported that they did not know how to access these services. Some participants noted that while they remained in contact

with Aya Contigo's team, other harm-reduction organizations could not stay in regular communication with them:

"[Aya Contigo team] were a support because later they stopped answering me from [local organizations], and I really kept communicating with you... and it was really good."—Participant 6

The ongoing communication that Aya Contigo's team could provide was an important component of the abortion care experience. By establishing trust through this communication channel, participants could seek additional support and ask questions to the team when needed. Participants appreciated that the study team offered referrals to a local sexual and reproductive health clinic that offered contraceptive resources.

For some participants, Aya Contigo was viewed as an additional resource and support that improved their abortion experience. For others, the information, support, and referrals provided by the Aya Contigo team were critical to feeling they had the resources and confidence to successfully complete the abortion process:

"It's just that if I hadn't known [Aya Contigo], I wouldn't have known that person either. Because without the communication with you, how would I also have met those [other trusted source] people? How would I have gone? I would not have met them, and they would not have helped me. That is why I tell you that you were a fundamental tool." -Participant 38

Overall, participants valued that study participation enabled them to connect with other sexual and reproductive organizations operating locally. These connections usually happened outside of the app itself; most participants did not use the recommended resources section as it listed organizations outside of Venezuela. Participants reported that they would prefer if local organizations or doctors were listed in the app, although many understood that this would be challenging to implement given the legally restrictive setting.

Discussion

Aya Contigo is the first digital application designed to support medication abortion and contraceptive care for pregnant people in Venezuela, where sexual and reproductive health rights are heavily repressed and maternal mortality rates are rising. Building on the ground-breaking work of activist and feminist organizations in the region, Aya Contigo shows promise as an intervention to support self-managed medication abortion and post-abortion care. The digital app's informational guides and real-time virtual accompaniment service helped participants feel prepared, confident, and supported during the abortion process. Aya Contigo also connected participants with local sexual and reproductive health resources and enabled individuals to select a contraceptive option post-abortion. The digital intervention can bridge existing SRH services by expanding access to evidence-

based information and accompaniment services for self-managed abortion in Venezuela.

Aya Contigo's informational guides for medication abortion were designed to provide pregnant people with a clear understanding of the process. The interactive abortion eligibility checklist and the medication abortion steps were highly valued by participants and helped them feel prepared. Guidelines suggest that medication abortion pain can be severe and that people undergoing abortion should have adequate resources to reduce suffering (42). While the pain symptoms associated with medication abortion have historically been minimized by providers (43–45), the digital tool helped participants anticipate pain and bleeding symptoms. While most study participants reported that the pain and bleeding associated with medication abortion was more severe than a regular menstrual period, they often felt confident in managing their symptoms with the support of Aya Contigo.

In addition to the application's informational features, the virtual accompaniment service was a key factor in the intervention's uptake and acceptability among participants. While Aya Contigo was initially developed as an evidence-based information source for people seeking self-managed abortion, the need for individualized support became evident early on in the study. Aya Contigo's in-app abortion guide was then coupled with a real-time virtual chat over Whatsapp with a study team member trained in abortion accompaniment. Personal accompaniment services have been shown to increase the efficacy of self-managed medication abortions in legally-restrictive settings (46, 47). The virtual accompaniment service provided guidance around health-related questions and assistance with any unique challenges encountered throughout the abortion process. Virtual companions offered important emotional support, though some expressed that a digital tool cannot replace in-person support. While digital health solutions are not a panacea, Aya Contigo's model shows promise as an intervention for people seeking abortion in under-resourced and restrictive settings. Since study completion, the virtual chat support function has been embedded within the app itself to facilitate streamlined communication with a team of trained companions.

There were some important challenges encountered during the self-managed abortion process, which participants described in the interviews. Almost all participants had difficulty accessing and affording safe abortion medications, which is a known and pervasive problem within Venezuela (7, 9). While all participants had a complete abortion, three required further intervention, most likely because they could not initially obtain a full abortion medication regimen. By partnering with trusted organizational partners, Aya Contigo provided participants with information about where they could access essential resources and further healthcare if needed.

The Aya Contigo checklist for abortion completion was created based on evidence that patient post-abortion checklists are accurate and comparable to in-clinic assessment (48). However, some participants were inappropriately alerted that they may still be pregnant after completing the in-app checklist, a concern that has been reported by other research evaluating self-managed abortion (49). In order to reconcile this, participants clarified their concerns

and symptoms over the real-time chat with trained companions. Based on participant feedback, the app now prompts participants to check-in with the virtual care team or a healthcare provider if there are any flagged ongoing symptoms or concerns.

Cybersecurity is an area of growing concern within the FemTech space, as protecting user privacy and security is of utmost importance when offering abortion services in legally-restrictive settings. Participants appreciated that Aya Contigo provided them with an anonymized and discreet option for self-managed abortion. Recognizing the risks of criminalization in Venezuela, participants seeking abortion suggested that the app include additional safeguards. In order to minimize the risk of participant data breaches from unwanted or punitive third parties (27, 50, 51), the virtual chat component was embedded into the app itself. All users receive information on how to permanently delete information from their personal devices, and back-end data security policies are regularly reviewed to ensure maximum encryption. The ability to evolve with the legal and technological landscape will be essential to protect the security and privacy of Aya Contigo users.

Limitations

The study was conducted within an active humanitarian crisis, where citizens and research team members experienced economic, infrastructural, and socio-legal challenges on a daily basis during the study period. This context limited participant recruitment and retention in research, particularly because the study focused on abortion, which is heavily restricted and criminalized in Venezuela. As a result of these constraints, the study has important limitations in its scope and size. There was high loss to follow-up throughout the study recruitment period, which has been similarly reported in other studies evaluating self-managed abortion (49). We completed recruitment and data collection on a small convenience sample of 17 participants, which limits the study's generalizability. Participants' experiences with self-managed medication abortion as guided by Aya Contigo may not represent the experiences of the wider Venezuelan population seeking sexual and reproductive health care. All participants identified as women, and therefore the unique narratives of trans and non-binary people experiencing pregnancy are not captured in the data. Further, the majority of participants lived in urban settings and reported high levels of education which is not representative of the national average. The fact that this service was viewed as useful even among those with higher resources than average suggests that this intervention may be useful to those in greatest need.

In line with current data on the safety and efficacy of self-managed medication abortion, the study restricted enrollment to those within the first trimester of pregnancy. As a result, the possible benefits of this digital guide and accompaniment service for medication abortion are limited to people in early pregnancy. In an effort to support those beyond 12 weeks of gestation, the Aya Contigo application provided information on trusted local resources and healthcare facilities that offered reproductive health services.

Data was collected in Spanish by research team members native to Venezuela, but this data was translated to English for analysis, which has the potential to lose some of the original meaning. The study relies on self-reported outcome data, which is valuable for understanding participants' experiences but cannot be corroborated. Qualitative and quantitative data were collected at a single time point from participants, most often within the 2-week period following self-managed abortion, which prevents the reporting of participant experiences months or years after the abortion. While the study benefitted from utilizing an adapted SUS scale and garnered rich qualitative data, the sample size was ultimately too small to make definitive conclusions around the application's acceptability and feasibility in Venezuela.

Implications

The results of this pilot study have informed the iterative development of Aya Contigo and its affiliated services for people seeking abortion and contraceptive care in Venezuela. In 2022, Aya Contigo was released to the general population in Venezuela and early data reveals significant uptake among people interested in self-managed medication abortion (8). The World Health Organization selected Aya Contigo as one of five key interventions in the global abortion care movement as part of International Safe Abortion Day 2023 (52). Beyond the application's introduction in Venezuela, this study offers insights into digital health tools for abortion care in legally-restrictive settings. Our results echo the need for localized, human-centered design in the development of mobile applications and other interventions to effectively meet the needs of users. This model can act as a guide for other abortion and SRH-focused digital health interventions, particularly within humanitarian or restrictive settings.

Conclusions

This mixed-methods pilot study demonstrates that the Aya Contigo mobile application may support pregnant people seeking medication abortion and post-abortion contraceptive services in Venezuela. Participants valued the provision of evidence-based information, virtual accompaniment services, and locally-available sexual and reproductive health resources via the digital tool. Further research and interventions are needed to ensure that all pregnant people in Venezuela can access safe abortion and contraceptive resources.

Data availability statement

The datasets generated and/or analyzed during the current study are not publicly available as they contain sensitive information about structurally marginalized populations. Raw data supporting the conclusions of this article will be made available by the corresponding author, upon reasonable request.

Ethics statement

The studies involving humans were approved by Allendale Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

KC: Conceptualization, Formal Analysis, Investigation, Methodology, Software, Writing – original draft. AS: Data curation, Formal Analysis, Methodology, Project administration, Writing – original draft. NZ: Conceptualization, Writing – review & editing, Methodology. SM: Conceptualization, Writing – review & editing, Methodology. GT: Conceptualization, Funding acquisition, Writing – review & editing. RG: Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fghw.2024.1401779/full#supplementary-material>

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Social and behavioral research with end-users and healthcare providers into understanding perceptions of and reactions to a monthly oral contraceptive capsule in Bangladesh, Senegal and Zimbabwe

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Introduction: Unintended pregnancy is a global public health challenge. Many contraceptive methods are available to end users, but non-use and discontinuation due to health concerns or side effects, particularly related to unpredictable or undesirable menstrual bleeding, are common. Oral contraceptive pills (OCPs) often have regular bleeding patterns compared to other hormonal contraceptives but require daily adherence. To address the issues of bleeding-related side effects and daily adherence, researchers are developing a monthly oral contraceptive (MOC) containing the same hormones as common OCPs. We studied women's and healthcare providers' (HCPs') perceptions of the MOC technology with the primary goal of providing feedback on product attributes to inform early design decisions.

Methods: Our study consisted of a qualitative phase with in-person in-depth interviews (IDIs) with a total of 60 women of reproductive age in three regions in three countries (Bangladesh, Senegal, and Zimbabwe) and quantitative surveys, which took place after the qualitative phase, via face-to-face computer-assisted interviews of a total of 1,825 women in 17 regions in these three countries. We conducted 96 IDIs and 632 quantitative interviews with HCPs in one urban area per country.

Results: Women's and HCPs' perceptions of MOC product attributes were assessed and included a focus on potential menstrual changes and possible reasons for discontinuation. Overall, the most appealing attribute of an MOC was its 1-month duration. Women and HCPs alike preferred regular, monthly menstruation. Any unpredictable or irregular bleeding, including heavy bleeding or amenorrhea, would be a reason to discontinue an MOC if it were to have those attributes.

Discussion: Overall, an MOC has a high and broad level of appeal amongst all the groups of women and HCPs who participated in the study and has a strong value proposition for important contraceptive needs including convenient duration, ease of use, discretion, and acceptable side effects. This appeal assumes that the experience of using an MOC would be very similar to that of daily OCPs except for dose timing. Future research on a hormonal MOC should include an exploration of women's tolerance and acceptability of potential side effects, particularly regarding bleeding, to validate its value proposition.

KEYWORDS

family planning, acceptability, preferences, contraceptives in development, Africa, Asia, women, attributes

Introduction

In 2019, there were approximately 111 million unintended pregnancies, of which 77% were among women with an unmet need for contraception or those who wanted to avoid pregnancy but were not using a modern method of contraception (1). Demographic and Health Surveys (DHSs) consistently report that side effects or health issues are stated reasons for the non-use of contraception (28% in Africa and 23% in Asia) (2). It is common to experience menstrual bleeding changes with the use of modern hormonal methods, indicating a potential correlation between non-use or discontinuation due to dissatisfaction and method-related side effects (3, 4). In fact, DHS data indicate that women who reported non-use due to side effects or health concerns were more likely to have previously used modern contraceptive methods such as implants, injectables, intrauterine devices (IUDs), or oral contraceptive pills (OCPs) (2). Furthermore, a recent review article on women's tolerance of contraceptive-induced menstrual bleeding changes (CIMBCs) reported that in over half of the studies, women perceived bleeding changes such as spotting or irregular or more frequent bleeding to be unacceptable (5).

Daily combined OCPs (containing estrogen and progestin) are a favored product among many users because of the regular monthly withdrawal bleed (which occurs when there is a change in hormones such as that during the hormone-free interval), but also due to their ease of use, wide availability, low cost, and high efficacy when used as directed. Yet, a lack of supply, forgetting to take the pill every day, or not taking it at the same time each day are possible reasons that OCPs have typical use failure rates three to eight times greater than in clinical trials (6–10).

To address failure rates linked to the daily adherence burden, once-a-month oral contraceptives have been developed. In the 1960s, scientists developed once-a-month contraceptive pills using quinestrol (estrogen) and norgestrel or levonorgestrel (progestogen) that were registered in China, but concerns have been raised about their safety given rates of side effects and hypertension associated with use (11). Mifepristone has also been studied for once-a-month use and has been shown to be efficacious and acceptable to women (12, 13). However, some women with varying beliefs, values, and experiences do not want to use a method that could interfere with the implantation of a fertilized egg (14). These insights highlight the importance of

understanding different end user practices, views, and preferences when designing a new contraceptive product (14).

Historically, new contraceptives have been developed without much direct input from end users early in the design phase despite available research methodologies and expertise (15, 16). In more recent years, approaches that have been used in the commercial healthcare sector are being used to solicit user feedback and inform early product design, including for long-acting methods (16–21). Our study examines both end user and healthcare provider (HCP) preferences and attitudes in Bangladesh, Senegal, and Zimbabwe to provide key information for the early product design of a new monthly oral contraceptive (MOC). An MOC is a capsule containing a specially designed formulation that can deliver up to 3 weeks of contraceptive protection using a combination of two hormones found in daily OCPs, such as ethinyl estradiol and levonorgestrel, and thus would inhibit ovulation (22). A withdrawal bleed would follow the 3 weeks of contraceptive protection, mimicking monthly menstruation and signaling that the next monthly pill should be taken. Such a new MOC has the potential to provide women and adolescents seeking contraception with an option that addresses reasons for non-use, discontinuation, and method failure with fewer bleeding disruptions and better compliance.

Our study involved 1,935 women and 728 HCPs in Bangladesh, Senegal, and Zimbabwe with the primary objective of understanding the overall perception of an MOC, with a focus on product attributes. The countries in the study represent diverse OCP use rates (50% in Bangladesh, 19% in Senegal, and 57% in Zimbabwe) (23) to test the hypothesis that countries with strong OCP use rates are conducive environments into which to introduce an MOC. The secondary objective was to provide evidence for refining messaging and the value proposition based on a Consumer-Targeted Product Profile (CTPP). The tertiary objective was to understand the level of appeal and likelihood of trying an MOC.

Methods

Overview of project

Our study consisted of two phases: a qualitative phase followed by a quantitative phase. Respondents who participated in the

qualitative component did not participate in the quantitative component. All the interviews were conducted at a place of the respondent's choosing, often in their home, or a space where they felt they could talk openly.

End users

For the qualitative phase, data were collected via in-person in-depth interviews (IDIs) with a total of $n=60$ women in Bangladesh (Dhaka and Sreepur), Senegal (Dakar and Linguère), and Zimbabwe (Harare and Hurungwe). This sample was divided into $n=10$ rural-based women in both Zimbabwe and Senegal, and $n=20$ rural-based and $n=20$ urban-based women in Bangladesh. A higher IDI sample size was implemented in Bangladesh due to the sensitivity of the topic and the consequent limitations of group discussions, preventing the possibility of qualitative focus groups, which were conducted in Senegal and Zimbabwe ($n=50$, with 10 mini-workshops of $n=5$ per workshop). As such, we have focused on shared methodologies in this paper. The qualitative work in Senegal and Zimbabwe was carried out prior to the work in Bangladesh. The respondents were asked to think about contraception broadly to situate them in the topic. Next, they reviewed all the provided stimuli (first a video, then a profile, and finally a prototype of the outer capsule). At each point, the respondents were asked to describe how they perceived the MOC, including benefits, challenges, concerns, and whether they would be willing to try it. Finally, respondents were asked about communication and how they would seek information on/tell others about an MOC. For the quantitative phase of the research, data were collected via face-to-face computer-assisted personal interviews (CAPIs) with a total of $n=1,825$ women in Bangladesh (Dhaka $n=305$, Chattogram $n=151$, Rajshahi $n=80$, and Khulna $n=81$), Senegal (Dakar $n=206$, Thiès $n=154$, Saint-Louis $n=39$, Kaolack $n=67$, Ziguinchor $n=68$, and Diourbel $n=67$), and Zimbabwe (Harare $n=181$, Manicaland $n=138$, Mashonaland East $n=106$, Bulawayo $n=87$, Matabeleland $n=43$, Mutare $n=38$, and Masvingo $n=14$).

HCPs

For the qualitative phase, data were collected via in-person IDIs with a total of $n=96$ HCPs ($n=32$ in Dhaka, Dakar, and Harare, respectively). For the quantitative phase, data were collected face-to-face via CAPIs with a total of $n=632$ (Dhaka $n=79$, Chattogram $n=51$, Rajshahi $n=41$, and Khulna $n=41$), Senegal (Dakar $n=77$, Thiès $n=57$, Saint-Louis $n=13$, Kaolack $n=22$, Ziguinchor $n=22$, and Diourbel $n=22$) and Zimbabwe (Harare $n=62$, Manicaland $n=46$, Mashonaland East $n=36$, Bulawayo $n=30$, Matabeleland $n=15$, Masvingo $n=9$, and Mutare $n=8$).

Stimuli

The participants were exposed to the following stimuli:

Qualitative: A three-sentence description outlining the concept of the MOC without explaining its mechanism of action, images of the prototype (Supplementary Figure S1), initial CTPP, and two short informational videos (one animated lasting 54 s and the

other a live-action demonstration lasting 53 s; both videos were silent, with an accompanying moderator script which was read to participants). The revised video, which incorporated important user learnings from the qualitative research which had been completed in Senegal and Zimbabwe (see quantitative stimuli below), was used in the qualitative research in Bangladesh, as this was carried out after the research in Senegal and Zimbabwe.

Quantitative: A three-sentence description outlining the concept of the MOC without explaining its mechanism of action (for end users only), images of the prototype (Supplementary Figure S1), revised CTPP following changes made in the post-qualitative phase, and a revised informational video lasting 1 min 48 s (a combination of aspects from the two videos in the qualitative phase, based on feedback from respondents).

Proprietary information on the mechanism of action has been redacted from the stimuli when reproduced here, and no information or results from the discussions concerning the video can be shared.

The three-sentence description is as follows: "This is a new contraceptive product that prevents unintended pregnancy when it's used correctly and consistently. It needs to be taken only 1 time per month, rather than daily like other oral contraceptives. It is intended to prevent pregnancy on a month-to-month basis".

Reproduced in the Supplementary Material is the revised end user CTPP (Supplementary Figure S2), as used in the quantitative component of the study. This includes an informational section on the reproductive system and menstrual cycle which was not included in the CTPP shown to HCPs, which was otherwise the same apart from wording changes. All wording changes in the CTPP shown to providers are shown in Supplementary Figure S2.

Population sample

End users

The target population was women of childbearing age (18–40 years for the qualitative phase, and 18–49 years for the quantitative phase) who self-reported being sexually active, were not currently pregnant, were not planning to conceive in the next year, and who were open to using contraceptives/family planning, in socio-economic classes (SEC) C and D. This research utilized the EquityTool which is a short, country-specific questionnaire to measure relative wealth (24). The C and D SEC strata were selected for this research as they encompass the broadest and largest section of the population and are critical target populations for contraceptive programs. Participants aged 18–40 years were selected as the age range for the qualitative sample as an upper limit of 40 years was considered to be able to provide an adequate representation of the older age range among childbearing women in the qualitative sample. For the quantitative sample, however, the 18–49 year age group was chosen in order for the quantitative results to be generalizable across the broader demographic of women of childbearing age in these locations (25, 26). Other demographic information was captured during the interviews; however, this did not determine eligibility. Aside from the eligibility

criteria detailed above, there were no quotas for subdividing the sample, and the characteristics of the sample depended on the natural subject distribution following recruitment. The respondents who participated in the qualitative component did not participate in the quantitative component.

HCPs

HCP eligibility criteria included a set quota of provider types which comprised doctors, nurses, community health workers (CHWs), and pharmacists/medicine sellers. The provider types could operate within either a public or private setting and had to have been practicing for over 1 and be under 40 years old. The providers had to regularly (on a daily or weekly basis) provide counsel to women on family planning/use of contraceptives. Finally, providers were not eligible if they were working for any pharmaceutical company or manufacturer as a clinical trial investigator, consultant, researcher, or in any other capacity, and if they had participated in market research about family planning or contraceptive methods within the 6 months preceding the study.

The majority of our HCP sample were women (61.8% overall, 64.6% in Bangladesh, 62.0% in Senegal, and 58.7% in Zimbabwe). There were significantly more men in the doctor and pharmacist specialties (72.0% and 62.0% overall, respectively) and a significantly higher proportion of nurses and CHWs were women (80.0% and 86.3% overall, respectively).

Country selection

The study selected countries based on the question of whether those with high OCP use would provide conducive environments for an MOC. This was done by contrasting two countries with high OCP usage (Bangladesh and Zimbabwe) with one with a mixed distribution of methods, including high proportions of long-acting reversible contraceptive (LARC) usage (Senegal) (23).

Translations

All informed consent forms, stimuli, and research tools were translated into the main languages spoken in the areas where the fieldwork was conducted (Bengali in Bangladesh, French in Senegal, and Shona and Ndebele in Zimbabwe). The respondents were able to choose the language for the written materials and discussion and could switch during interviews if they preferred.

Data collection

For the qualitative component, discussions were via face-to-face IDIs and lasted between 40 and 60 min. For data collection, the interviews were audio-recorded, transcribed, and, where necessary, translated prior to analysis. For the quantitative phase, women were surveyed via face-to-face CAPIs, which lasted between 30 and 35 min. For data collection, mobile phones/tablets with offline data

storage capabilities were used and data were automatically uploaded when an internet connection was available.

The research teams, comprising female interviewers and recruiters and mixed-sex supervisors, were selected for their qualitative and quantitative competencies and background, and were briefed and trained. Pilot interviews were observed across all three countries, ensuring adherence to objectives, processes, and ethical considerations. Interviews were conducted by experienced interviewers in the local language or English, based on respondent preference.

Due to the COVID-19 pandemic, precautions were put in place to minimize risk. Inter-country travel was minimized; our study team briefed the in-country fieldwork teams remotely using video meeting technology. Fieldwork was only conducted when there were no government restrictions in place that would be contravened by carrying out this work. Guidelines were developed based on those provided for face-to-face interviewing by the European Society for Opinion and Market Research (ESOMAR) (25).

Provision was made for the use of alternative formats for completing the research such as telephone interviews or video interviews using programs such as Zoom or Skype if needed to comply with government restrictions; however, these provisions were not utilized as it was possible to conduct all research face to face.

Data analysis

For the qualitative data, codebooks were developed iteratively following a review of transcripts by the core study team of four research directors, each with at least 5 years of qualitative analysis experience. This framework was used to code transcripts and identify key themes that emerged from the data. An iterative and systematic process of content and pattern analysis was carried out. The study team used the analytical categories developed as part of the coding framework to derive meaning from the various pieces of evidence to answer the research questions. The study analysis team met regularly to review codebook outputs, with a view to align/calibrate and/or resolve coding challenges which included a discussion and consensus building, revisiting the codebook, and a third-party review.

The closed-ended quantitative data were analyzed by initial base analysis including an examination of the data at a total respondent level, as well as by key groups such as marital status, across age groups, and urban vs. rural. In accordance with the conventional acceptance of statistical significance at a P -value of 0.05 or 5%, confidence intervals (CIs) were calculated at a confidence level of 95%. The tests used in the analysis included the paired/overlap t -test for means and the paired/overlap z -test for percentages. In general, if an observed result is statistically significant at a P -value of 0.05, then the null hypothesis should not fall within the 95% CI. Statistical significance ($P \leq 0.05$) was observed when the differences in data from one country were not different from the findings in the other due to chance. There were, however, no significant differences between sample distinctions (demographics such as age, setting, contraceptive use, etc.) that were relevant to the objectives.

This study utilized a 5-point rating scale or Likert rating scale for some questions. When responding to a Likert rating scale question, the respondents specified their level of agreement or disagreement on a symmetric agree-disagree scale for a series of statements (27). Thus, the range captured the intensity of their feelings for a given item (27). Analysis of these questions is presented with data for each scale item and, in some cases, includes Top 2 Box scores, sometimes denoted as T2B (or “positive” scoring), and Bottom 2 Box (“negative” scoring) as a way of examining and presenting the responses to the Likert scale questions (28).

Open-ended data within the quantitative interviews were also analyzed. The process began with a review of the verbatim responses for each question. Common themes were identified, as well as factors associated with each theme. This represented a code frame. Each verbatim response was then analyzed and assigned an appropriate code.

Results

Table 1 shows the demographic information concerning the respondents who took part in the research. In terms of quantitative end user location, the rural/urban (or peri-urban) distribution of respondents was as follows: 51.4% urban vs. 48.6% rural in Bangladesh; 69.0% urban vs. 31.0% rural in Senegal; 58.3% urban vs. 41.7% rural in Zimbabwe. The HCP sample for this study was $n = 631$, split fairly equally between four specialties: doctor (23.9% overall), nurse/family welfare visitor (FWV)/counselor (26.5%), CHW (24.6%), and pharmacist/medicine seller (25.0%). Table 2 shows the data across specialties and countries. Overall, the sample was split equally between those spending the majority of their time in either a public (50.4%, driven by Senegal and Zimbabwe with 56.8% and 55.3%, respectively) or private setting (49.6%, driven by Bangladesh with 60.8%), with the private setting being split further between hospitals/health clinics/facilities (27.9%) and pharmacies/medicine shops (21.7%).

The results described in this paper are the total of all three countries; country differences and other data cuts are expressed in the tables. Statistical significance is noted where a result from one country is significantly different from the other two (given as “significantly high” or “significantly low”). Percentages in the text and tables are given to one decimal place. Where predefined lists of reasons were provided in the quantitative questionnaire, these were informed by answers from the qualitative phase, with an “Other—specify” option also included. The results from the qualitative research are given to provide context for quantitative results.

Context

End user contraceptive awareness and use

Quantitative: The respondents were asked a variety of questions about their contraceptive awareness and use. The most frequently spontaneously recalled method was the daily

TABLE 1 Demographic and motherhood-related data, self-reported.

	Total ($n = 1,825$)	BGD ($n = 617$)	SEN ($n = 601$)	ZWE ($n = 607$)
Age (%)				
18–23 years old	19.6	22.9	14.5 ^a	21.3
24–30 years old	38.6	44.2	38.8	32.6 ^a
31–35 years old	22.7	21.1	20.5	26.7 ^b
36–48 years old	19.1	11.8	26.3 ^b	19.4
Mean (years)	29.87	28.49	31.10	30.04
Relationship status (%)				
Married and living together ^c	77.5	96.4 ^b	71.0	64.7
Single + BF ^s ^d	9.7	—	16.1	13.2
Married and not living together ^e	6.3	3.4	7.5	8.1
Not living together	1.8	—	0.2	5.3 ^b
Living together	1.6	0.2	0.7	4.1 ^b
Divorced	1.5	—	2.5	2.1
Widowed	0.4	—	0.3	0.8
Number of children (%)				
None	11.2	9.6	17.5 ^b	6.8
1	25.1	28.7	20.8	25.7
2	33.2	44.2 ^b	25.0	30.0
3	16.9	14.3	14.1	22.2 ^b
4	7.8	2.8 ^a	11.5	9.4
5	4.1	0.2 ^a	3.7	1.2
6 or more	1.7	0.3 ^a	3.7	4.8
Mean	1.95	1.75 ^a	2.05	2.06
Education level (%)				
Primary + below	19.6	26.7	22.5	9.6
Junior secondary	35.3	39.9	18.8 ^a	47.1 ^b
Senior secondary	22.9	23.0 ^a	15.8	29.8

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

^cMarried and living with partner.

^dBoyfriend(s).

^eMarried and not living with partner.

OCP, mentioned by 89.8% of respondents. Next was the contraceptive injection, named by 57.0% of respondents. The third most named method was the contraceptive implant, mentioned by 50.4% of respondents. The results for all the methods mentioned are in Table 3. Note that no distinction was made between the combined pill (containing estrogen and progestogen) and the so-called mini pill (containing progestogen only).

The most reported aided awareness (respondents were shown a list of contraceptive methods displayed with a randomized image) was of the daily OCP, at 94.9%. The second most reported was the contraceptive injection, at 87.1% overall. Awareness of the male condom was the third most reported, at 77.4%. The results for all methods are listed in Table 4.

The most reported method ever used was the daily OCP, at 73.5%. The next most used method was the male condom, used by 52.2%. The third most reported method was the contraceptive injection, at 36.5%. A minority of respondents, 3.1% overall ($n = 57$), specified that they had never used a contraceptive method. The results for all methods are listed in Table 5.

TABLE 2 Distribution of HCP respondent specialties across countries (number of respondents, $n = 631$).

	Total ($n = 96$)	BGD ($n = 32$)	SEN ($n = 32$)	ZWE ($n = 32$)	Total ($n = 631$)	BGD ($n = 212$)	SEN ($n = 213$)	ZWE ($n = 206$)
	Qualitative component (n)				Quantitative component (n)			
Doctor	24	8	8	8	151	51	50	50
Nurse/FWV/counselor	24	8	8	8	167	53	59	55
CHW	24	8	8	8	155	52	52	51
Pharmacist/medicine shop owner/medicine seller	24	8	8	8	158	56	52	50

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

TABLE 3 End user respondents' unaided recollection of contraceptive methods.

	Total ($n = 1,825$) (%)	BGD ($n = 617$) (%)	SEN ($n = 601$) (%)	ZWE ($n = 607$) (%)
Oral birth control pill/"daily pill"	89.8	96.9 ^b	83.7	88.5
Contraceptive injection/DMPA/"shot"/"jab"	57.0	72.0	73.4	25.7
Contraceptive implant/"rod"/"strand"	50.4	21.9 ^a	72.5 ^b	57.3
Male condom	47.9	74.4 ^b	18.0 ^a	50.7
IUD/Copper T, "non-hormonal loop," "copper loop," or "coil"	37.4	24	27.8	60.5 ^b
Levonorgestrel intrauterine system (LNG-IUS) or "hormonal loop"	18.6	—	4.3	51.7 ^b
Female condom	13.9	—	1.8	39.9 ^b
Oral emergency contraceptive pill/"emergency pill"	4.4	1.6 ^a	3.8	7.7
Other methods	4.1	2.8	2.8	6.8 ^b
Counting days/rhythm method	1.5	0.2	3.8 ^b	0.5
Diaphragm/"cap"	0.8	1.0	0.5	1.0
Withdrawal	0.8	—	—	2.5
Contraceptive vaginal ring (CVR)	0.6	—	1.7	0.2
Spermicide/spermicidal jelly, foam, suppository, or film	0.5	—	0.2	1.3
Contraceptive patch	0.2	—	0.5	—
None	0.3	0.3	0.2	0.5

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

^cDepot medroxyprogesterone acetate.

TABLE 4 End user respondents' aided recollection of contraceptive methods.

Summary of top score	Total ($n = 1,825$) (%)	BGD ($n = 617$) (%)	SEN ($n = 607$) (%)	ZWE ($n = 607$) (%)
Oral contraceptive pill	94.9	96.8	91.7 ^a	96.2
DMPA	87.1	90.4 ^b	85.0	85.7
Male condom	77.4	93.5	45.6 ^a	92.4
Contraceptive implant	69.3	48.8 ^a	77.5	82.0
IUD	48.5	45.9	39.1 ^a	60.5 ^b
Oral emergency contraceptive pill	39.2	36.3	35.4	46.0 ^b
Female condom	38.8	8.8 ^a	22.1	86.0 ^b
LNG-IUS	26.2	5.2 ^a	26.5	47.3 ^b
Contraceptive vaginal ring (CVR)	7.5	6.8	8.3	7.2
Diaphragm	7.1	4.4	5.3	11.7 ^b
Counting days/rhythm method	5.8	1.6 ^a	7.5	8.2
DMPA-SC ^c /bubble injection/Sayana Press	5.2	4.4	9.7 ^b	1.5
Spermicide	4.6	3.1	3.0	7.7 ^b
Contraceptive patch	3.3	3.1	4.3	2.6
Withdrawal	2.1	—	—	6.3
Other methods	0.9	0.3	1.3	1.2
None	0.3	0.2	0.5	0.3

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

^cDepot medroxyprogesterone acetate-subcutaneous.

TABLE 5 Contraceptive methods ever used by the end user respondents.

	Total (<i>n</i> = 1,820) (%)	BGD (<i>n</i> = 606) (%)	SEN (<i>n</i> = 598) (%)	ZWE (<i>n</i> = 616) (%)
Oral contraceptive pill	73.5	87.8 ^b	49.2 ^a	82.8
Male condom	52.2	70.5 ^b	23.7 ^a	61.7
Contraceptive injection	36.5	37.3	37.1	35.0
Contraceptive implant	20.2	5.5 ^a	31.1 ^b	24.4
Oral emergency contraceptive pill	13.1	13.3	10.5	15.5
Female condom	6.0	1.1 ^a	4.2	12.7 ^b
IUD	4.9	3.1	7.0	4.6
Other methods ^c	3.4	1.1 ^a	3.3 ^b	5.8 ^b
LNG-IUS	1.3	0.2 ^a	2.2	1.7
DMPA-SC	0.8	—	2.5	—
CVR	0.7	0.3	1.5 ^b	0.3
Diaphragm	0.4	—	0.8	0.5
Spermicide	0.3	—	0.5	0.3
Contraceptive patch	0.2	—	<0.1	—

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

^cNatural family planning, “the rhythm method,” or the “standard/calendar days”/“counting beads” method.

TABLE 6 Contraceptives currently being used by the end user respondents.

	Total (<i>n</i> = 1,584) (%)	BGD (<i>n</i> = 545) (%)	SEN (<i>n</i> = 498) (%)	ZWE (<i>n</i> = 541) (%)
Oral contraceptive pill	48.2	58.7	30.3 ^a	54
Contraceptive injection	16.7	14.7	23.3 ^b	12.8
Contraceptive implant	13.9	1.8	24.7 ^b	16.1
Male condom	11.0	19.4 ^b	5.6	7.6
IUD	2.7	0.4	5.2 ^b	2.8
Oral emergency contraceptive pill	1.2	1.5	1.0	1.1
Other methods ^c	0.9	0.7	1.6	0.4
LNG-IUS	0.8	—	1.6	0.9
Female condom	0.7	0.4	0.6	1.1
DMPA-SC	0.5	—	1.6	—
Diaphragm	0.3	—	0.6	0.2
Contraceptive vaginal ring (CVR)	0.3	—	1.0	—
Contraceptive patch	0.1	—	0.4	—
None	11.1	9.2	14.1	10.4
Mean	1.04	1.03	1.05	1.06

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

^cNatural family planning, “the rhythm method,” or the “standard/calendar days”/“counting beads” method.

With regard to the methods currently used (respondents were able to specify more than one method), the most commonly used method was the daily OCP, at 48.2% overall. The next most used method was the contraceptive injection, at 16.7%. The third most used method was the contraceptive implant, at 13.9% overall, as shown in Table 6. A minority of respondents (11.1%) reported that they were not using any contraceptive method and 11.0% reported using the male condom. The proportion of respondents who reported usage of any other methods was between 0.1% and 2.7%.

Under a third of respondents (28.9%) stated that they had not visited a healthcare provider and discussed contraceptives in the past 12 months. Furthermore, 14.2% of the respondents reported one visit, 14.4% of the respondents reported two visits, and 12.2% of respondents reported three visits. The median number of visits reported was 2.0.

Most respondents (59.3%) specified they had received their most recent contraceptive from a healthcare facility. Pharmacies/medicine sellers were specified by 31.3%. A minority (9.4%) specified that they received their most recent contraceptive method from the community.

HCP context

The median number of women of reproductive age (WRA) seen by the HCPs was 115 per month and the median number of women who consulted on contraceptive methods was 70 a month. The median number of women prescribed/offered a contraceptive method was 50. Providers in Bangladesh reported seeing more women than providers in the other two countries.

This could be due to the nearly 10-fold larger population in Bangladesh (29) or the higher distribution of HCPs with 0.7 per 1,000 people in Bangladesh compared to 0.1 and 0.2 per 1,000 in Senegal and Zimbabwe, respectively (30).

To understand the age distribution of the women who consult HCPs regarding hormonal contraception, HCPs were asked to estimate the age distribution, in percentages, of the premenopausal women they see or consult in a typical month, specifically regarding prescription or hormone-based contraceptive methods or family planning. The mean percentage distribution across all three countries was as follows: <15 years old, 3.0%; 15–17 years, 9.2%; 18–25 years, 30.8%; 26–35 years, 31.9%; 36–45 years, 18.4%; >45 years, 6.6%.

Nearly all providers stated they had prescribed the daily OCP and the contraceptive injection (98.6% and 92.4% respectively). The next most recommended method was the contraceptive implant (76.1%) followed by the IUD (64.3%). Table 7 shows the full list of contraceptives ever provided.

The method of contraception most provided in the previous 3 months was the daily OCP (mean percentage overall of 44.2%) followed by the contraceptive injection (25.8%) and the contraceptive implant (21.6%). Table 8 shows the full list of contraceptives provided in the previous 3 months.

HCPs were given a four-point scale regarding patients' compliance with contraception: *poor*, *moderate*, *good*, and *unknown*, and asked to give a percentage for each, with the total amounting to 100%. Compliance was considered *good* by just over half of the HCPs (52.8%). Table 9 shows the mean percentages for patient compliance across all the levels.

Product attributes

Familiarity with orally self-administered contraceptives

End users

Qualitative: The monthly capsule benefits from an established understanding and experience with some oral contraceptives. The monthly oral contraceptive was immediately compared with the daily OCP by respondents, and the vast majority found the critical difference (daily vs. monthly duration) to be the main driver behind the appeal.

Monthly duration

End users

Qualitative: The once-a-month duration was a critical product attribute for the respondents, which, while perceived as having benefits in itself, also led to other perceived benefits for the end users. These benefits include ease of use and remembering while removing the burden of daily administration. Monthly oral contraception bridges the gap between daily and longer-term protection as well as offering those using LARCs an option to use without healthcare administration. The once-monthly duration was considered a favorable amount of time, making it easier to remember and self-administer, as was the lack of a need to visit an HCP or travel to a healthcare facility.

TABLE 7 Prescription/hormonal contraceptives ever provided (or recommended in case of non-prescribers) by the HCP respondents.

Contraceptive methods ever provided	Total (n = 631) (%)	BGD (n = 212) (%)	SEN (n = 213) (%)	ZWE (n = 206) (%)
Contraceptive pill	98.6	99.5	99.1	97.1
Contraceptive injection	92.4	89.6	99.1	88.3
Contraceptive implant	76.1	62.3	88.7	77.2
IUD	64.3	59.9	88.3	44.2 ^a
LNG-IUS	21.7	4.7 ^a	39.9 ^b	20.4
Another form of prescription contraception	21.4	14.2	15.0	35.4
Contraceptive vaginal ring (CVR)	10.6	2.8 ^a	22.1	6.8

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

TABLE 8 Prescription/hormonal contraceptives provided (or recommended in case of non-prescribers) in the 3 months preceding the study by the HCP respondents.

Contraceptive methods provided in the previous 3 months, summary of means (%)	Total (n = 631) (%)	BGD (n = 212) (%)	SEN (n = 213) (%)	ZWE (n = 206) (%)
Contraceptive pill	44.2	53.6	23.5 ^a	56.2
Contraceptive injection	25.8	30.7	25.8	20.7
Contraceptive implant	21.6	13.5	29.5 ^b	18.9
IUD	16.8	14.0	20.8	12.4
LNG-IUS	10.6	3.7 ^a	11.8	9.8
Another form of prescription contraception	10.5	14.0	3.4 ^a	12.2
Contraceptive vaginal ring (CVR)	6.9	7.5	6.2	9.0

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

TABLE 9 HCP perceptions of women's compliance with contraceptives' instructions for use.

Summary of means (%)	Total (n = 631) (%)	BGD (n = 212) (%)	SEN (n = 213) (%)	ZWE (n = 206) (%)
Poor compliance	14.5	6.1 ^a	23.3 ^b	14.0
Moderate compliance	22.4	11.1 ^a	28.9	27.3
Good compliance	52.8	75.4 ^b	32.6 ^a	50.5
Unknown compliance	10.3	7.4	15.2 ^b	8.2

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

TABLE 10 Importance of features of a contraceptive method for the end user respondents.

Top 2 Box scores, 4 + 5 out of 5	Total (n = 1,825) (%)	BGD (n = 617) (%)	SEN (n = 601) (%)	ZWE (n = 607) (%)
It is easy to remember when to take it or renew it	89.6	92.9	86.2	89.8
It is discreet. No one knows that I am taking/using it	83.5	89.3	91.7	69.4 ^a
It does not cause irregular periods while using it	83.2	87.4	77.7 ^a	84.5
When side effects occur, they are not severe enough to disrupt my daily life	82.7	86.7	76.0 ^a	85.3
It allows me to become pregnant within 6 months of discontinuing it	82.3	93.5 ^b	74.7	78.4
It does not cause my periods to stop while using it	82.0	87.5 ^b	79.0	79.2
It does not cause side effects such as headaches or weight gain	81.4	85.7	76.5 ^a	81.9
It does not have to be taken every day	78.8	83.1	79.9	73.5 ^a
It protects against disease/infection	78.1	88.5 ^b	71.5	74.0

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

Quantitative: The respondents were asked two open-ended questions: (a) why they were interested in finding out more about the MOC having already watched a video on it, and (b) whether they were willing to try the MOC, having been exposed to the CTPP. The majority of women who were interested in finding out more and who were willing to try the MOC stated that it was because of its monthly duration and the ease of use associated with a monthly duration, at 50.8% and 49.4% respectively. Other reasons for interest or willingness to try were mentioned; however, all were mentioned by a comparatively low proportion of the respondents (under 10%).

The respondents were asked how important a number of features of a contraceptive method were to them, using a 5-point Likert rating scale from *Not at all important* to *Very important*. The list of features and data for all three countries can be found in Table 10. The most important feature selected by 89.6% of respondents within the T2B was “It is easy to remember when to take it or renew it.”

Respondents were later shown the same list and asked how much they agreed that the MOC would fulfill the feature requirement on a 5-point rating scale from *Completely disagree* to *Completely agree*. There was a high level of agreement by the majority of the respondents on all the tested features, with “It is easy to remember when to take it or renew it” scoring the highest T2B. Table 11 presents the respondents' agreement levels by country.

End user discontinuation of the daily OCP

Quantitative: The respondents who had reported ever using the daily OCP but who were not currently using it were asked to select

the reasons why from a predefined list (based on results from the qualitative phase; an “Other—specify” option was also provided). The sample size for this question was $n = 606$, as opposed to the total sample size of $n = 1,825$. The most selected reason for discontinuation was “It was hard to remember to take it every day/not convenient” (33.3%). The second most common reason, driven by Bangladesh, was “I experienced headaches/migraines from it” (24.8%). The third most mentioned reason was “It upset my stomach/caused nausea” (22.4%). Table 12 shows all the reasons mentioned by the respondents.

HCPs

Quantitative: HCPs were asked how appealing they found the MOC, using a 5-point Likert scale ranging from *Very unappealing* to *Very appealing*, and those who rated their appeal in the T2B were asked to provide a reason. The providers reported the once-a-month duration as the main appeal (42.5%). The remaining reasons among a minority of providers (between 11.7% and 15.4%) included: *Easy to use*, *Easy to remember*, and *Easy to swallow*. Providers were also asked why they thought women would find an MOC appealing, and the leading reason was *Once-a-month duration* (42.9%). The second and third reasons were *Easy to remember* and *Convenient* (23.9% and 11.1% respectively).

Capsule size

End users

Qualitative: The end users were asked their views on the size of the capsule and whether they thought they would be able to

TABLE 11 How much the end user respondents agree that the MOC fulfills specified features of a contraceptive method.

Top 2 Box scores, 4 + 5 out of 5	Total (n = 1,825) (%)	BGD (n = 617) (%)	SEN (n = 601) (%)	ZWE (n = 607) (%)
It is easy to remember when to take it or renew it	88.7	95.5 ^b	81.4 ^a	89.1
It is discreet. No one knows that I am taking/using it	86.1	88.0	83.4	87.0
It will allow me to become pregnant within 6 months of discontinuing it	71.1	84.4 ^b	58.4 ^a	70.2
It may reduce period cramps and may reduce the symptoms women can experience pre-menstruation (PMS) such as bloating, headaches, and changes in mood	60.5	67.7 ^b	55.2	58.3
It may clear up acne	52.3	61.8 ^b	50.2	44.8
It may cause my period to occur less than once a month	49.3	51.4	46.9	49.4
It may cause spotting or bleeding between periods	39.0	46.8 ^b	31.6 ^a	38.4
It may cause my periods to stop while using it	37.0	40.0	33.6	37.2

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

TABLE 12 The reasons given by the end user respondents for discontinuing the oral contraceptive pill.

	Total (n = 606) (%)	BGD (n = 235) (%)	SEN (n = 156) (%)	ZWE (n = 215) (%)
It was hard to remember to take it every day/not convenient	33.3	22.1 ^a	39.1	41.4
I experienced headaches/migraines from it	24.8	40.0 ^b	12.2	17.2
It upset my stomach/caused nausea	22.4	43.4 ^b	5.8	11.6
I gained weight from it	16.7	21.3	16.0	12.1
I didn't like it	15.2	16.6	12.8	15.3
I didn't like that my periods became irregular while I was using it	8.3	4.7	7.1	13.0
It wasn't very effective at preventing pregnancy	4.8	2.6	3.8	7.9
It was difficult to find/not available	4.5	0.4	<0.1	12.1
I haven't needed contraception since I stopped taking the contraception pill	4.1	0.4	6.4	6.5
My friends suggested I try something different	3.8	1.3	1.3	8.4
My doctor/nurse suggested I try something different	3.6	2.6	5.1	3.7
My partner did not like it	3.5	2.6	4.5	3.7
I had difficulty swallowing it	3.1	5.5	<0.1	2.8
I heard bad/worrying things about it	3.0	2.1	2.6	4.2
I was worried it may prevent me from being able to have a baby in the future if I decide I want one/another one	2.8	2.6	5.8	0.9
I had to travel long distances to get it	2.1	0.9	<0.1	5.1
I didn't like that it reduced my monthly bleeding	1.7	2.1	0.6	1.9
I didn't like that it stopped my monthly bleeding	1.7	0.9	3.8	0.9
It was too expensive	1.5	1.3	0.6	2.3
I didn't like still getting my periods while using it	1.5	1.3	0.6	2.3
It wasn't very effective at stopping the spread of disease/infections	1.0	—	1.9	1.4

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

swallow it easily. The respondents in all three countries remarked on the MOC capsule being large, with this being something most respondents in Senegal would like to change, but to a lesser extent in Zimbabwe and Bangladesh, where fewer than half (Zimbabwe) and a smaller minority (Bangladesh) of respondents said they would change the size. However, almost all respondents indicated that they believed they would be able to swallow the capsule, with the two main reasons being that it could be swallowed easily with water and that, being a capsule, it would have a slippery coating.

Quantitative: Having seen the video and CTPP, the respondents were asked to state how easy they thought the

capsule would be to swallow. Ease of administration was evaluated on a 5-point Likert scale ranging from *Very difficult* to *Very easy*. The vast majority of participants felt that the capsule would be either somewhat or very easy to swallow (86.4% within the T2B). The mean score overall was 4.36.

HCPs

Quantitative: The confidence of the HCPs in a woman's ability to swallow the capsule was evaluated on a 5-point Likert scale ranging from *Not at all confident* to *Very confident*. Nearly all (91.3%) respondents reported being *Confident* or *Very confident*.

Menstruation experience

Predictability

End users

Quantitative: The respondents who had ever used a contraceptive method were asked to report whether they had experienced any of the following contraceptive-related bleeding patterns: *Spotting in between periods* (25.9%), *Prolonged bleeding/bleeding for longer than usual* (21.7%), *Bleeding occurring less frequently than once a month* (31.4%), *Bleeding occurring more frequently than once a month* (23.2%), or *None of the above* (43.5%). In total, 61% of the sample reported currently using the daily OCP (see Table 6), meaning that withdrawal bleeding was occurring rather than menstruation.

Unscheduled bleeding patterns

Quantitative: The respondents who had ever used a hormonal contraceptive method ($n = 1,663$) were asked to report whether they had experienced any of the following contraceptive-related bleeding patterns: *Spotting in between periods*, *Prolonged bleeding/bleeding for longer than usual*, *Bleeding occurring less frequently than once a month*, *Bleeding occurring more frequently than once a month*, or *None of the above*. Under half, albeit the biggest single proportion (42.6%), reported that they had not experienced any of the unscheduled bleeding patterns. A third (32.1%) reported bleeding occurring less frequently, driven by Bangladesh (44.3%, significantly high). Approximately a quarter reported experiencing the remaining unscheduled bleeding patterns, with significantly more respondents in Zimbabwe reporting experiencing these patterns. All the data are presented in Table 13.

Those who had experienced unscheduled bleeding patterns or period stoppage ($n = 1,204$) were asked to rate how concerned they felt during various scenarios on a 3-point Likert scale ranging from *Not at all concerned* to *Very concerned*, with an option for *I don't remember*. Overall, the mean scores were high across all bleeding patterns/stoppage, indicating that they were very concerned. The mean ranged from 2.13 out of 3.00 for *Bleeding occurring less frequently than once a month* to 2.54 out of 3.00 for *Prolonged bleeding/bleeding longer than usual*. Table 14 shows the data across all three countries and score levels.

Amenorrhea

Quantitative: Of those respondents who had ever used a contraceptive method ($n = 1,763$), 69.6% said their periods did not completely stop whilst using a method.

Menstruation preferences

Amenorrhea vs. regular periods

End users

Qualitative: Amenorrhea was considered unacceptable by almost all respondents. There was a high importance placed upon periods as part of a woman's life, particularly in Senegal. Having a period was considered important because it was perceived to be healthy, normal, and to have a cleansing effect on the body; these views were consistent across all three countries. Furthermore, periods were widely viewed as a reassuring indication of not being pregnant. A small minority of respondents in Bangladesh and Zimbabwe indicated that amenorrhea would be acceptable, but for different reasons: as long as they were informed of this and it was explained that it was a side effect (Bangladesh), or it did not have an impact on fertility (Zimbabwe).

Quantitative: When asked if they prefer a product that allows for a regular period each month or a product that causes periods to stop occurring while using it, the majority preferred a regular monthly period (89.3% overall), with a small minority preferring a product that causes amenorrhea (7.0%).

HCPs

Qualitative: Overall, HCPs thought that women would largely prefer to have regular periods, although some thought that some women would accept amenorrhea; very few thought that it would be preferred. While the preference for periods was largely consistent across countries, this view was expressed by proportionally more respondents in Senegal, followed by Zimbabwe and Bangladesh. In Zimbabwe, multiple HCPs stated that women believed that periods cleanse the body of bad blood or dirt, a view which was expressed by only one HCP in each of the other countries. A significant reason given for women wanting regular periods was that they provide reassurance that one is not pregnant; HCPs also expressed the view that women

TABLE 13 Unscheduled bleeding patterns experienced by the end user respondents while using a contraceptive.

	Total ($n = 1,663$) (%)	BGD ($n = 582$) (%)	SEN ($n = 511$) (%)	ZWE ($n = 570$) (%)
Bleeding occurring less frequently than once a month	32.1	43.3 ^b	24.7	26.1
Spotting in between periods	26.7	19.6 ^a	26.2	34.4 ^b
Bleeding occurring more frequently than once a month	23.6	22.2	18.6	29.6 ^b
Prolonged bleeding/bleeding for longer than usual	21.9	17.4	17.4	30.7 ^b
None of the above	42.6	41.2	47.0	40.0

Country names using Alpha-3 codes: Bangladesh (BGD), Senegal (SEN), and Zimbabwe (ZWE).

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

TABLE 14 Levels of concern felt by the end user participants due to experiencing unscheduled bleeding patterns while using a contraceptive.

	Total (n = 1,204) (%)	BGD (n = 396) (%)	SEN (n = 391) (%)	ZWE (n = 417) (%)
Spotting in between periods (n)	470	120	143	207
Very concerned (3)	41.3	55.0	15.4 ^a	51.2
Somewhat concerned (2)	29.6	31.7	37.1	23.2
Not at all concerned (1)	25.1	12.5	39.9 ^b	22.2
I don't remember	4.0	0.8	7.7	3.4
Mean	2.17	2.43	1.73 ^a	2.30
Prolonged bleeding/bleeding for longer than usual (n)	393	109	99	185
Very concerned (3)	65.1	59.6	52.5	75.1 ^b
Somewhat concerned (2)	17.3	22.9	23.2	10.8
Not at all concerned (1)	13.2	16.5	14.1	10.8
I don't remember	4.3	0.9	10.1	3.2
Mean	2.54	2.44	2.43	2.66 ^b
Bleeding occurring less frequently than once a month (n)	566	270	139	157
Very concerned (3)	37.8	38.1	27.3 ^a	46.5
Somewhat concerned (2)	31.8	40.0	33.8	15.9
Not at all concerned (1)	25.6	19.6 ^a	33.1	29.3
I don't remember	4.8	2.2	5.8	8.3
Mean	2.13	2.19	1.94 ^a	2.19
Bleeding occurring more frequently than once a month (n)	423	137	110	176
Very concerned (3)	61.0	58.4	40.0 ^a	76.1
Somewhat concerned (2)	19.1	25.5	28.2	8.5 ^a
Not at all concerned (1)	13.5	13.9	18.2	10.2
I don't remember	6.4	2.2	13.6	5.1
Mean	2.51	2.46	2.25 ^a	2.69
Period completely stopping (n)	550	134	222	194
Very concerned (3)	53.6	72.4 ^b	43.2	52.6
Somewhat concerned (2)	16.5	10.4	25.2 ^b	10.8
Not at all concerned (1)	23.8	15.7	23.4	29.9
I don't remember	6.0	1.5	8.1	6.7
Mean	2.32	2.58	2.22	2.24

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly lower than the two other countries.

^bSignificantly higher than the two other countries.

believed that periods showed that they were healthy, or that conversely, the absence of periods could mean either that they were sick or that the contraceptive was harming them in some way. Of the HCPs who stated that amenorrhea would be acceptable, or acceptable for some, the importance of education was highlighted; it was believed that amenorrhea could be accepted only if the women were made aware that it was a side effect of the contraceptive and was not harmful, and that some women accept this now with other contraceptives (this was particularly mentioned in Bangladesh). In Zimbabwe, expense was mentioned as a reason to prefer amenorrhea, given the cost of sanitary products.

Timing of monthly oral contraceptive administration

End users

Quantitative: The respondents were asked to state their preference regarding three options for when to take an MOC. Option 1: *You take the next capsule after 28 days each month (regardless of when you have your period)* (38.1%), option 2: *You take the next capsule once your period starts* (24.2%), and option

3: *You take the next capsule within 5 days of when your period starts each month* (24.6%). The respondents were also able to state whether they had no preference (13.0%).

Side effects and discontinuation

Qualitative: Perceived abnormality, both in terms of menstruation and from other side effects, was thought to be disruptive to the end users' lives in terms of peace of mind, relationships, time, and money. While overall women indicated a preference to experience non-disrupted periods, there was a general sense that they may be willing to trade disruption for an MOC's perceived benefits. Disrupted periods were considered better than amenorrhea, and lighter bleeding was typically not considered to be disruptive. Uncertainty was disruptive. Overall, the respondents across all three countries indicated that they would prefer predictability (a monthly period) and would discontinue if they experienced destabilizing side effects such as heavy bleeding.

Quantitative: A 5-point Likert scale was used, ranging from *Definitely would discontinue* to *Definitely would not discontinue*, to assess the likelihood of end users discontinuing MOC use if

they were to encounter a specified list of menstruation-related side effects. The respondents indicated whether the specified side effects would likely prompt discontinuation by selecting either option 1 (*Definitely would discontinue*) or 2 (*Probably would discontinue*). The side effects listed were heavy bleeding, increased menstrual pain above the normal level, irregular periods, missing a period, shorter but regular periods, and lighter periods.

Heavy bleeding was the side effect that prompted the highest stated likelihood to discontinue (73.5%). Increased menstrual pain had a moderately high potential to prompt discontinuation (61.7%). Irregular periods and missing a period were indicated as somewhat likely to prompt discontinuation (59.3% and 55.0%, respectively).

In terms of side effects that would be less likely to prompt discontinuation, shorter but regular periods (29.1%) and lighter periods were indicated (34.3%).

HCPs

Qualitative: Across all three countries, HCPs specified that bleeding-related side effects as a whole were the main reason for contraceptive discontinuation. Nausea/vomiting was the second most given reason, again across all three countries; other frequently mentioned reasons were weight gain, headache, and, by a moderate number of HCPs, negative impact on libido.

Quantitative: While HCPs were not specifically asked about reasons for discontinuation, they were asked how frequently women express concerns about a specified list of aspects of contraceptives, including the following bleeding-related side effects: *Causing episodic bleeding or spotting*, *Causing missed menses*, *Causing amenorrhea*, and *Causing prolonged bleeding*. All of these were indicated by over half, and in many cases over 70% of the respondents, as being raised either very or somewhat frequently (Table 15).

Access

Qualitative: The end users indicated a general preference for obtaining the MOC at a healthcare facility (including family planning clinics) or pharmacy/medicine seller (particularly in Bangladesh) and taking it at home. There were country differences in challenges accessing healthcare facilities. In Bangladesh, long working hours and busy lives caused time limitations on visiting facilities. In Senegal, transport costs were mentioned. In the rural areas of Zimbabwe, irregular income due

to seasonal variation, such as selling a tobacco harvest or livestock, led to a need to plan when to purchase items, as well as to factor in the high travel and time costs involved in visiting facilities.

Quantitative: The most popular access locations (from a pre-provided list) for end users to access an MOC were a clinic/family planning clinic (34.0%) and the pharmacy/medicine seller (33.0%). In terms of where respondents would like to take the MOC, most respondents selected at home (59.2%), followed by a health clinic/family planning clinic (20.0%) and the doctor's office (5.8%).

Likelihood to try

End users

Qualitative: Across all three countries, the end user respondents in the qualitative part of the study demonstrated a high level of interest in trying the MOC. Reasons for this included convenience because of reduced pill burden, discretion, and perceived affordability benefits related to reduced financial and time commitments surrounding travel to healthcare facilities.

Quantitative: The end users were asked to provide usage intent regarding the MOC, having learned about it from an HCP and if it were available to them, on a 5-point Likert scale, ranging from *Definitely do not want to use* to *Definitely want to use*. Intent to use was defined as having selected option 4 or 5, T2B. The majority of the end users showed intent to use (83.0%).

HCPs

Qualitative: HCPs were asked whether they would recommend the MOC, whether they would recommend it to a particular patient group, and whether there were any patients for whom they would not recommend it. The vast majority of HCPs indicated they would recommend it, for similar reasons as those the end users outlined regarding their willingness to try: increased convenience and a perceived reduction in forgetting to take the pill. There were no identifiable patient groups for whom it was felt to be particularly suitable, with HCPs across all three countries stating that its appeal would be broad or specifying varied ranges of groups. In terms of patients for whom it would not be recommended, this was governed by the typical precautions regarding the risks of combined hormonal contraceptives in relation to medical conditions such as hypertension, or circumstances such as being over the age of 35 and a smoker.

TABLE 15 Menstrual side effects which women were reported to express concern about either very frequently or frequently by the HCP respondents.

Top 2 Box scores, 4 + 5 out of 5	Total (n = 631) (%)	BGD (n = 212) (%)	SEN (n = 213) (%)	ZWE (n = 206) (%)
Causing episodic bleeding or spotting	77.7	76.9	76.1	80.1
Causing missed menses	76.1	71.7	85.9 ^a	70.4
Causing amenorrhea (no bleeding at all)	61.6	55.7	76.1 ^a	52.9
Causing prolonged bleeding	65.5	67.0	53.5 ^b	76.2

Country names using Alpha-3 codes: BGD, Bangladesh; SEN, Senegal; ZWE, Zimbabwe.

^aSignificantly higher than the two other countries.

^bSignificantly lower than the two other countries.

Quantitative: The end users were asked to evaluate the appeal of an MOC on a 5-point Likert scale, ranging from *Very unappealing* to *Very appealing*. The majority of the end users perceived the MOC to be either somewhat or very appealing (86.5%).

HCPs were also asked about the likelihood of them providing the MOC to premenopausal women on a 5-point Likert scale. The majority of HCPs reported a high likelihood to provide an MOC (*Would definitely provide* or *Likely to provide*, 78.4%).

Multipurpose prevention technology (MPT)—combined protection from HIV and unintended pregnancy

End users

Qualitative: The end users were asked about their views on combining contraceptive protection with HIV prevention within the MOC capsule. Across all three countries, the views on this idea were generally positive, on the grounds that it would provide important protection and that it would have the benefit of having two functions within one product. The respondents specified a variety of women for whom they felt this would be suitable, including those who were not able to trust their partner's fidelity and sex workers. Potential stigma was noted as a downside in Zimbabwe, in that respondents felt that male partners may feel that their female partner is HIV positive, is being unfaithful to them, or implying that they are unfaithful.

Quantitative: The end users were asked whether a dual-prevention product such as an MOC providing protection against both pregnancy and HIV would be of interest, to which nearly all answered *Yes* (94.4%).

HCPs

Qualitative: The HCPs were asked about combining contraceptive protection with both HIV prevention and antiretroviral therapy (ART). The views were mixed but positive overall. The reasons for thinking that dual prevention was a good idea and would be appealing to women included the idea of one medication with two functions, discretion, and a reduction in HIV incident cases. The reasons for negative opinions included the view that the MOC should only be for one purpose and that it could cause confusion, and that it could be seen as promoting unprotected sexual intercourse. Some HCPs thought it would be useful for sex workers and other at-risk populations. In terms of combining pregnancy prevention with HIV treatment, the views were mainly positive, with a strong indication that there would be high demand for this. Pill burden was highlighted here, with HCPs feeling that monthly pills would be better than daily. In terms of country differences, in Senegal, there was more discussion of HIV as taboo, and a small minority of HCPs in Senegal were not aware of the current existence of preventative drugs for HIV; some felt that the combination of the two types of protection was not necessary. The views in Bangladesh were generally positive, with HCPs confident that there would be demand for such a product. In Senegal and Zimbabwe, challenges in dispensing were highlighted with regard to

combining contraceptive protection with antiretroviral (ARV) treatment, as patients may not wish to reveal their HIV status.

Quantitative: The HCPs were asked whether they would be interested in providing or recommending a dual-prevention product such as an MOC providing protection against both pregnancy and HIV, to which virtually all answered *Yes* (94.3%).

Discussion

This paper describes user perceptions of an MOC in Bangladesh, Senegal, and Zimbabwe with a focus on preferred product attributes, appropriate messaging, and the value proposition, to inform further product development and the eventual introduction and promotion of this contraception method. An MOC has broad and high appeal for the women and HCPs in our study given its duration, familiar form, predictable monthly menstruation, discretion, convenience, and acceptable side effects. Overall, an MOC has higher appeal among study participants from Bangladesh than Senegal or Zimbabwe with a lower proportion of participants from Senegal favoring key attributes such as duration and pill size and expressing willingness to try an MOC. This may be due to the lower overall use of OCPs in Senegal than in Bangladesh or Zimbabwe and could reflect a preference for longer-acting methods such as implants. These findings confirm our hypothesis that countries with high OCP use are strong candidates for the initial introduction of an MOC as end user preferences align with the developed CTPP and support the value proposition of the method, i.e., its convenient duration, ease of use, discretion, and favorable side effect profile.

Over 60% of the participants in our study reported current use of a daily OCP and it was the most reported method ever used among the participants overall. A daily OCP offers benefits to women and adolescents as it is user-controlled, discreet, affordable, and can be accessed at many locations. Despite high current use of the OCP, approximately one-third of study participants had used the OCP in the past but discontinued. The reasons driving their discontinuation of the OCP were inconvenience (daily pill burden and the travel associated with it), difficulty remembering to take the pill every day, and the side effects experienced such as headache. These responses align with other studies that have found the reasons for the discontinuation of daily OCPs being linked to accessing and using the pills correctly (31) and dissatisfaction due to side effects (32).

Our study examined end user and HCP preferences for different attributes of the MOC including duration of pregnancy protection, capsule size, predictability of menstruation, timing of administration, side effects, and access. The once-a-month duration was the most appealing attribute for end users and HCPs alike because it is easy to use and remember, removing the need for daily administration and lending itself to higher typical use efficacy rates than daily OCPs (6–10). The monthly duration was also the primary reason for the study participants expressing an interest in learning more about and trying the MOC, which aligns with what participants stated as the most important

feature of any contraceptive: being easy to remember to take or renew.

Our study confirms that the proposed MOC capsule size was acceptable and was perceived as very or somewhat easy to swallow. Furthermore, the study confirms that taking the pill every 28 days, or approximately every 1 month, was the preferred option regardless of when a woman's period starts. The study participants were confident in being able to remember a monthly dosing schedule and a monthly withdrawal bleed could serve as a reminder to take the next dose. Preferences regarding these product attributes were aligned across the three countries.

The women's feedback on the MOC stressed the importance of minimizing side effects, especially unpredictable ones that may interfere with their daily lives. Nearly 90% of women in our study indicated that they want monthly menstruation for reasons including it being healthy or normal, cleansing the body, and as an assurance that a woman is not pregnant. The women in our study from Bangladesh were more likely to discontinue the MOC due to bleeding changes than the women from Senegal and Zimbabwe where there were more women who would accept certain bleeding changes. For example, less than half of the study participants from Zimbabwe were likely to discontinue the MOC if it caused irregular periods, a missed period, shorter periods, or lighter periods. This may be due to greater use and experience with hormonal methods that result in bleeding changes in Senegal and Zimbabwe than in Bangladesh. Unanimously, the women indicated that other changes in bleeding patterns such as heavy bleeding, skipping or irregular menstruation, amenorrhea, or increased pain would prompt discontinuation of the MOC. These findings support that one of the main benefits of the MOC is having a regular withdrawal bleed, which contributes to greater continuation, and aligns with what is known about women's dislike and discontinuation of existing contraceptive methods (3–5).

The HCPs raised additional questions about the MOC that will be important to explore as the method is further developed and clinical studies are undertaken. The HCPs wanted to know more about the product's safety and efficacy including interactions between the MOC and other medications. In Senegal, the HCPs expressed concern about what to do if a client found the side effects intolerable and could not discontinue the method, and, in Zimbabwe, the HCPs were concerned about safety linked to overdosing or for cardiovascular disease. The HCPs were also concerned that the MOC could displace condom use and protection against sexually transmitted infections (STIs), particularly among those using condoms for contraception. The HCPs indicated that women who are interested in the MOC will want to know its effectiveness, side effects including amenorrhea, and their return to natural fertility after use. When planning the introduction of the MOC, it will be important to design and test appropriate messaging and information on the MOC. This will include how it is used, possible side effects, the importance of condom use to protect against STIs, and contraindications for HCPs and the women themselves.

An MOC has great potential for wide availability and self-use, alleviating the time and resources required from end users to access contraception and HCPs to provide family planning. Preferences

regarding where to access the MOC vary by geography. The study participants from Bangladesh were split in their preference for the pharmacy/drug shop/medicine seller and health/family planning clinics. The participants from Senegal and Zimbabwe preferred a healthcare facility or clinic. Women primarily want to take the pill in the privacy of their own homes. Upon the initial introduction of the MOC, it is important to have broad availability to increase awareness and ensure women have the knowledge, skills, and confidence to use it on their own in the future.

Additional research

Conducting this study early in the development of the MOC is important to align the design with end user preferences and maximize the potential for uptake once the product is available. More qualitative research would help uncover gaps in understanding the reasons driving certain preferences such as why women would prefer to access the product from a healthcare provider or facility and what drives that motivation, or, in the case of Senegal, why there was a lower percentage of women interested in the MOC compared to the other two countries and what underlies their concerns or hesitancy. Other areas to test with users include instructions for use and packaging appeal as the MOC is further developed. Developing and testing messaging to the end users and appropriate counseling messaging for HCPs will be important, particularly regarding questions related to product safety and side effects.

It is important to conduct actual use studies to understand the user's perspective on side effects and their impact on uptake and continuation. The study participants disliked changes in their menstrual bleeding, but also other side effects such as weight gain and headaches. However, the extent to which these would influence uptake and continuation is unknown.

Product launch planning will be important as the MOC is developed. Data on acceptable pricing for procurers and end users are important, as well as segmentation and demand forecasting to support decision-making on funding and manufacturing needs. Demand forecasts should also take into consideration all current contraceptive options on the market to understand possible shifts in the use of other methods when the MOC is introduced. Furthermore, research to inform countries' policies that impact the accessibility and availability of the method, particularly regarding private sector pharmacy or drug shop access, may be necessary.

Limitations

This study explores end user preferences for and HCP perspectives on a novel monthly contraceptive but has limitations. The study was designed to understand the stated preferences for the MOC and did not explore the preferences for the MOC vs. other methods. Many women in our study were current users of OCPs, which could cause significant shifts in demand from OCPs to the MOC, resulting in a limited impact in reducing unintended pregnancies. Understanding continuation rates with the actual use

of the MOC will be important to better define its potential impact in meeting women's needs for family planning.

We do not recommend drawing broad conclusions across and between different country populations. The qualitative portion of the study is indicative in nature, and further, qualitative samples often fluctuate as not all questions are asked or answered. The scope of our research did not include data for a segmentation, a forecast, or modeling of product pricing or price sensitivity evaluation.

Conclusion

The results from our study demonstrate that the MOC has high and broad appeal in all three countries. Feedback from the end users and HCPs was consistent across the countries for the various product attributes with only some differences. Product developers can use this information to modify and improve the final MOC design. There were some concerns among the study participants and HCPs regarding the potential for unpredictable side effects such as bleeding changes or, from the HCPs, regarding product safety and possible contraindications. The overall high appeal of the MOC was based on its value proposition for important contraceptive needs including convenient duration, ease of use, discretion, and acceptable side effects. Future clinical research on a hormonal MOC should include an exploration of women's tolerance and acceptability of the side effects, particularly regarding bleeding, to validate its value proposition.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Bangladesh Medical Research Council (BMRC) in Bangladesh (Registration Number 367 13 12 2020); Comité Nationale d'Ethique pour la Recherche en Santé (CNERS) in Senegal (Protocol SEN 19/82); Medical Research Council of Zimbabwe (MRCZ) in Zimbabwe (Reference MRCZ/A/2553). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MouE-S: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Methodology, Project administration, Resources, Supervision, Visualization, Writing – original draft, Writing – review & editing. RE: Formal Analysis, Project

administration, Writing – original draft, Writing – review & editing. MonE-S: Writing – review & editing. JL: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing. TS: Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that they all work for private companies: Routes2Results and Trisha Wood Santos Consulting, LLC. TW was employed by Trisha Wood Santos Consulting, LLC.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fgwh.2024.1433189/full#supplementary-material>

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Corrigendum: Social and behavioral research with end-users and healthcare providers into understanding perceptions of and reactions to a monthly oral contraceptive capsule in Bangladesh, Senegal and Zimbabwe

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Error in the Article Title

In the published article, there was an error in the article title. Instead of “Understanding the perceptions and reactions to a monthly oral contraceptive capsule with end users and healthcare providers in Bangladesh, Senegal, and Zimbabwe”, it should be “Social and behavioral research with end-users and healthcare providers into understanding perceptions of and reactions to a monthly oral contraceptive capsule in Bangladesh, Senegal and Zimbabwe”.

Error in Author List

In the published article, there was an error in the order of the author list. The corrected author list appears below.

Moushira El-Sahn
Rose Elliott
Trisha Wood Santos
Mona El-Sahn
Jeff Lucas

The authors apologize for this error and state that this does not change the scientific conclusions of the article in any way. The original article has been updated.

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Using the PEBIC criteria to assess the quality of responses provided during a Family Planning radio program

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Introduction: Radio remains a dominant source of information, in Sub-Saharan Africa, with 75% of the population relying on it. In Nigeria, radio reaches over 70% of citizens and stands as a vital tool for behavior change. Tailoring radio programs to address needs and cultural contexts of communities has proved essential for building trust and influencing behavioral change. Traditional evaluation of radio interactive programs focus on listener engagement metrics but overlooks the evaluation of the quality of the resource person's responses to the caller's questions. This study aimed to assess the quality of information delivered by resource persons during the interactive segments of a Family Planning (FP) radio program using a criteria.

Methods: A qualitative analysis was conducted on caller questions and resource person responses from FP radio programs in three Nigerian states. A customized ranking system based on "Presentation," "Empathy," "Provider's Bias elimination," "Information correctness," and "Context Specificity" (PEBIC) was used by FP experts to assess the resource person's response quality. The scores for the responses were segmented and categorized into low, moderate and high quality using the mean, and standard deviation then analyzed using SPSS version 20.

Results: For the technical segment of the radio program, while individually assessing each item on the criteria, the quality of responses was high, with an average of 91.2%. For the entertainment education segment of the radio program, while individually assessing each item on the criteria, the quality of responses with empathy was low (28%), however, the quality of responses for other criteria was high, with an average of 79.8%. Furthermore, in the overall quality of response for the technical segment, the responses given by the resource persons were of high quality (81%) while those of the entertainment education segment were of moderate quality (58%).

Conclusion: The radio program excelled in delivering technical information but fell short in fostering adequate empathy during the entertainment education segment. Additional training for resource persons to hone their skills in embedding their message delivery in an empathetic frame thus strengthening the emotive connection with the audience is key. This could significantly improve the program's overall impact.

KEYWORDS

Hormonal IUDs, contraception, radio programming, SBCC, PEBIC criteria, Family Planning (FP)

Introduction

Radio, emerging in the late 19th century, evolved from telegraphy into a global broadcasting tool, with Marconi's 1901 transmission and Fessenden's 1906 broadcast marking key milestones (1, 2). Despite the advancements in digital technology and telecommunication, radio remains highly influential, particularly in Sub-Saharan Africa, where 75% of the population relies on it as their primary source of information (3, 4). Nigeria serves as a prime example, where radio programming holds immense potential, reaching over 70% of the population and serving as a powerful tool for promoting health-related behavioral change across diverse demographics (5, 6).

The cost-effectiveness, extensive reach, and ability to penetrate remote regions with limited internet connectivity make radio indispensable for driving societal transformations, including influencing health-related behaviors (7). Moreover, its capability to transcend geographical and linguistic barriers allows radio broadcasts to effectively engage audiences across Nigeria's 36 states and 774 local government areas providing a distinct advantage, particularly in rural areas with limited internet access (8).

Radio allows for a more intimate relationship with listeners than other media since the human voice in familiar languages can elicit emotions, develop trust, and drive action (9). Listeners often cultivate parasocial relationships with radio personalities, enhancing their receptivity to messages and calls to action (10, 11). This phenomenon can be particularly potent in delivering health messages, as recent research indicates that audio narratives, including radio dramas, are effective tools for promoting positive health behaviors, such as those associated with Family Planning (FP) (12, 13). Family Planning radio programs play a crucial role in disseminating information and promoting awareness about reproductive health and FP choices (14). These programs cater to diverse audiences, often in remote areas with limited access to other information sources. Tailoring radio programming to meet the individual needs and cultural idiosyncrasies of Nigerian communities builds trust and increases the possibility of engaging with listeners, favorably affecting their behavior (12).

The use of resource persons on information dissemination on radio program

Traditionally, assessments of radio programs including those focused on FP have primarily concentrated on audience engagement metrics like listenership and call-in rates. While these metrics offer valuable insights, they do not directly evaluate the quality of the resource person's responses to the caller's questions (15).

Resource persons are essential in radio programs that have interactive segments, specifically programs with opportunities for listeners to ask questions in real time through calls or text messages (16). This gives room for information dissemination, providing expertise, credibility, and diverse perspectives that enhance content quality and impact. Experts such as academics, researchers, and professionals offer specialized knowledge and engage listeners with engaging delivery, ensuring accuracy and comprehension (17). Their

credibility fosters trust and encourages audience engagement, particularly when addressing complex or controversial topics. Including resource persons from various backgrounds enriches discussions, offering multiple viewpoints and insights into real-world experiences (18). Effective utilization involves careful selection based on relevant expertise and strong communication skills, thorough preparation, and facilitation of engaging dialogue, as exemplified in a public health radio program addressing sanitation and hygiene practices with contributions from a medical doctor, sanitation engineer, and community leader (19).

This paper proposes a novel approach to assessing FP radio programs by focusing on the quality of responses from the resource person. By shifting the focus from audience response to the program's content and quality of delivery, evaluating the resource person's responses is of paramount importance for several reasons. This unique approach offers valuable insights by identifying areas for program improvement, highlighting where the resource person can enhance their responses to better engage and inform the audience. Moreover, it contributes to the dissemination of accurate and reliable information on FP through the program, ensuring quality information reaches the audience. Additionally, by encouraging the development of communication skills specific to FP radio shows, this approach promotes more engaging and impactful programs.

Get it Right radio program

The "Get it Right" radio magazine program was a 30-minute live program that included an interactive phone-in segment. The program was broadcast in English, Pidgin, Yoruba, and Hausa, which are the predominant languages of the project states. The program's format was kept simple to emphasize the content and the phone-in segment. Additionally, radio jingles that promote FP and amplify the testimonials of a male whose partner uses FP were played. These radio jingles were aired at least three times a week and twice during the radio program.

The magazine program was divided into two segments and contained 20 episodes in total. It combined basic information on FP with lifestyle approaches. The first eleven episodes (segment one- technical) focused on technical FP topics, while the last 9 episodes (segment two- entertainment education) were designed using an entertainment education format that chronicled the journey of a Hormonal Intra-Uterine Device (H-IUD) user.

Segment one covered modern FP and Childbirth Spacing (CBS) methods in Nigeria, exploring the benefits of FP, who can use it, and the importance of communication between couples. It also dived into specific methods like the H-IUD, addressing myths and misconceptions surrounding it, the role of religion, culture, healthcare workers, and the overall impact of FP/CBS on health.

Segment two outlined a more persuasive strategy to promote H-IUD as a FP method infusing the story of a satisfied HIUD user into the contents of the radio program to inform potential users and listeners about the benefits and accessibility of H-IUDs.

Six radio stations were selected to air the "Get it Right" radio program from the 17th of July to the 15th of December 2023, across the project states. In Delta state, Trend FM and Crown FM were

chosen, while Parrot FM, Splash FM, and Gravity FM were selected for Oyo state, and Plateau Radio and Television corporation (PRTV) Peace FM was included for Plateau state. The selection was based on considerations of regional reach, diverse audience demographics, and the need to accommodate language and cultural sensitivities. Each station was chosen to explore urban-rural distinctions, religious impacts, and unique media environments within their respective states. This meticulous approach allowed for targeted interventions to address distinct FP challenges and dispel prevalent misconceptions. A team comprising experienced On-Air Personalities (OAPs) and Resource persons were identified across the states to deliver the content of the episodes. The OAPs were selected based on their extensive experience in FP programs, while the resource persons are State FP Coordinators who have been trained and have relevant experience in the subject matter.

Objective of study

To assess the quality of responses provided by resource persons to callers' questions during the radio program.

Methodology

Study design

The assessment was a cross-sectional study which utilized a qualitative approach to gather and assess questions asked by callers and responses given by resource persons during an FP radio program.

Study area

The assessment was done on calls and responses from the "upgrade your life" FP radio programs on stations in Delta, Oyo, and Plateau states.

Sample size estimation:

The estimated sample size for the study was calculated as:

$$n = \frac{(Z_{1-\alpha/2})^2 P(1-P)}{d^2}$$

n is the sample size

- $Z_{1-\alpha/2}$ is standard normal varied alpha level (5%) = 1.96
- P is the expected proportion of radio listenership in Nigeria = 77% (20).
- d is precision set at 5% (0.05)
- 10% non-response rate

$$n = \frac{(Z_{1-\alpha/2})^2 P(1-P)}{d^2}$$

$$n = \frac{(1.96)^2 \times 0.77(1-0.77)}{(0.05)^2}$$

$$n = \frac{3.84 \times 0.77 \times 0.23}{0.0025} = 272$$

$$\begin{aligned} \text{Calculating the 10\% non-response} &= 10\% \text{ of } 272 \\ &= 10/100 \times 272 \\ &= 27 \end{aligned}$$

The calculated sample size needed for the study = 299.

Data collection/extraction

Qualitative data was gathered through the transcript from the audio recordings of calls from callers on the FP radio program. A total of 723 callers' questions and responses from the resource persons were identified throughout the life span of the radio program (for a period of six months). All were purposively included in the study.

Resource persons response ranking

A customized ranking sheet (checklist) was developed to rate the resource person's responses to questions asked by the callers. This was developed based on a set of criteria to guide the rating of the responses given and later validated with evidence derived from literature.

These criteria are "Presentation", "Empathy", "provider's Bias elimination", "Information correctness", and "Context Specificity". Each criterion was categorized as good or bad through a "0" or "1" point. Zero stands for bad and one stands for good. If a response had all the criteria correct, it would be assigned a total of "5 points" or scored according to the set of criteria that was marked correct.

Family Planning experts read through each response using the World Health Organization (WHO) Frequently Asked Questions (FAQ) "Your Contraception guide" (21, 22) and their prior experience of over ten (10) years in FP programming to ascertain if the resource persons conveyed the right information using the criteria developed that is: presenting their thoughts well and demonstrating empathy. The Family Planning experts also ascertained if there were any elements of provider bias in the response and whether the contents of the responses provided were specific to the context of the questions asked. The items on the criteria are defined below:

Presentation:

This refers to the way the resource person delivers their response. As outlined by Ekholm et al. (23), the answer should be clear, and concise, and avoid irrelevant details. It should demonstrate a strong understanding of the subject matter and be well-organized with a logical flow of thought.

Empathy:

This criterion focuses on the resource person's ability to connect with the caller on an emotional level. As suggested by Houtepen et al. (24), it involves understanding the caller's emotions and responding with sympathy and respect. The resource person should use language appropriate to the caller's level of understanding.

Bias Elimination:

This ensures responses are objective and avoids promoting personal opinions or the provider's own biases. Kreuter et al. (25) emphasize the importance of distinguishing personal views from information. The resource person should present a balanced perspective to allow the audience to form their own conclusions.

Information Correctness:

This criterion ensures the accuracy of the information provided. The Family Planning experts verified the information against the WHO FP FAQs and ensured responses avoided subjective statements, unconfirmed information, or irrelevant tangents (21).

Context Specificity:

This assesses if the resource person directly addresses the caller's specific question. As highlighted by Myers et al. (26), generic responses or information not relevant to the topic should be avoided. The resource person should demonstrate expertise in the specific context area and provide insights that directly connect to the caller's query and context.

Data analysis

Family Planning experts were engaged to rate the quality of resource persons' responses to questions asked during the radio program based on the PEBIC criteria. The engagement and quality of the responses on the radio program were assessed also bearing the standards stipulated in the radio program design documents, communication strategy and the "your contraception guide" on frequently asked questions and definitions of FP practices in mind. This analysis generated a score for each of the items on the criteria and the ranked scores were analyzed using SPSS version 20.

Ranked scores summation and categorization

Using the Mean (M) and Standard Deviation (SD) of the summed scores for each response. Resource person's responses with scores less than or equal to the Mean—SD were classified as "Low quality", scores between the Mean—SD and Mean + SD were classified as "Moderate quality" and responses with scores greater or equal to the M + SD were classified as "High quality".

Quality assurance

Each episode of the radio program was recorded. A full transcript of the 30 min radio program was done of the questions asked by callers and the resource person's responses were extracted. A procedure for applying the PEBIC criteria was deployed and strictly followed. The criteria for selecting the FP experts that reviewed the responses of the resource persons was

developed. After an FP expert reviews the resource person's responses, the same responses are given to a different FP expert to validate, and the reviews are compared to ensure accuracy. A checklist that consists of the PEBIC criteria was also developed to ensure seamless ranking.

Results

Radio listeners' engagement with the Get it Right radio program

Distribution of questions from callers

The "Get it Right" radio program had a lot of engagement from the listeners. The radio program recorded 1,048 call attempts across the radio stations of which 723 calls were received while 325 calls were either dropped or missed due to high call traffic and poor network reception respectively. The Figure 1 below shows the distribution of calls and messages received during the radio program.

Quality of the resource persons' responses

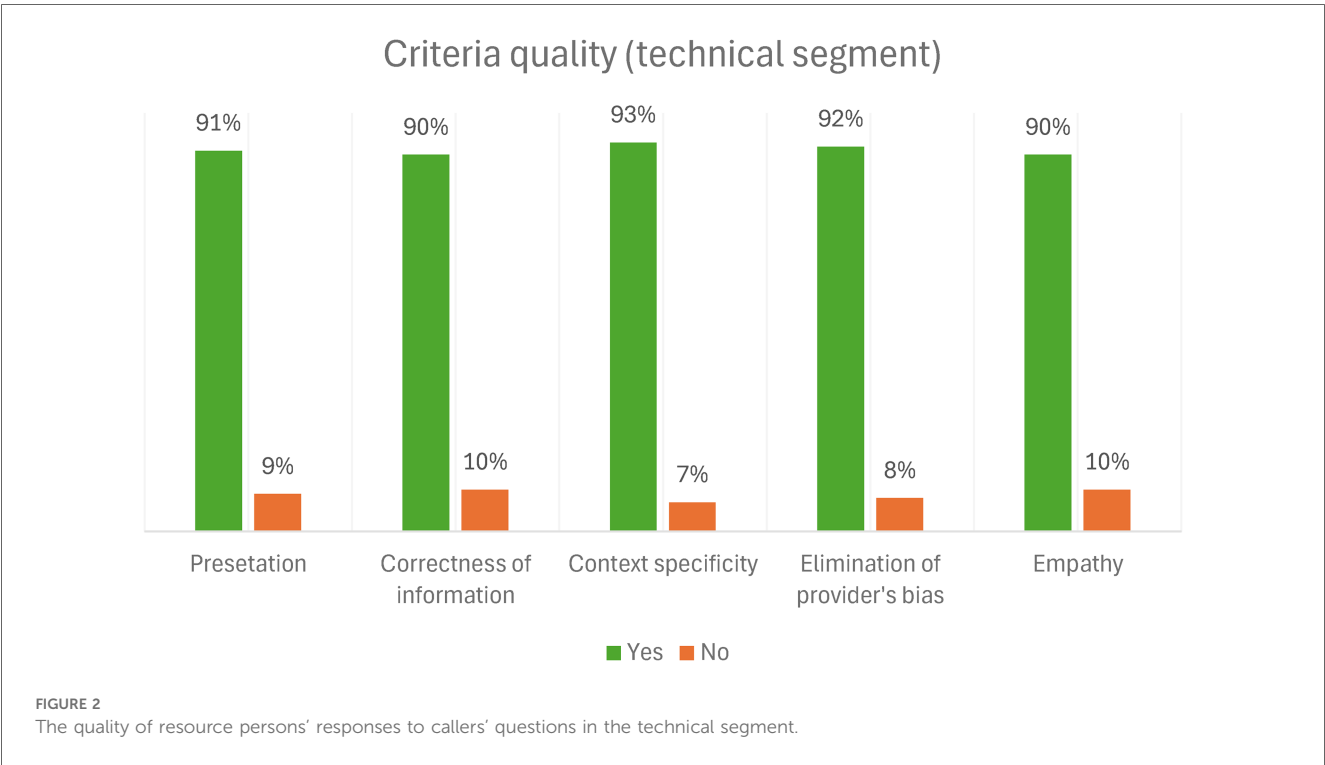
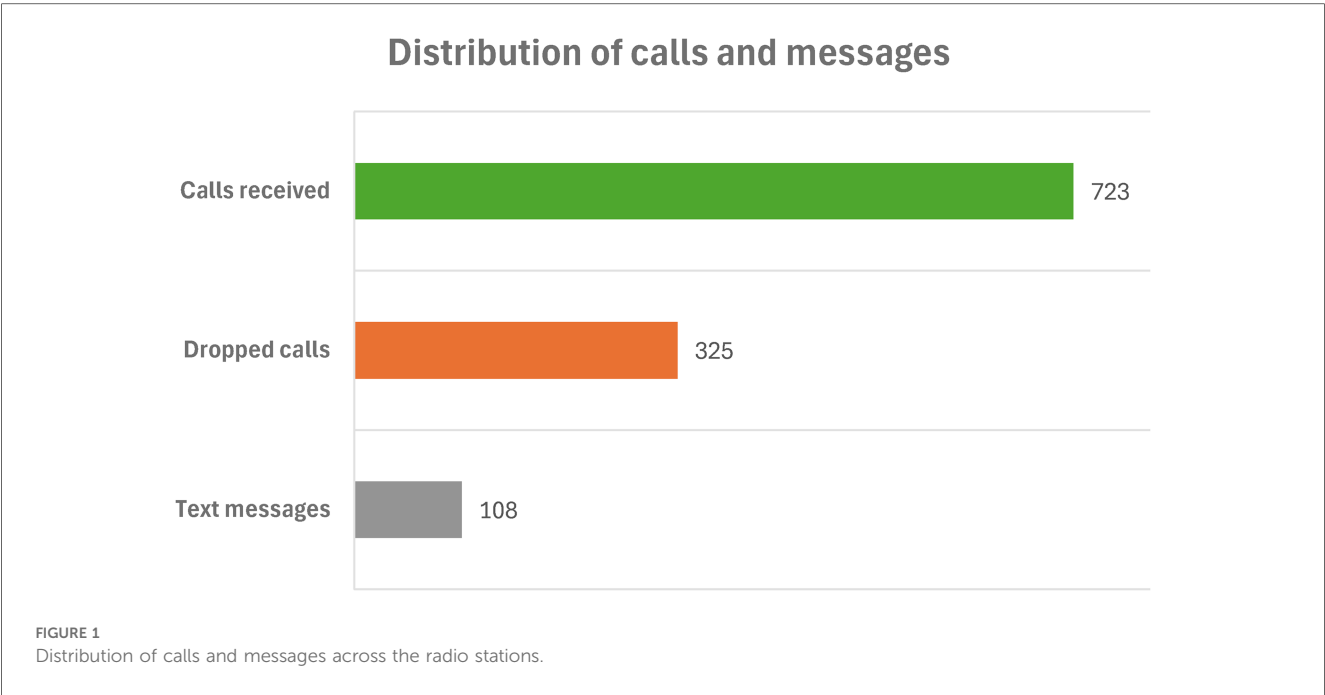
The quality of the responses delivered by the resource persons during the project's radio program was tested by ranking the responses based on the PEBIC criteria. The responses were ranked using "0" for an incorrect response (No) and "1" for a correct response (Yes). The quality of the response was assessed in two ways: (a) Assessing each of the items that form the criteria individually and (b) Assessing all the criteria together (overall).

When assessing each item individually, for the technical segment of the radio program, the quality of responses for the criteria was high, with an average of 91.2%. When assessing each item individually for the entertainment education segment, the quality of responses with empathy was low (25%). However, the quality of responses for other criteria was high, with an average of 79.8%. Figures 2, 3 below show the criteria for the technical and entertainment education segment and their associated percentages of the radio program.

When assessing all the criteria together, the overall quality of the responses for the technical and entertainment education segments was derived by summing all the scores for the responses of the individual items (on the criteria) in each segment and categorizing them into low, moderate, and high quality using the mean and standard deviation.

For the overall technical segment, the results show that the responses given by the Resource persons were of high quality. Figure 4 below shows the level of quality of the overall response for the technical segment.

For the entertainment education segment, the results showed that most of the responses given by the resource persons were of moderate quality (57%). Figure 5 below shows the level of quality of the overall response for entertainment education.

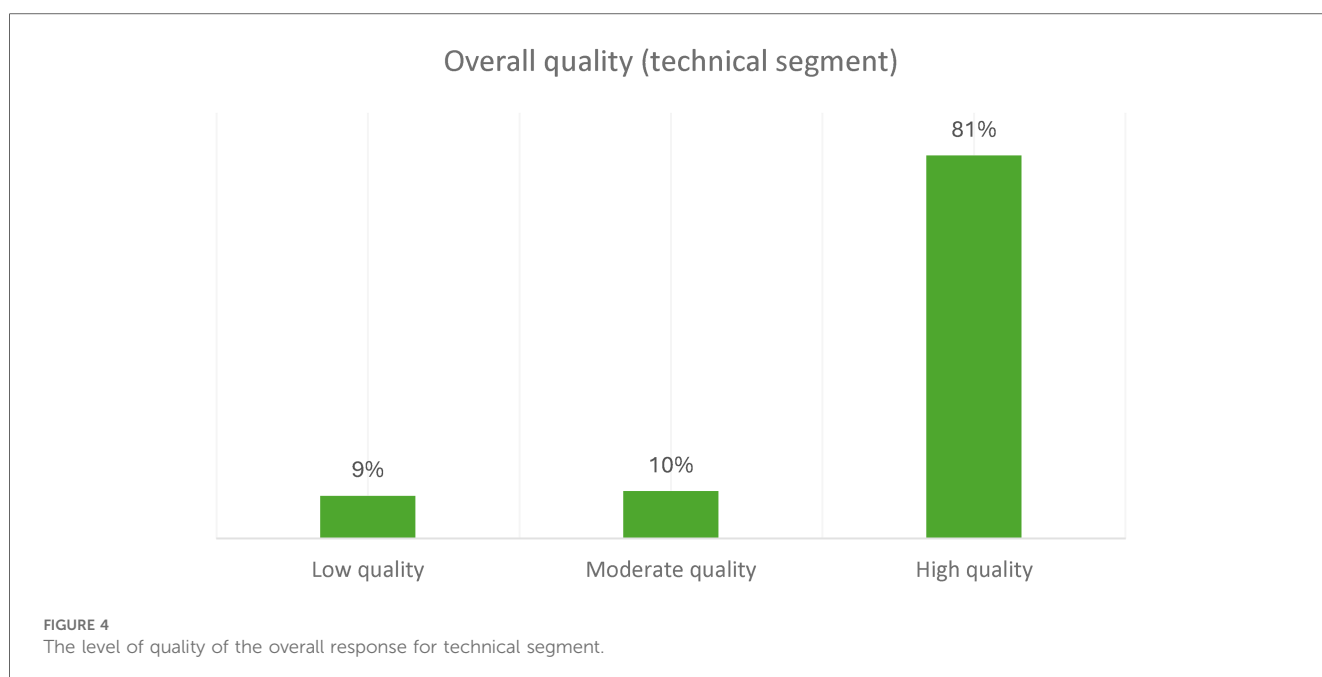
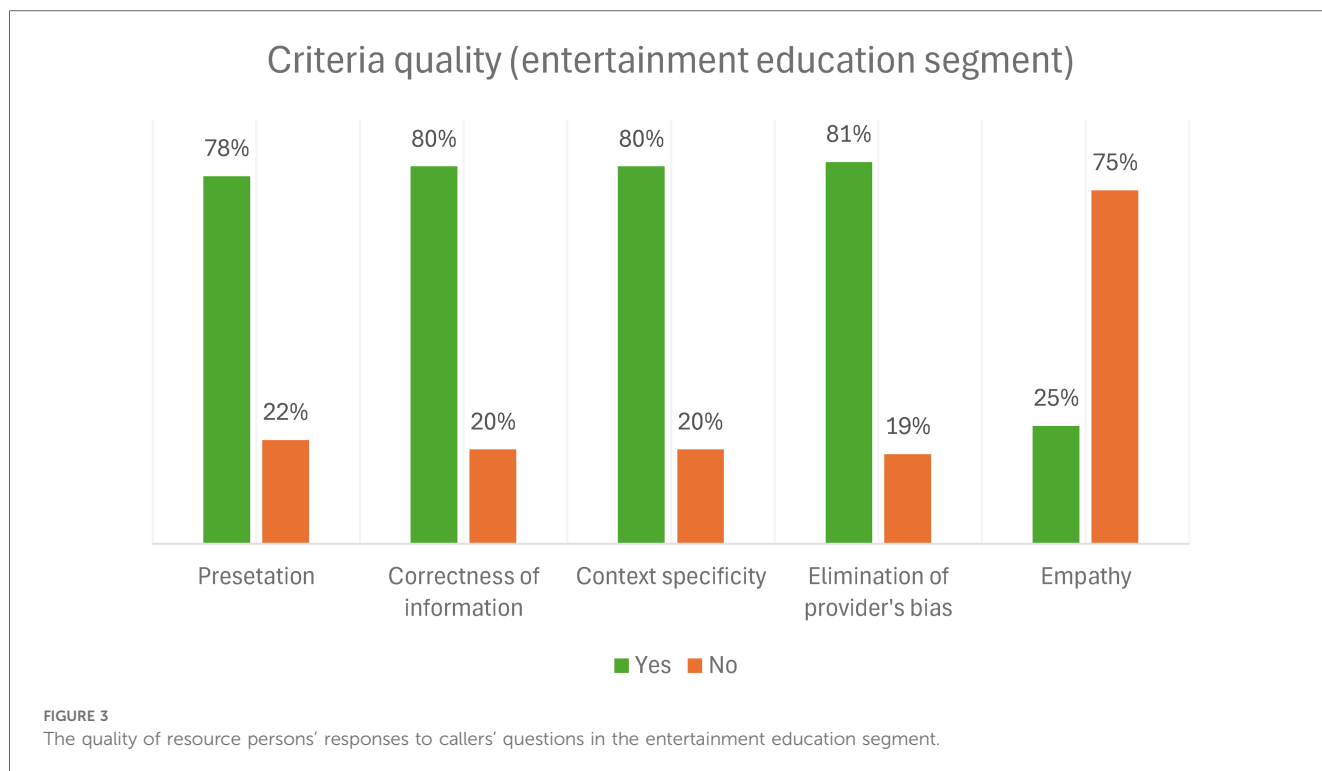


Discussion

The assessment of resource persons' responses to caller questions utilized a comprehensive ranking using the PEBIC criteria to provide valuable insights into the effectiveness of the Get it right radio program. In the technical segment, resource persons exhibited high responses with effective delivery of clear and accurate technical information which aligns with best

practices in evaluating health communication interventions highlighted by (27), affirming the Get it right radio program's efficacy in equipping participants with the requisite knowledge and skills to communicate factual details in a manner that connects with the audience.

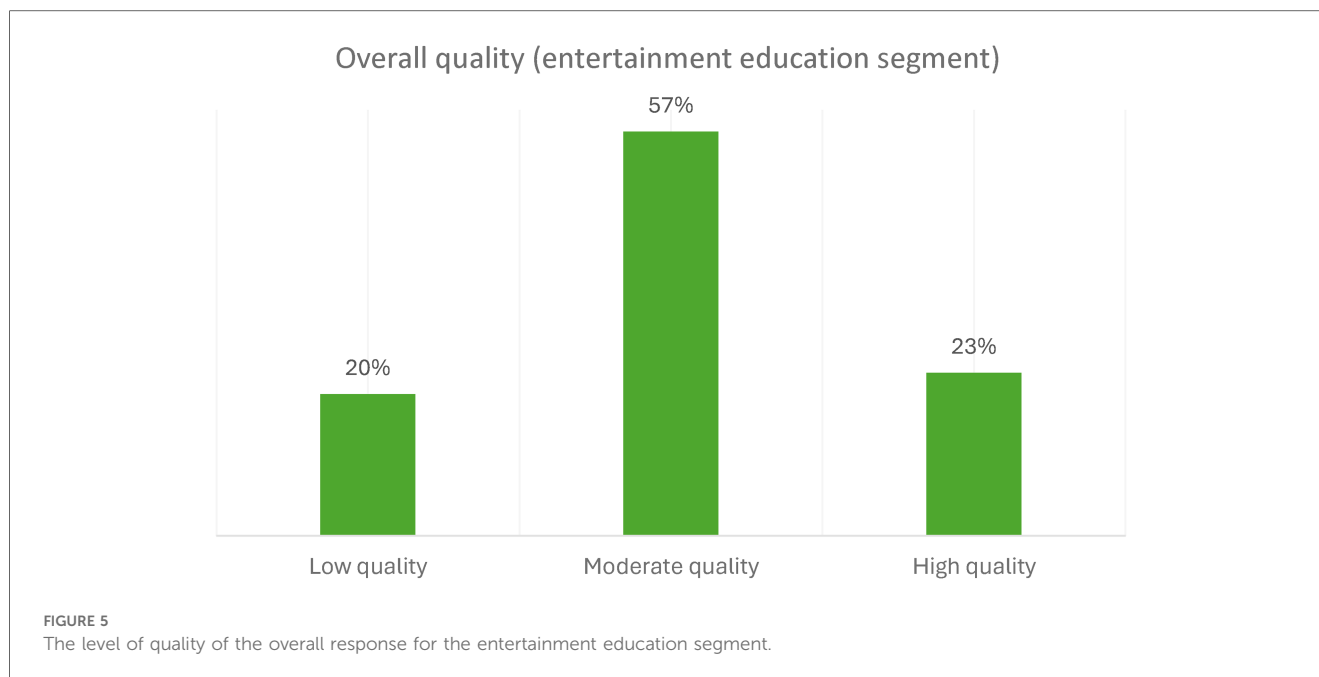
Different studies have utilized various criteria to assess resource person responses to caller questions. Some studies emphasize technical aspects such as response accuracy and completeness (23),



while others prioritize caller-centered communication skills such as active listening and open-ended questioning (28). Myers et al. (26) delved into explaining how cultural competency is in ensuring information resonates with diverse audiences.

Although Resource persons demonstrated proficiency in aspects such as presentation style, context specificity, information correctness, and bias elimination, their capacity to cultivate empathy with the audience was noticeably lacking. Nurturing

empathy during communication, as underscored by Houtepen et al. (24), emphasizes the critical role of empathy in health communication for fostering trust and catalyzing behavior change. Empathy serves as a bridge that connects individuals emotionally, fostering a deeper understanding and resonance with the message being conveyed (29). In the context of health communication, empathetic engagement can empower individuals to embrace positive health behaviors and make



informed decisions regarding their well-being (30). Thus, enhancing empathy in resource persons' interactions can significantly amplify the impact of health communication initiatives, ultimately leading to improved health outcomes and societal well-being (31).

Our assessment was a holistic evaluation approach, which considers both technical proficiency and audience engagement. While the accurate delivery of information remains paramount, neglecting the emotive connection fostered by empathy could impede behavior change. By integrating empathy alongside established criteria, this study offers a more comprehensive assessment of Resource person effectiveness, particularly within the entertainment education format.

Fortunately, several techniques can bridge the empathy gap and enhance the effectiveness of entertainment education segments. Mohseni-Moghadam et al. (32) advocate for incorporating storytelling, active listening, and acknowledging listener concerns as fundamental strategies for fostering adequate empathy in health communication. Future research could explore the specific impact of these techniques on empathy scores within entertainment education settings.

By addressing the identified empathy gap and conducting further research, we can refine capacity building formats to equip resource persons with a comprehensive skill set for effective health communication, with an emphasis on delivering technical information in an empathetic manner, ultimately facilitating positive behavior change within the target audience.

Conclusion

The implemented multi-criterion ranking system proved effective in evaluating the resource persons' response quality. This assessment

evaluated the quality of a radio program resource persons' responses using the PEBIC criteria (Presentation, Empathy, Bias elimination, Information correctness, Context Specificity) across two segments: technical and entertainment education.

The findings demonstrate a difference in the quality of responses between the segments based on empathy. The technical segment achieved a high average score across all PEBIC criteria, indicating clear, unbiased, and accurate presentations. However, the entertainment education segment, while maintaining high quality in other criteria, showed a weakness in empathy.

Furthermore, the overall quality assessment confirmed this disparity. The technical segment achieved a high-quality rating, whereas the entertainment education segment fell within the moderate quality range.

In conclusion, the radio program excelled in delivering technical information but fell short in promoting sufficient empathy during the entertainment education segment. Additional capacity building for resource persons on incorporating audience connection and emotional understanding within the entertainment format could significantly improve interactive radio program's overall impact.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Author contributions

BF: Conceptualization, Funding acquisition, Project administration, Resources, Supervision, Writing – original draft,

Writing – review & editing. AbA: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. TA: Data curation, Formal Analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. CU: Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. AU-N: Project administration, Writing – review & editing. BT: Project administration, Writing – review & editing. AdA: Project administration, Writing – review & editing.

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Dual contraceptive use among women living with HIV on anti-retroviral therapy in Boset district, Ethiopia

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Background: The World Health Organization advocates dual contraceptive methods for women with Human Immunodeficiency Virus (HIV) to prevent unintended pregnancies and sexually transmitted infections (STIs), enhancing education, economic opportunities, and maternal-child health outcomes. However, persistent global challenges stem from inadequate use of dual contraceptives and unsafe sexual practices, resulting in high rates of unintended pregnancies and significant health risks. Hence, this study aimed to assess dual contraceptive use among women living with HIV on anti-retroviral therapy (ART) in Boset District, Ethiopia.

Method: A facility-based cross-sectional study was conducted among 342 women living with HIV from September 12 to October 18, 2023. Participants were selected by systematic random sampling, and data were collected using an interviewer-administered structured questionnaire. The collected data were entered using Epi Info version 7.2.6 and analyzed using SPSS version 26.0. Bivariable and multivariable binary logistic regression analyses were performed to assess the association between the outcome and explanatory variables. In the multivariable analysis, an adjusted odds ratio (AOR) with a 95% confidence interval (CI) was used to show the strength of the association, and the level of significance was set at a *p*-value of <0.05.

Results: The magnitude of dual contraceptive use was 33.7% (95% CI: 28–40). Urban residence (AOR = 2.5; 95% CI: 1.97–8.08), good knowledge about dual contraceptives (AOR = 3.8; 95% CI: 2.36–8.67), STIs history in the past 12 months (AOR = 2.6, 95% CI: 1.25–4.72) and having two or more number of sexual partners, (AOR = 1.9; 95% CI: 1.18–6.68), were factors significantly associated with dual contraceptive use.

Conclusion: One-third of women living with HIV on ART utilized dual contraceptives. Place of residence, knowledge about dual contraceptives, history of STIs in the past 12 months, and number of sexual partners were factors associated with dual contraceptive use. It is essential to implement focused educational programs to increase knowledge about dual contraceptives, alongside expanding access to contraceptive services in rural and underserved areas.

KEYWORDS

antiretroviral therapy, dual contraceptives use, women living with HIV, Ethiopia, Boset district

1 Introduction

Dual contraceptive utilization involves using a barrier contraceptive to lower the risk of transmitting sexually transmitted infections (STIs) alongside another effective birth control method to prevent unplanned pregnancies (1, 2). The World Health Organization (WHO) advocates for women living with HIV (WLHIV) to employ dual contraceptive methods to prevent unintended pregnancies and STIs (3). Rising rates of STIs are more common in women with HIV than in those without HIV (4). Studies show that unintended pregnancy often happens when individuals engage in sexual intercourse without using contraception, use contraception improperly, or face contraceptive failure despite using it correctly (5).

For women and girls with HIV, using dual contraceptives correctly and consistently leads to better education and economic opportunities, helping to achieve gender equality, empower women, and reduce poverty. It also improves infant and child health by preventing illness and death from unintended pregnancies and STIs, including HIV. This allows for safer, planned pregnancies, benefiting both maternal and child health (6, 7).

Poor utilization of dual contraceptives not only increases the incidence of unplanned pregnancies but also contributes to the spread of HIV/AIDS and other STIs (2, 8). Globally, inadequate use of dual contraceptives and unsafe sexual practices result in over 2 million HIV-infected women becoming pregnant annually, leading to over half a million deaths from pregnancy-related complications (3, 9). Women living with the Human Immunodeficiency Virus often experience unintended pregnancies because women either use ineffective birth control, inadequate education, sexual violence, contraceptive failure, or lack access to family planning services (10). Evidence also suggests that a majority of unintended pregnancies result in unsafe abortion (2).

Studies conducted in different settings indicated that the prevalence of dual contraceptive utilization among WLHIV was 10.7% in Swiss (11), 29.6% in Thailand (3), 27% in Atlanta Georgia (12), 27% in Brazil (13), 32% in Nigeria (14), 33.3% in Cameroon (15), 38.5% in Kenya (16) and 40% in Rwanda (17).

In Ethiopia, the pooled prevalence of dual contraception use among WLHIV was 34.08% (18). The highest proportion of dual contraceptive methods was reported in Bishoftu town which accounts for 56.9% (19). Other studies have found that the prevalence of dual contraceptive utilization among WLHIV was 13.2% in the University of Gondar Hospital (20), 15.7% in Mekelle town (21) 19.4% in Borana district (22), 19.8% in Gebretsadik Shawo Hospital (23), 21.4% in West Shewa Zone (24), 30% in Gimbie town (25).

Previous studies have indicated that factors such as age, marital status, place of residence, educational status, occupational status,

having children, fertility desire, counseling on family planning, family support, discussion with a partner, number of sexual partners, disclosure of HIV status, Clusters of differentiation (CD4) cell count were significantly associated with dual contraceptive method utilization (2, 23, 26–28).

Despite several studies on dual contraceptive use among WLHIV in Ethiopia, there remains a limited body of evidence specific to the study setting. Given the regional and contextual differences in healthcare access, contraceptive utilization, and socio-cultural factors, this may limit the direct generalizability of previous findings. Therefore, this study aimed to provide valuable insights by examining the magnitude and factors associated with dual contraceptive use among WLHIV on antiretroviral therapy in Boset District, Ethiopia. The findings will contribute to locally tailored interventions to prevent unintended pregnancies and the transmission of STIs/HIV. Furthermore, the results will bolster planning and decision-making capacities, facilitating collaborative efforts with relevant stakeholders to identify and implement effective solutions to address these issues in the study setting.

2 Methods and material

2.1 Study design, area, and period

A facility-based cross-sectional study was conducted in the Boset district, central Ethiopia, from September 12 to October 18, 2023. The Boset district is bounded by the Amhara Regional State to the north, Adama Woreda to the west, the Arsi Zone to the south, and Fentale Woreda to the east. The district is comprised of 5 urban and 37 rural kebeles, situated approximately 125 km from Addis Ababa, the capital of Ethiopia. It has a total population of 220,362, of which 112,385 are females (29). The district's healthcare infrastructure includes one hospital, seven health centers, and 30 private clinics. However, only three public health facilities (two health centers and one hospital) provide HIV care and treatment services. A total of 1,610 women were registered as receiving antiretroviral therapy (ART), of whom 764 were women of reproductive age: 206 at Olenchite Hospital, 454 at Olenchite Health Center, and 104 at Bole Health Center.

2.2 Study population, and eligibility criteria

All WLHIV who were on ART follow-up in Boset district public health facilities were the source population, while all randomly selected WLHIV who were receiving ART during the study period constituted the study population. The study included women of reproductive age attending ART care services who had attended at least one visit before the study commenced. However, women who were critically ill, unable to communicate, or experiencing mental health issues were excluded. Additionally, women with medical conditions contraindicating the use of contraceptives or other conditions identified based on WHO medical eligibility criteria were excluded to ensure the

Abbreviations

AIDS, acquired immunodeficiency syndrome; AOR, adjusted odds ratio; ART, antiretroviral therapy; CD4, cluster of differentiation; CI, confidence interval; COR, crude odds Ratio; HIV, human immunodeficiency virus; STIs, sexually transmitted diseases; WLHIV, women living with human immunodeficiency virus.

appropriateness and safety of contraceptive use among participants.

2.3 Sample size determination and sampling procedure

A single population proportion formula was used to calculate the sample size with an assumption of 28.8% of the population proportion of dual method of contraceptive use (p) from a previous study done in Gonder City (30), 95% confidence level, 5% margin of error and a 10% non-response rate.

$$n = \frac{(z\alpha/2)^2 p(1-p)}{d^2}$$

Where; n : Sample size; Z : Confidence coefficient; d : Margin of error (0.05); P : estimation of dual method of contraceptive use rate.

$$n = \frac{0.288(1 - 0.288)(1.96)^2}{0.05^2} \approx 315$$

After adding 10% contingency for non-response the final sample size of the study becomes 347.

The study included all three public health facilities providing HIV care and treatment services in the Boset district. The calculated sample size was proportionally allocated to each of these facilities based on the average number of women on ART in the previous three months. Study participants were selected from each

chosen health facility using systematic random sampling. The sampling interval at each facility was determined by dividing the average number of women on ART over the previous three months by the required sample size. Thus, the calculated k -value becomes two. The index participant was then chosen at random from 1 to 2 in each hospital. Accordingly, every second participant was chosen using a systematic random sampling technique until the required sample size was reached (Figure 1).

Before data collection, eligibility criteria were established to determine the eligibility of WLHIV attending the ART clinic for participation. Once eligible participants were identified, they were assigned sequential numbers based on their arrival order. Participants were then selected at regular intervals (K). To prevent multiple enrollments of the same person, a mark was placed on their medical record.

2.4 Study variables

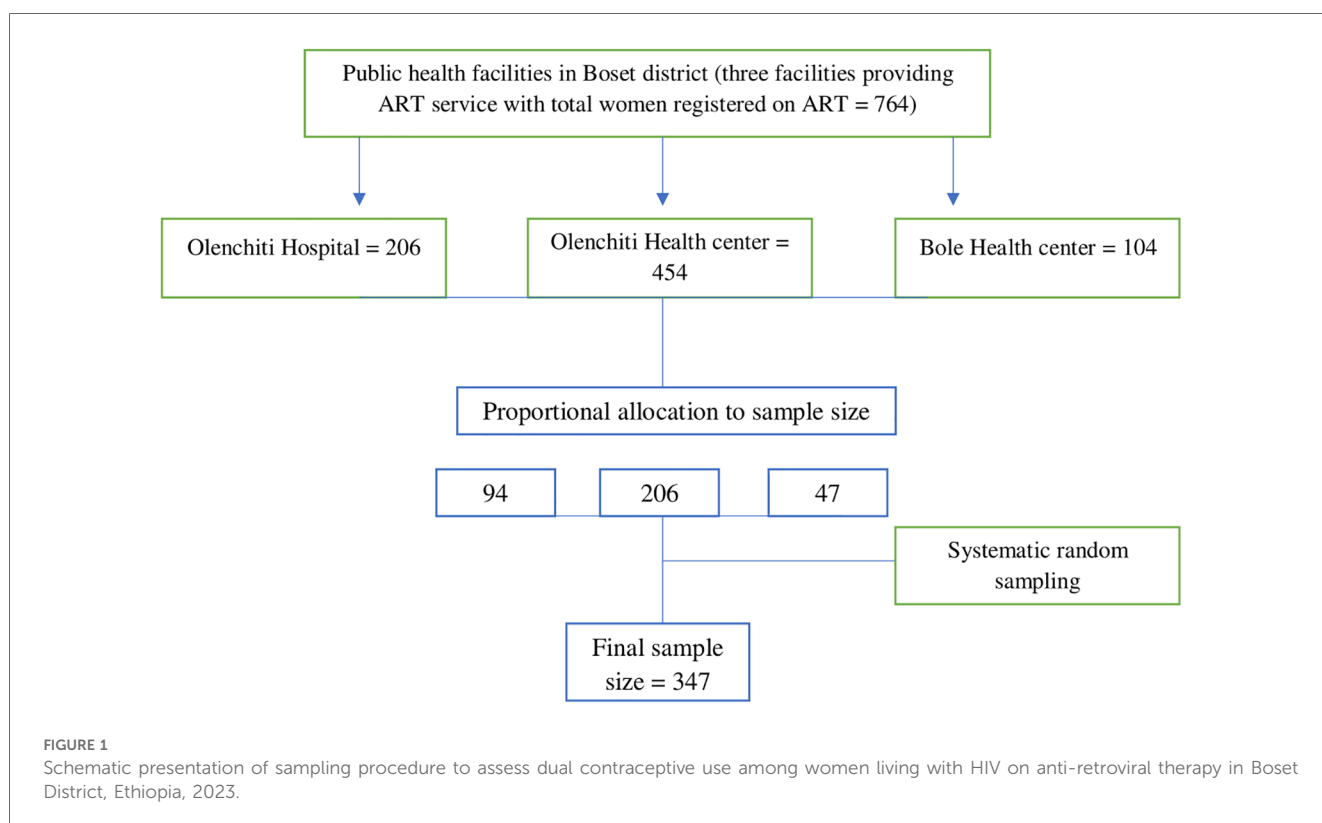
Dependent variable

Dual contraceptive use (yes/no).

Independent variables:

Socio-demographic factors: age, place of residence, religion marital status, ethnicity, Women's educational status, spouse educational status, women occupation. Spouse occupation, and average monthly income.

Sexual and reproductive health characteristics: number of children, women's desire to have more children, partner's desire to have more children, ever used any contraceptive method since



being HIV-positive, pregnancy since HIV positive, and knowledge about dual contraceptives.

Clinical and HIV-related characteristics: STI history in the past 12 months, number of sexual partners, knowing the HIV status of the partner, disclosed HIV status to partner, perceived disclosure of HIV status to a sexual partner is important, Duration on ART, current CD4 cell count, and Current viral load.

2.5 Operational definitions

Dual contraceptive utilization: The concurrent use of two methods of contraception during sexual encounters in the 12 months preceding the study: a barrier method (male/female condom) and other highly effective modern contraceptive methods (such as the IUCD, contraceptive implants, injections, and pills) (19, 27, 30, 31).

Knowledge of dual contraceptives: In this study, the aggregate of eight dichotomized questions assessed knowledge about contraceptive methods. A score of 0 indicated an incorrect answer, while a score of 1 indicated a correct answer. Women who scored at or above the mean were classified as having good knowledge, while those scoring below the mean were classified as having poor knowledge (27).

2.6 Data collection procedure and quality control

Data were collected using a pretested, structured, interviewer-administered questionnaire and medical record review. The questionnaires were adapted from various relevant literature with necessary modifications tailored to the specific context of the study (2, 16, 19, 24, 27, 30, 32). A data abstraction format was used to gather the required information from patients' records. A team of six trained midwives conducted the data collection, while two public health officers served as supervisors during the process.

Data were collected using a pretested, self-structured, interviewer-administered questionnaire and medical record review. The questionnaire was adapted from various relevant literature with necessary modifications tailored to the specific context of the study (2, 16, 19, 24, 27, 30, 32). A data abstraction format was used to gather the required information from patients' records. A team of six trained midwives conducted the data collection, while two public health officers served as supervisors during the process. The questionnaire has been included as [Supplementary Material](#) for reference.

The questionnaire was first written in English, then translated into Afan Oromo, and finally back into English to check for consistency. To ensure the questionnaire and data collection methods matched the study's objectives, a pre-test was conducted with 5% of the total patient sample. Data collectors and supervisors were trained for two days on research ethics, data collection tools, and procedures to ensure high-quality data. During the data collection phase, ongoing supervision of data collectors occurred, and regular meetings were held involving data collectors, supervisors, and investigators. Participants were interviewed in private places to ensure their privacy and confidentiality as well as

to encourage participation. Before data entry, collected data underwent review and checks to ensure completeness.

2.7 Data processing and statistical analysis

Following the coding and inputting of data into Epi Info version 7.2.6, the data were exported to the Statistical Package for Social Sciences (SPSS) version 26 for cleaning and analysis. Descriptive statistics including frequency, percentage, mean, and standard deviation were used to present key characteristics of the study population. The association between independent variables and dual contraceptive use was modeled using binary logistic regression analysis. In the bivariable logistic regression model, a significance level of 0.25 was set as a threshold to select variables for multivariable logistic regression analysis, aiming to control for confounding effects. The existence of multicollinearity among explanatory variables was assessed using the variance inflation factor (VIF). In this study, the mean VIF was 1.3, indicating that there was no multicollinearity. The model was fitted using the standard model-building approach. Hosmer and Lemeshow's goodness-of-fit test was used to assess the model's fitness. The diagnostic result indicated the model fit the data well ($p = 0.86$). In the multivariable logistic regression analysis, the adjusted odds ratio (AOR) with a 95% confidence interval (CI) was utilized to determine predictors of dual contraceptive use. At this level, variables with a p -value less than 0.05 were deemed statistically significant.

3 Result

3.1 Socio-demographic characteristics

Among the 347 sampled respondents, 342 completed the interview, yielding a response rate of 98.6%. The mean age of the participants was 33.52 (± 5.16) years. One hundred five (30.7%) of the participants were in the age group of 30-34, and the majority, 212 (62%) were urban residents. About 33.6% of women were able to read and write, and 156 (45.6%) were housewives ([Table 1](#)).

3.2 Sexual and reproductive health characteristics

In this study, 159 respondents (46.5%) reported having 1-2 children, while approximately two-thirds of the participants (217, 63.5%) expressed a desire to have more children. Among the respondents, 216 individuals (63.2%) had used some form of contraception since testing positive for HIV. Additionally, 173 participants (51.0%) demonstrated good knowledge of dual contraceptive methods ([Table 2](#)).

3.3 Clinical and HIV-related characteristics

Out of all participants, only 53 (15.5%) reported having a history of other STIs in the past year, and the majority, 299

TABLE 1 Socio-demographic characteristics of women living with HIV receiving anti-retroviral therapy at public health facilities in boset district, Ethiopia, 2023 (*n* = 342).

Variables	Categories	Frequency	Percentage
Age	15–24	27	7.9
	25–29	73	21.3
	30–34	105	30.7
	35–39	95	27.8
	40–49	42	12.3
Place of residence	Urban	212	62.0
	Rural	130	38.0
Religion	Orthodox	152	44.4
	Protestant	99	28.9
	Muslim	73	21.4
	Others*	18	5.3
Marital status	Married	241	70.5
	Single	44	12.9
	Divorced	32	9.3
	Separated	25	7.3
Ethnicity	Oromo	262	76.6
	Amhara	49	14.3
	Gurage	20	5.9
	Others**	11	3.2
Women Educational status	No formal education	70	20.5
	Read and write	115	33.6
	Primary	95	27.8
	Secondary	36	10.5
Spouse educational status (<i>N</i> = 298)	College and above	26	7.6
	No formal education	40	13.4
	Read and write	45	15.1
	Primary	138	46.4
	Secondary	46	15.4
Women occupation	College and above	29	9.7
	Housewife	156	45.6
	Daily laborer	79	23.1
	Merchant	59	17.3
	Government employee	23	6.7
Spouse occupation (<i>n</i> = 298)	Others***	25	7.3
	Farmer	171	57.4
	Daily laborer	53	17.8
	Merchant	51	17.1
	Government employee	15	5.0
Average monthly income	Others****	8	2.7
	≤1,000 Ethiopian birr	141	41.2
	>1,000 Ethiopian birr	201	58.8

*Catholic, Wakefata, **Tigre, Wolaita, Silte, ***Student, Housemaid, Waitress, Female sex workers, ****non-governmental employee, driver, unemployed/jobless.

(87.4%), had single sexual partners. About 221 (74.2%) disclosed their HIV status to their partner (Table 3).

3.4 Dual contraceptive use

The utilization of dual contraceptives among women living with HIV who are receiving antiretroviral therapy at public health facilities in the Boset district was found to be 33.7% (95% CI: 28–40). Among those who used dual contraceptives, the majority used condoms plus implants (54.9%), followed by condoms plus injectables (20.7%).

TABLE 2 Sexual and reproductive health-related characteristics of women living with HIV receiving anti-retroviral therapy at public health facilities in boset district, Ethiopia, 2023 (*n* = 342).

Variables	Categories	Frequency	Percentage
Number of children	0	49	14.3
	1–2	159	46.5
	3–4	105	30.7
	≥5	29	8.5
Women's desire to have more children	No	125	36.5
	Yes	217	63.5
Partner desire to have more children (<i>N</i> = 298)	No	101	33.9
	Yes	197	66.1
Ever used any contraceptive method since being HIV-positive	No	126	36.8
	Yes	216	63.2
Pregnancy since HIV positive	No	204	59.6
	Yes	138	40.4
Knowledge about dual contraceptive	Poor	169	49.0
	Good	173	51.0

TABLE 3 Clinical and HIV related characteristics among women living with HIV receiving anti-retroviral therapy at public health facilities in boset district, Ethiopia, 2023(*n* = 342).

Variables	Categories	Frequency	Percentage
STI history in the past 12 months	No	289	84.5
	Yes	53	15.5
Number of sexual partners	1	299	87.4
	≥2	43	12.6
Know the HIV status of the partner (<i>n</i> = 298)	No	117	39.3
	Yes	181	60.7
Partner's HIV status (<i>n</i> = 181)	Positive	107	59.1
	Negative	74	40.9
Disclosed HIV status to partner (<i>n</i> = 298)	No	77	25.8
	Yes	221	74.2
Reason for not disclosing (<i>n</i> = 77)	Fear of divorce	57	74.0
	Fear of violence by a partner	47	61.0
	Fear of stigma and discrimination	17	22.1
Perceived disclosure of HIV status to a sexual partner is important	No	82	24.0
	Yes	260	76.0
Duration on ART (years)	≤5	189	55.3
	>5	153	44.7
Current CD4 cell count	<250	79	23.1
	250–349	71	20.8
	≥350	192	56.1
Current viral load	Suppressed	323	94.5
	Low viremia	10	2.9
	high viral load	9	2.6

CD4, clusters of differentiation 4; HIV, human immunodeficiency virus; STI, sexually transmitted infections.

3.5 Factors associated with dual contraceptive use

Place of residence, women's desire to have more children, knowledge about dual contraceptives, STI history in the past 12 months, number of sexual partners, perceived disclosure of HIV to a sexual partner, and current CD4 cell count were the variables that fulfilled the criteria $P < 0.25$ and transferred to

TABLE 4 Factors associated with dual contraceptive utilization among women living with HIV receiving anti-retroviral therapy at public health facilities in boset district, Ethiopia, 2023.

Variables	Categories	Dual contraceptive use		COR (95% CI)	AOR (95% CI)
		Yes (%)	No (%)		
Place of residence	Rural	30 (19.5)	100 (48.4)	1	1
	Urban	95 (80.5)	117 (51.6)	2.7 (2.01–7.27)*	2.5 (1.97–8.08)**
Women's desire to have more children	No	72 (47.4)	53 (27.9)	1	1
	Yes	80 (52.6)	137 (72.1)	0.4 (0.33–0.93)*	0.5 (0.52–1.35)
Knowledge about dual contraceptive	Poor	49 (30.6)	120 (65.9)	1	1
	Good	111 (69.4)	62 (34.1)	4.4 (2.51–8.14)*	3.8 (2.36–8.67)**
STI history in the past 12 months	No	94 (75.2)	195 (89.9)	1	1
	Yes	31 (24.8)	22 (10.1)	2.9 (2.17–7.19)*	2.6 (1.25–4.72)**
Number of sexual partners	1	83 (81.4)	216 (90.0)	1	1
	≥2	19 (18.6)	24 (10.0)	2.1 (1.22–5.31)*	1.9 (1.18–6.68)**
Perceived disclosure of HIV status to a sexual partner is important	No	40 (22.3)	42 (25.8)	1	1
	Yes	139 (77.7)	121 (74.2)	1.2 (1.01–4.81)*	0.99 (0.76– 3.21)
Current CD4 cell count	<250	34 (21.8)	45 (24.2)	1	1
	250–349	24 (15.4)	47 (25.3)	0.7 (0.24–0.93)*	0.4 (0.16–1.10)
	≥350	98 (62.8)	94 (50.5)	1.4 (0.48–1.83)	1.1 (0.33–1.69)

AOR, adjusted odds ratio; CI, confidence interval; CD4, Clusters of differentiation 4; COR, crude odds ratio; HIV, human immunodeficiency virus; STI, sexually transmitted infections.

*Significant at p -value <0.25 in unadjusted logistic regression analysis.

**Significant at p < 0.05 in adjusted logistic regression analysis, 1 = Reference.

multivariable analysis. After adjusting for confounding variables in the multivariable analysis, place of residence, knowledge about dual contraceptives, STI history in the past 12 months, and the number of sexual partners were found to be statistically significant factors associated with dual contraceptive utilization.

Accordingly, the odds of dual contraceptive use were 2.5 times greater among urban residents compared with rural residents (AOR = 2.5, 95% CI: 1.97–8.08). Compared to women with poor knowledge of dual contraceptives those with good knowledge of dual contraceptives had nearly 4-fold higher odds of dual contraceptive utilization (AOR = 3.8, 95% CI: 2.36–8.67). Women who had a history of STIs in the past 12 months had 2.6 times higher (AOR = 2.6, 95% CI: 1.25–4.72) odds of dual contraceptive use than their counterparts. Moreover, the odds of dual contraceptive utilization were about twice as high among women with two or more sexual partners compared to those with a single sexual partner (AOR = 1.9, 95% CI: 1.18–6.68) (Table 4).

4 Discussion

This study revealed that the magnitude of dual contraceptive use was 33.7% (95% CI: 28–40), knowledge about dual contraceptives, STI history in the past 12 months, and number of sexual partners, were factors significantly associated with dual contraceptive use.

The current study revealed that the magnitude of dual contraceptive use was 33.7% (95% CI: 28–40). This finding is comparable to results from studies conducted in Thailand (29.6%), India (30%) (33), South Africa (33%) (34), Bungoma City, Kenya (38.5%) (16), Wolaita Zone, Southern Ethiopia (28.6%) (27), Hossana Hospital, Ethiopia (28.3%) (35), Gondar

City, Northwest Ethiopia (28.8%) (30), Gimbie Town, Ethiopia (30%) (25), and Fitche Hospital, Ethiopia (32%) (26). However, it was higher than studies conducted in Switzerland (10.7%) (11), Zambia (17.7%), South Africa (6.8%), Mekelle, Ethiopia (15.7%) (21), Addis Ababa, Ethiopia (14.7%), West Showa Zone, Ethiopia (21.4%) (24), Gebretsadik Shawo Hospital, SNNPR, South West Ethiopia (19.8%) (23), Finote-Selam Hospital, Northwest Ethiopia (21.8%) (36), and Gondar Hospital, Ethiopia (13.2%) (20). The higher dual contraceptive use in this study compared to previous findings may be due to enhanced integration of family planning with HIV services, improved healthcare access, and increased awareness of dual protection. Differences in study periods, sample characteristics, and regional variations in contraceptive uptake could also explain the discrepancy.

Moreover, the use of dual contraceptives in this study was lower than in studies done in Brazil (72%) (37), Mumbai India (69%) (38), Bahirdar town, Ethiopia (64.2%) (28), and Bishoftu town, Ethiopia (56.9%) (19). This discrepancy may be attributed to variations in the sociodemographic and cultural characteristics of the study participants. Furthermore, inconsistencies between studies might arise from differences in sample size, study period, and the settings in which the studies were conducted.

Urban women had higher odds of using dual contraceptives compared to their rural counterparts. This finding is supported by studies conducted in Finote-Selam Hospital, Northwest Ethiopia (36), Hossana, Southern Ethiopia (32), Gondar City, Northwest Ethiopia (30), and West Showa Zone, Ethiopia (24). This could be attributed to disparities in access to information and contraceptive services. Urban residents have greater exposure to information and technologies related to contraceptives, which may facilitate their effective use. Furthermore, urban women are thought to have easier access to contraceptive methods (39).

Women with good knowledge of dual contraceptive methods had higher odds of using dual contraception compared to those with poor knowledge. This is in line with a study undertaken in Bungoma City, Kenya (16). Increased awareness and understanding of these methods likely empower women to make informed choices about their contraceptive practices, thereby enhancing their likelihood of use (40).

This study also revealed that the odds of dual contraceptive use were greater among women with a history of STI. This finding aligns with a study conducted in Wolaita zone, Southern Ethiopia (27). This may be attributed to increased risk awareness among women with a history of STIs, which motivates them to adopt dual contraceptive methods for comprehensive protection against both STIs and unintended pregnancies (41, 42).

Moreover, women who had multiple sexual partners had increased odds of using dual contraceptives compared to their counterparts. This finding is consistent with a study done in Hossana, Southern Ethiopia (32). This can be justified by the heightened awareness and perceived risk of STIs and unintended pregnancies among women with multiple partners. The need for additional protection against both STIs and pregnancy likely motivates these women to adopt dual contraceptive methods to ensure comprehensive protection (43). Conversely, findings from Finote-Selam Hospital, Northwest Ethiopia, showed that women with multiple sexual partners had lower odds of dual contraceptive utilization (36).

4.1 Implications for practice and policy

The findings of this study have important public health implications. The moderate level of dual contraceptive use indicates the need for intensified efforts to promote dual protection among WLHIV. Health education programs should emphasize the benefits of dual contraceptive use, particularly in rural areas, where access remains limited. Integrating reproductive health services with ART programs can enhance access to contraceptive counseling and increase uptake. Moreover, healthcare providers should leverage STI treatment visits as opportunities for reinforcing dual protection messages.

5 Limitations of the study

Being a cross-sectional study prevented the establishment of causal relationships between variables. Additionally, because it was conducted in health facilities, the findings may not apply to HIV-positive women outside the study area or those who do not access healthcare. The study also lacked qualitative data and did not include perspectives from sexual partners, limiting its depth. Furthermore, recall bias may have affected the accuracy of participants' reports on past contraceptive use or STI history. Social desirability bias could also be a concern, as some participants might have provided responses they deemed socially acceptable rather than truthful.

6 Conclusion

In this study, one-third of WLHIV on ART utilized dual contraceptives. Factors such as place of residence, knowledge about dual contraceptives, history of STIs in the past 12 months, and number of sexual partners were identified as statistically significant factors associated with dual contraceptive use. The findings suggest the need for targeted educational programs to enhance awareness and knowledge about dual contraceptives, especially in rural areas, and expanding access to contraceptive services in rural and underserved areas are crucial steps forward.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethical approval was obtained from the Institutional Ethical Review Board of Adama General Hospital Medical College. The study's proposal was formally presented to both the Oromia Regional Health Office and the Boset district Health Office to secure official approval for carrying out the study. The data was collected after getting official permission from the Boset district health office administration. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

YAB: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MS: Writing – original draft, Writing – review & editing. MNG: Conceptualization, Data curation, Writing – original draft, Writing – review & editing. MSG: Writing – original draft, Writing – review & editing. YMN: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fgwh.2025.1510299/full#supplementary-material>

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Immediate postpartum modern family planning utilization and associated factors among postpartum women in Gurage Zone, Southern Ethiopia 2022: community-based cross-sectional study

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Background: The period immediately following delivery is crucial for addressing the many requirements women have in terms of reproductive health, including the need for family planning after delivery and for lowering the risks associated with closely spaced pregnancies. However, contraception during the immediate postpartum period has not received enough attention in Ethiopia. Information on the use of modern family planning in the immediate postpartum period is also sparse in this study area. Therefore, the current study aimed to assess the level of immediate postpartum modern family planning utilization and associated factors among mothers who had given birth within the past twelve months in Gurage Zone, Southwest Ethiopia.

Methods: The present study was conducted from May 1 to July 1, 2022, involving 844 mothers who had given birth in the previous year in the Gurage Zone of Southern Ethiopia. A community-based cross-sectional study design was utilized, with participants selected through a multistage sampling method. Data collection was performed via face-to-face interviews using a structured questionnaire. After data entry, which was done using EpiData version 3.1, analysis was carried out using the Statistical Package for Social Science (SPSS) version 26. To investigate the relationships between dependent and independent variables, both binary and multivariable logistic regressions with 95% confidence intervals were applied. In the multivariable logistic regression analysis, variables with *P*-values below 5% were considered statistically significant.

Result: Altogether, a total of 836 postpartum women participated in the current study. The overall prevalence of immediate postpartum modern family planning utilization (IPFP) was (42.9%) with 95% CI (39.6–46.3%). Attending secondary school [AOR = 1.966(1.028–3.761)], postpartum women from wealthier families [AOR = 2.57 (95% CI: 1.44–4.58)], giving birth in health facility [AOR = 2.06 (95% CI: 1.26–3.38)], reporting higher women empowerment [AOR = 4.365 (2.436–7.824)], having favorable attitude [AOR = 2.65 (95% CI: 1.86–3.78)], getting counseling during ANC [AOR = 1.93 (95% CI: 1.36–2.76)] and immediate postpartum period [AOR = 2.51 (95% CI: 1.77–3.56)] were significant associated factors of IPFP utilization.

Conclusion: This study concluded that approximately two in five postpartum women utilized immediate postpartum family planning this study area. Socio-economic and informational factors significantly influence the adoption of these methods. To enhance the uptake of immediate postpartum family planning, it is essential to improve the quality of counseling provided during antenatal care visits and at the time of delivery, thereby empowering women with the knowledge needed for informed decision-making. Additionally, efforts to change attitudes toward immediate postpartum family planning through community education and awareness campaigns are vital for increasing acceptance and utilization of these services.

KEYWORDS

immediate postpartum, modern family planning, associated factors, Gurage Zone, Ethiopia

Introduction

Family planning (FP) is a vital aspect of maternal and child health, with immediate postpartum family planning (IPFP) playing a crucial role in enhancing the health and well-being of mothers and their children (1). The immediate postpartum period, defined as the first 48 h after childbirth, is a key time for initiating family planning methods, as women are particularly open to receiving counseling and starting contraception during this phase (2, 3). Adopting family planning during this time can significantly lower the risks of unintended pregnancies, maternal morbidity, and mortality. It also aids in improving birth spacing, which is essential for the health of both mothers and children (4, 5). Despite the evidence highlighting the advantages of postpartum family planning, over 120 million women worldwide require pregnancy prevention but are not using any form of family planning (6–8). In resource-limited settings, 222 million women did not have access to modern contraceptive methods within the first year after giving birth (9).

Unplanned pregnancies remain a major public health concern, especially in the year following a previous delivery (10). Such pregnancies can lead to abortion and, if they occur shortly after childbirth, may result in preterm labor, restricted fetal development, and stillbirth (11). It is also associated with increased stress, lower quality of life, delays in starting prenatal care, and higher maternal mortality rates (12, 13). Preventing unplanned pregnancies is crucial for meeting global development goals, including the Sustainable Development Goals. The World Health Organization (WHO) emphasizes that family planning should be integral to maternal and child health services (14). Moreover, utilizing effective contraception during the immediate postpartum period has proven to be a successful approach to mitigate some adverse outcomes (15). According to the WHO's 2015 Medical Eligibility Criteria for contraceptive use, women in the immediate postpartum phase have multiple family planning options, including progesterone-only pills (category 2), injectable

(only for non-breastfeeding women; category 1), implants (category 2), postpartum intrauterine contraceptive devices (PPIUD; category 1), and permanent methods like bilateral tubal ligation (category: accept) (16).

Worldwide, the decline in the number of women and girls dying annually from pregnancy complications and childbirth, from 415,000 in 2,000–295,000 in 2017, reflects a significant improvement (17). Still, approximately every two minutes, one woman dies due to complications related to pregnancy and childbirth. Most of these deaths and complications—68 percent—occur in Sub-Saharan Africa, where the maternal mortality rate stands at 533 deaths per 100,000 live births (17). In 2016, Ethiopia's maternal mortality rate was 412 deaths per 100,000 live births. This figure is slightly lower than the average for Sub-Saharan Africa, but it remains considerably higher than the global average. As an essential life-saving initiative, the Ethiopian government sought to increase the contraceptive usage rate among married women of reproductive age to 50% and reduce the unmet need for contraception to 10% as part of the second Health Sector Transformation Plan (HSTP-II) (18). However, among postpartum women who did not plan to have children soon, only 23.7% utilized modern family planning (19), and 22% of their children were born less than two years after their siblings (20). The 2019 Ethiopia Mini Demographic and Health Survey revealed that only 41% of currently married women utilize modern family planning methods (21). Moreover, immediate postpartum family planning services remain underutilized in Ethiopia, with only 9% of postpartum women using it (22).

To enhance the use of immediate postpartum family planning, the Ethiopian government and its development partners have implemented strategies such as integrating family planning services with maternal and child health services, training healthcare workers, and ensuring the availability of necessary supplies (23). However, there remains a significant gap in the utilization of immediate postpartum family planning (IPFP) (22). This gap is especially noticeable in rural and underserved regions, where limited access to healthcare services, lack of awareness, and cultural attitudes toward contraception can obstruct the adoption of modern family planning methods (24–28). While some studies have explored IPFP utilization in

Abbreviations

ANC, antenatal care; IPFP, immediate postpartum family planning; WHO, world health organization.

Ethiopia, they have largely overlooked the relationship between women's empowerment, wealth status, and IPPFP utilization (29, 30). Research focusing on IPPFP utilization and its influencing factors in the Gurage Zone is limited, highlighting the need for comprehensive studies to identify and understand these determinants. Therefore, the present study aimed to assess utilization of modern family planning in the immediate postpartum period and its influencing factors among postpartum women in Gurage Zone, Southwest Ethiopia. Understanding these factors is vital for developing tailored interventions that address the specific needs of postpartum women in the Gurage Zone.

Methods and materials

Study area and period

The present study was carried out in the Gurage Zone of the Southern Nations, Nationalities, and Peoples' Region (SNNPR) in Ethiopia. Gurage Zone is situated 153 kilometers southwest of Addis Ababa, the capital city of Ethiopia, and comprises two town administrations and 13 Woredas. According to the 2007 census by the Central Statistical Agency of Ethiopia, the total population of Gurage Zone is 1,280,483 (31). The area is served by 72 health centers and seven hospitals, which include two general zonal hospitals and five primary hospitals. The study was conducted from May 1–July 1, 2022.

Study design

This study employed a community-based cross-sectional design to assess the uptake of immediate postpartum modern family planning and associated factors among mothers who had given birth in the past twelve months.

Populations

All mothers who gave birth in the Gurage zone in the past twelve months (from May 1, 2021–April, 30, 2022) before the study period constituted the source population in the current study. The study population consisted of all selected mothers who gave birth in the selected Kebele in the last 12 months.

Eligibility criteria

This study included all women who gave birth during the last 12 months and resided in the study area for at least six months and excluded those women who were unable to communicate with the interviewer, were seriously ill, and involuntary to participate.

Sample size determination and sampling procedure

We used Epi Info version 7 StatCalc function to determine sample size by considering the following factors: a confidence interval of 95% ($Z = 1.96$), a margin of error of 5% ($d = 0.05$), and a proportion of immediate postpartum long-acting family planning method (53.2%) taken from the study done at Jimma university medical center, western Ethiopia (3) to determine the adequate sample size in the present study. Based on the above information sample size became 383, and adding 10% non-response gave us 422. However, because of the design effect, the final sample size for this study was 844. A design effect of 2 was applied in the sample size calculation.

We implemented a multistage sampling technique in the current study. Altogether, the Gurage zone has 13 woredas and two town administrations. We took six woredas and one town administration randomly by lottery method. We took four and two kebele from each randomly selected woredas and town administration, respectively. We conducted a preliminary assessment to identify eligible women in the selected Kebele with the help of health extension workers (HEW). Then, we allocated the final sample size proportionally for each kebele depending on the number of postpartum women they had. Finally, a simple random sampling technique was used to select 844 postpartum women for this study.

Variables of the study

Immediate postpartum modern family planning utilization was a dependent variable, socio-demographic factors: age, occupation, religion, education, marital status, Obstetric related factors: gravid, parity, birth to the birth interval, the current mode of delivery, discussion with a partner to use immediate postpartum family planning, Health service-related factors: ANC visit, number of ANC visits, location of delivery, FP counseling during delivery and ANC, Availing FP method, and prior FP use, knowledge, attitude, women empowerment status, and household wealth status were independent variables in this study.

Operational definitions and definition of terms

- **IPPFP utilization:** In this study, IPPFP utilization was defined as a postpartum woman using any modern postpartum family planning methods [such as progesterone-only pills, intrauterine contraceptive devices, injectable, dual methods, sterilization (permanent family planning method), or implants] within 48 h of delivery, prior to being discharged from the health facility (32, 33).
- **Knowledge of IPPFP-** In the present study, knowledge of IPPFP was assessed using 10 questions, requiring participants to respond with either "yes" or "no." Each correct answer was

assigned a value of 1, while incorrect answers received a value of 0. Scores ranged from 0–10, with the mean score used as the cut-off point. Participants were categorized as having good knowledge if their score was equal to or greater than the mean, and as having poor knowledge if their score was below the mean.

- **Attitude towards IPPFP**– The attitude toward IPPFP was assessed using 10 attitudinal questions. Participants rated their agreement with statements about FP on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total possible score ranged from 10–60, with the mean score serving as the cut-off point. A favorable attitude was defined as a score equal to or above the mean, while an unfavorable attitude was indicated by a score below the mean on the 10 attitudinal questions.

Data collection tools and procedure

In the present study, we used pretested and structured instruments for data collection to achieve the study objectives, adapted the tools from the previous research (29, 34), and organized the tools into the following parts: Socio-demographics factors, reproductive histories-related factors, health service-related factors, women empowerment status, household wealth index, knowledge, and attitude-related factors ([Supplementary File S2](#)).

To assess women's empowerment status in the current study, we adapted an instrument from EDHS (35) and another relevant research (36). Women's participation in household decision-making, community group membership, access to money, home or land ownership, and educational attainment were all questions that study subjects answered to measure women's empowerment. After adding up the results, the women's empowerment index was divided into three categories: low, moderate, and high. But to make a dichotomous variable, the middle and low classes were combined during the analysis.

In the present study, the households wealth index measuring instrument was developed by Principal Component Analysis (PCA), and it was adopted from the Ethiopian Demographic Health Survey (DHS) (35) and another related study (37). More than twenty household-related variables, including fuel used for cooking, presence of a separate kitchen, land occupancy, wall, roof, and floor material, and other household properties, were included to assess the wealth indexes. We coded all these variables between 0 and 1, and then after variables were entered and analyzed using PCA, those variables having a communality value of greater than 0.5 were used to produce factor scores in this study. Finally, factor scores were summed, and for the analysis, the household's wealth index score was categorized into three categories (poor, medium, and rich).

In the current study, the face validity of the questionnaires was checked by experts with several backgrounds (An assistant professor of maternity and reproductive health nursing, an epidemiologist, and a gynecologist). Before the actual data collection, the questionnaire was translated into Amharic and re-

translated to English to check the consistency of the translation. Seven Diploma and three MSC maternity health nurses who have experience in data collection and are fluent in English and local languages (Amharic and Guragigna) were recruited as data collectors and supervisors, respectively.

Data quality management

We provided training (one day theoretical and one day practical) for data collectors and the supervisors regarding the purpose of the study, the benefit of the study, the data collection tools, and procedures, how to approach respondents, and how to maintain confidentiality before the start of data collection to maintain data quality. Supervisors and the principal investigators verified the completeness and consistency of filled questionnaires at the end of each day of data collection. In the present study, the instrument used for data collection was translated into Amharic and re-translated to English to check its consistency, pretested on 5% of the sample size to determine whether the questions were understandable and the language was appropriate before conducting the main study, following the pretest some adjustments were made, including logical ordering and rewriting of difficult-to-understand items, and the time required for data collection estimated. Each questioner was coded with unique identification and entered into Epi Data because Epi Data has a controlling mechanism for error detection. Double data entry was performed by two separate data clerks to check the consistency of data entry. A file containing the data was kept in a safe location where only the principal investigator could access it, and missing values and outliers were examined using simple frequencies and cross-tabulation in the current study.

Data processing and analysis

The principal investigator and supervisors ensured the completeness and consistency of the data, marking the corresponding code numbers on the margins of the questionnaires. For this study, data entry was performed using EpiData version 3, and data analysis was conducted with Statistical Package for Social Science (SPSS) version 26. Descriptive statistics, including frequencies and proportions, were calculated using SPSS's descriptive statistics function. To examine the relationship between immediate postpartum modern family planning use and the independent variables, inferential statistics, such as binary logistic regression with 95% confidence intervals (CI), were applied. In the binary logistic regression model, variables with P -values < 0.25 were included in multivariable logistic regression. A multivariable logistic regression analysis with a backward stepwise variable selection method was conducted to adjust for confounding factors and evaluate the relative influence of independent variables on the overall use of modern family planning immediately after childbirth. In this study, we considered factors associated with IPPFP utilization using a P -value of < 0.05 and a 95% confidence interval in the

multivariable logistic regression model. None of the independent variables had a variance inflation factor (VIF) greater than 10 (all VIFs were below 3.107), and the model showed a good fit (P -value = 0.127) according to the Multicollinearity test and the Hosmer and Lemeshow assumption tests.

Ethical considerations

Before starting data collection, ethical clearance was obtained from the institutional review board of the College of Health Science and Medicine, Wolkite University, and an official letter was sent to the Gurage Zone health department to obtain permission. Data collection started after a cooperation letter was written to all districts where the study was conducted. The purpose and significance of the study were explained to the study participants, and they understood the study's objective and signed written informed consent. Before filling out the questionnaire, participants were asked for their voluntary participation, and if they did not want to continue, they were told to withdraw at any time without giving any reason, and all interviews were conducted in a private setting to ensure participant confidentiality.

Results

Sociodemographic characteristics of study participants

Eight hundred thirty-six (836) of the 844 invited immediate postpartum women completed the interview making a response rate of 99.05%. The current study's findings showed that the mean age of the participants was 27.0 years (SD: 5.02), and 306 (36.6%) of them fell into the 25- to 29-year-old range. Regarding the study subjects religion, marital status, and educational status, the current study results indicate that the majority of the study participants were Islam (92.5%), married (97.1%), and had completed the primary (1–8) level. Regarding women's empowerment and household wealth status, the current study demonstrated that less than three-fourths of study subjects were low/moderately empowered, and more than half of the study participants had medium wealth status (Table 1).

Reproductive history and family planning-related characteristics of study participants

The results showed that three-fourths of the study participants were multigravida and multipara. The results of the current study's findings regarding the study participants' mode of birth and ANC visits revealed that more than half (61.4%) of the study subjects experienced spontaneous delivery, and almost all (97.1%) of the study subjects had a history of ANC visits during a recent pregnancy. Concerning counseling for immediate postpartum family planning, more than half of the study participants received counseling for family planning during ANC visits and

TABLE 1 Sociodemographic characteristics of postpartum women in the Gurage Zone, Ethiopia, 2022 ($n = 836$).

Variables	Category	Frequency	Percent (%)
Age in years	≤19	58	6.9
	20–24	219	26.2
	25–29	306	36.6
	30–34	164	19.6
	≥35	89	10.6
Marital status	Married	812	97.1
	Single	17	2.0
	Divorced/Separated	7	.8
Religion	Islam	773	92.5
	Orthodox	33	3.9
	Protestant	18	2.2
	Catholic	12	1.5
Educational status	Illiterate	99	11.8
	Primary	330	39.5
	Secondary	257	30.7
	College and above	150	17.9
Occupational status	Unemployed	392	46.9
	Formal Employment	154	18.4
	Informal Employment	290	34.7
Wealth status	Poor	179	21.4
	Medium	445	53.2
	Rich	212	25.4
Women empowerment status	Low	384	45.9
	Moderate	264	31.6
	High	188	22.5

delivery (the immediate postpartum period). This study also revealed that Depo-Provera and implants were used by around 50.1% and 36.2%, respectively. Regarding the knowledge and attitude of study subjects towards immediate postpartum family planning, the findings of the present study revealed that more than half of the study subjects (54.2%) and 53.5% had good knowledge and positive attitude towards immediate postpartum family planning, respectively (Table 2).

Utilization of IPPFP level among study participants

Overall, 359 (42.9%) of the study's participants used IPPFPs, with a 95% confidence interval (39.6%–46.3%). Depo-Provera 180 (50.1%) and Implants 130 (36.2%) were the two contraceptive methods most frequently adopted in the immediate postpartum period.

Factors associated with IPPFP utilization

Binary and multivariate logistic regression analyses were used in the present study to identify factors associated with IPPFP utilization. Each independent variable was separately entered into a binary logistic regression model with 95% CI. The result showed that age, educational status, occupational status, women empowerment status, wealth index, parity, having ANC visits, need partner

TABLE 2 Reproductive history and family planning-related characteristics of postpartum women in the Gurage Zone, Ethiopia, 2022 (*n* = 836).

Variables	Category	Frequency	Percent (%)
Gravidity	Primigravida	205	24.5
	multigravida	631	75.5
Parity	Primipara	194	23.2
	Multipara	642	76.8
The current mode of delivery	Spontaneous delivery	513	61.4
	Vacuum/ Forceps	66	7.9
	Cesarean Section C/S	257	30.7
Place of delivery	Hospital	319	38.2
	Health center	398	47.6
	Home	119	14.2
Needs partner approval to use IPPFP	No	31	3.7
	Yes	805	96.3
Do you have ANC follow up?	No	27	2.9
	Yes	809	97.1
Counseled for immediate FP during ANC	No	391	47.9
	Yes	425	52.1
Counseled for immediate FP at immediate postpartum period	No	510	61.0
	Yes	326	39.0
Were you given information on the available FP option to start within 48 h after birth?	No	415	50.3
	Yes	421	49.7
If yes, which available options were you given the information	IUCD	17	4.0
	Implants	233	55.3
	Depo-Provera	149	35.4
	POP	22	5.2
Which family planning method you adopted within 48 h after you gave recent birth	IUCD	23	6.4
	Implants	130	36.2
	Depo-Provera	180	50.1
	POP	26	7.2
Knowledge of the participants	Poor knowledge	383	45.8
	Good knowledge	453	54.2
Attitudes of the participants	Non-favorable	389	46.5
	Favorable	447	53.5

approval to use IPPFP, attitude towards IPPFP utilization, knowledge towards IPPFP utilization, place of delivery, counseled about FP during ANC visit and delivery was candidate variable for multivariable logistic regression analysis at *p*-value < 0.25 (Table 3).

Altogether, thirteen variables were entered into the multivariable logistic regression analysis to identify the final factors associated with IPPFP utilization. Backward logistic regression was employed to select variables in the final model. The results showed that women's empowerment level, wealth index, attitude towards IPPFP use, place of delivery, advice about IPPFP during ANC, and immediate delivery (childbirth) were significantly associated with IPPFP use.

In the present study, mothers who attended secondary school (9–12) were nearly two times more [95% CI: 1.03–3.76] likely to utilize immediate postpartum family planning compared with illiterate women. Postpartum women from wealthier families were 2.57 times more [95% CI: 1.44–4.58] more likely to use immediate postpartum family planning than women from poorer

families. Postpartum women who had favorable attitude towards immediate postpartum family planning were 2.65 times more [95% CI: 1.86–3.78] likely to utilize immediate postpartum family planning than women who had unfavorable attitude. Women who have been counseled about FP during immediate postpartum period were 2.51 times more [95% CI: 1.77–3.56] and during ANC visits were 1.93 times more [95% CI: 1.36–2.76] likely to utilize immediate postpartum modern family planning method than those who have not been counseled about family planning. Mothers who had given birth in health facility were 2.06 times more likely [95% CI: 1.26–3.38] to utilize immediate postpartum family planning than those who gave birth at home. Regarding women's empowerment, the odds of using modern family planning immediately after childbirth were 4.365 times [95% CI: 2.44–7.82] higher for women with high levels of women's empowerment than their counterparts (Table 4).

Discussion

The objective of the current study was to determine the prevalence of immediate postpartum modern family planning utilization and its associated factors among postpartum women in Gurage Zone. The results of this study indicated that the prevalence of IPPFP utilization was 359 (42.9%) with a 95% CI (39.6%–46.3%). It also revealed that IPPFP utilization is significantly associated with women's empowerment status, wealth index, place of delivery, attitude towards IPPFP utilization, and counseling about IPPFP during ANC and delivery.

The study revealed that 42.9% of postpartum women utilized modern contraceptives right after the birth of their recent child. This finding is supported by a study conducted in Addis Ababa, Ethiopia (45.5%) (38), as well as research carried out in four regions of Ethiopia (Amhara, Tigray, Oromia, and SNNP), which showed a 39% result (39). The level of immediate postpartum family planning usage we observed is higher than the rates reported in North Shoa, Ethiopia (21.3%) (30), in Konta Special Woreda, Southern Ethiopia (35.2%) (40), Saint Paul Millennium Medical College in Addis Ababa (12.7%) (29), Sidama, Ethiopia (21.6%) (41), Rwanda (28.1%) (42), and western Kenya (35.6%) (34). The higher immediate postpartum modern family planning utilization observed in this study, compared to research conducted in the aforementioned countries, may be due to variations in socio-cultural factors, study settings, and differences in the time periods of the studies. Furthermore, 97.1% of the participants in this study had attended antenatal care (ANC), which may have increased their likelihood of using immediate postpartum contraception.

However, this result is lower than the rates reported in Thailand (73.7%) (43), Jimma town in Western Ethiopia (53.2%) (3), Kenya (50%) (44), South Africa (93.2%) (45), and the United States (49%) (46). The inconsistent findings could be attributed to the presence of contraceptive counseling aimed at promoting the use of contraception right after childbirth. For example, a randomized controlled trial in Thailand examined the effects of immediate postpartum contraceptive counseling on adolescent

TABLE 3 Binary logistic regression results showing factors associated with adoption of immediate postpartum modern family planning method in Gurage Zone, Ethiopia, 2022 (*n* = 836).

Variables	Use modern IPPFP		p-value	COR (95% CI)
	No (%)	Yes (%)		
Age in years				
<=19	37 (63.8%)	21 (36.2%)		1
20–24	137 (62.6%)	82 (37.4%)	.863	1.055 (.578, 1.924)
25–29	168 (54.9%)	138 (45.1%)	.212	1.447 (.810, 2.587)
30–34	92 (56.1%)	72 (43.9%)	.308	1.379 (.743, 2.558)
>=35	43 (48.3%)	46 (51.7%)	.067	1.885 (.957, 3.713)
Occupational status				
Unemployed	251 (64.0%)	141 (36.0%)		1
Formal Employment	75 (48.7%)	79 (51.3%)	.01	1.875 (1.286, 2.735)
Informal Employment	151 (52.1%)	139 (47.9%)	.002	1.639 (1.203, 2.232)
Needs partner approval to use PPFP				
No	26 (83.9%)	5 (16.1%)		1
Yes	451 (56.0%)	354 (44.0%)	0.04	4.082 (1.55, 10.74)
Parity				
Primipara	78 (40.2%)	116 (59.8%)		1
Multipara	399 (62.1%)	243 (37.9%)	0.02	2.44 (1.76, 3.39)
Place of delivery				
Hospital/health center	393 (54.8%)	324 (45.2%)	0.001	1.98 (1.30, 3.01)
Home	84 (70.6%)	35 (29.4%)		1
Wealth status				
Poor	126 (70.4%)	53 (29.6%)		1
Medium	258 (58.0%)	187 (42.0%)	0.004	1.723 (1.188, 2.500)
Rich	93 (43.9%)	119 (56.1%)	<0.001	3.042 (1.998, 4.631)
Educational status				
Illiterate	75 (75.8%)	24 (24.2%)		1
Primary (1–8)	196 (59.4%)	134 (40.6%)	0.003	2.136 (1.284, 3.556)
Secondary (9–12)	129 (50.2%)	128 (49.8%)	<0.001	3.101 (1.842, 5.219)
Collage and above	77 (51.3%)	73 (48.7%)	<0.001	2.963 (1.692, 5.188)
ANC visits				
No	18 (66.7%)	9 (33.3%)		1
Yes	459 (56.7%)	350 (43.3%)	0.031	0.66 (.291, 1.48)
Women empowerment				
Low	269 (70.1%)	115 (29.9%)		1
Moderate	129 (48.9%)	135 (51.1%)	<0.001	2.45 (1.77, 3.39)
High	79 (42.0%)	109 (58.0%)	<0.01	3.227 (2.25, 4.64)
Knowledge about IPPFP				
Poor knowledge	271 (56.8%)	206 (43.2%)		1
Good knowledge	112 (31.2%)	247 (68.8%)	0.17	2.901 (2.176, 3.868)
Attitude about IPPFP				
Non Favorable	277 (71.2%)	112 (28.8%)		1
Favorable	200 (44.7%)	247 (55.3%)	0.001	3.054 (2.290, 4.074)
Counseled about FP at immediate postpartum period				
No	353 (69.2%)	157 (30.8%)		1
Yes	124 (38.0%)	202 (62.0%)	0.014	3.663 (2.735, 4.905)
Counseled about FP during ANC visits				
No	259(66.2%)	132(33.8%)		1
Yes	204(48.0%)	221(52.0%)	0.01	2.126(1.602, 2.821)

Key: 1 = Reference category, COR, crude odds ratio.

TABLE 4 Multivariable logistic regression results showing factors associated with adoption of immediate postpartum modern family planning method in Gurage Zone, Ethiopia, 2022 ($n = 836$).

Characteristics	Use modern IPPFP		COR (95% CI)	AOR (95% CI)
	No (%)	Yes (%)		
Wealth status				
Poor	126 (70.4%)	53 (29.6%)	1	1
Medium	258 (58.0%)	187 (42.0%)	1.72 (1.19, 2.50)*	1.44 (0.86, 2.39)
Rich	93 (43.9%)	119 (56.1%)	3.042 (1.99, 4.63)**	2.570 (1.44, 4.58)*
Educational status				
Illiterate	75 (75.8%)	24 (24.2%)	1	1
Primary (1–8)	196 (59.4%)	134 (40.6%)	2.136 (1.28, 3.56)*	1.29 (.705, 2.36)
Secondary (9–12)	129 (50.2%)	128 (49.8%)	3.10 (1.84, 5.22)**	1.97 (1.03, 3.76)*
Collage and above	77 (51.3%)	73 (48.7%)	2.96 (1.69, 5.19)**	.491 (.22, 1.08)
Women empowerment				
Low/moderate	390 (64.0%)	219 (36.0%)	1	1
High	87 (38.3%)	140 (61.7%)	2.87 (2.09, 3.93)**	4.37 (2.44, 7.82)**
Attitude toward IPPFP				
Non Favorable	277 (71.2%)	112 (28.8%)	1	1
Favorable	200 (44.7%)	247 (55.3%)	3.05 (2.29, 4.07)**	2.65 (1.86, 3.78)**
Place of delivery				
Home	84 (70.6%)	35 (29.4%)	1	1
Health facility	393 (54.8%)	324 (45.2%)	1.98 (1.30, 3.01)	2.06 (1.26, 3.38)*
Counseled at (immediate) delivery				
No	353 (69.2%)	157 (30.8%)	1	1
Yes	124 (38.0%)	202 (62.0%)	3.66 (2.74, 4.91)**	2.51 (1.77, 3.56)**
Counseled about IPPFP during ANC visits				
No	259 (66.2%)	132 (33.8%)	1	1
Yes	204 (48.0%)	221 (52.0%)	2.13 (1.60, 2.82)**	1.93 (1.36, 2.76)**

1 = Reference category, COR, crude odds ratio; AOR, adjusted odds ratio.

*Statistically significant at $p < 0.05$.

**Statistically significant at $p < 0.001$.

utilization of long-acting reversible contraceptives. Additionally, the variation in results might stem from differences in the study populations. For instance, a study conducted in Kenya and South Africa focused on HIV-positive women, who were strongly encouraged to use contraceptives to limit childbirth.

The current study's finding showed a statistically significant association between the uptake of IPPFP and family planning counseling. Women who have been counseled about FP during immediate postpartum period and ANC were more likely to utilize immediate postpartum modern family planning method than those who have not been counseled about family planning. This result is supported by various studies conducted in different context, including Kebribeyah town in Eastern Ethiopia, Durame town in Southern Ethiopia, in India, Thailand, West-central Africa and a systematic review and meta-analysis in Ethiopia (43, 47–52). The consistency across these studies suggests that the positive impact of FP counseling is a widespread phenomenon, transcending cultural and geographical differences. Counseling provides women with essential information about their contraceptive options, addressing misconceptions and cultural barriers that may exist. It empowers women to make informed decisions about their reproductive health, ultimately leading to higher adoption rates of contraceptive methods immediately postpartum. Moreover, the consistency of these findings across diverse settings suggests that the relationship between counseling

and IPPFP use is not limited to a specific geographic or cultural context. This reinforces the need for health systems to strengthen FP counseling during ANC visits and immediate postpartum period to enhance the uptake of family planning services, thereby contributing to better maternal and child health outcomes.

In the present study mothers who had given birth in health facility were more likely to utilize immediate postpartum family planning than those who gave birth at home. This result is corroborated with another study conducted in Ethiopia (53). The possible justification for this result might be increased access to family planning services and health education and Counseling including family planning options, which increases awareness and likelihood of utilization. Another possible justification might be attributed to the Ethiopian government's recent national policies encouraging the integration of family planning services with maternity and child health (MCH) services may also be a contributing factor, since it ensures a greater uptake among individuals who give birth in a healthcare facility.

In this study, attitudes toward contraceptive use during the immediate postpartum period were linked to actual IPPFP use. Mothers with favorable attitudes toward the IPPFP were more likely to utilize it compared to those with unfavorable attitudes. This finding is consistent with research conducted in North Shoa (30), Kebribeyah town in Eastern Ethiopia (49), and Addis Ababa (29), which demonstrated that mothers with favorable

attitudes toward postpartum contraceptive methods were more likely to use it. These results suggest that favorable attitudes toward IPPFP are a precursor to its utilization across different contexts. This highlights the need for strategies aimed at changing societal attitudes toward family planning, particularly postpartum methods, by involving community leaders and influencers to promote positive perceptions and encourage utilization strengthening interventions aimed at improve the utilization. It is important to interpret this finding cautiously, as women who adopted PFPF may have more favorable attitudes on contraception.

Women's empowerment status is significantly associated with the immediate postpartum family planning method adoption. The odds of using modern family planning immediately after childbirth were 4.365 times higher among immediate postpartum women who reported experiencing higher levels of women empowerment than their counterparts. Similarly, a 2016 analysis of the EDHS (35) found that the likelihood of using health services to achieve their reproductive health goals was higher among women who described high female empowerment than those who reported low female empowerment. This result is similar to the study conducted in sub-Saharan Africa (54) and Burkina Faso (55). The possible explanation could be that women who are more empowered may have greater autonomy in making healthcare decisions, including reproductive choices. Additionally, empowered women are more likely to have access to reproductive health education and information, which improves their knowledge of FP availability, advantages, and procedures.

This study discovered that women from wealthier households were more likely to use IPPFP than women from poorer households, and this result is similar to the study conducted in Rwanda (56). The possible justification might be women from wealthier households are more likely to give birth in health facilities where IPPFP services are available, while poorer women may have limited access to institutional delivery and postpartum care. This result suggests that programs should focus on increasing women's and families' economic independence to improve women's use of family planning.

Strengths and limitations of the study

The study employed a community-based cross-sectional design with a large sample size to ensure the reliability and representativeness of the findings. However, there are some limitations to consider. The cross-sectional nature of the data restricts the ability to infer causality between the utilization of immediate postpartum family planning (IPPFP) and its associated factors. Additionally, respondents estimated the time between giving birth to their last child and the initiation of contraceptive use, which may introduce recall bias. Some important factors, such as the combined effects of family planning counseling during antenatal care, labor and delivery, and the postpartum period, were not addressed in this study and should be explored in future research. Furthermore, there may be response bias as a result of social desirability and the

dichotomization of variables including attitude and knowledge measuring items using a Likert scale.

Conclusion and recommendation

This study concluded that approximately two in five postpartum women adopted immediate postpartum family planning in this study area. The study further demonstrates that women's empowerment, wealth index, attitudes toward IPPFP utilization, place of delivery and counseling during antenatal care (ANC) and delivery are significantly associated with the utilization of IPPFP. Therefore, health campaigns and educational initiatives aimed to improve attitudes toward IPPFP, emphasizing its benefits for maternal and child health, improving access to healthcare facilities for delivery, strengthen family planning counseling during ANC and delivery, and strengthening efforts aimed at empowering women through education, economic opportunities, and social support systems to encourage family planning uptake, including IPPFP are recommended. Future researchers are recommended to conducted mixed study.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Institutional review board of the College of Health Science and Medicine, Wolkite University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

TG: Conceptualization, Formal analysis, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft. AT: Formal analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – review & editing. GM: Formal analysis, Investigation, Methodology, Software, Writing – review & editing. SS: Formal analysis, Investigation, Methodology, Resources, Software, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fghw.2025.1355620/full#supplementary-material>

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Post-abortion contraceptive uptake, choices, and factors associated with it among women seeking abortion services in Africa: a systematic review and meta-analysis

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Background: In Africa, over one-third of women experience multiple abortions, often due to inadequate access to effective modern contraceptives. This highlights a critical gap in understanding the patterns and predictors of post-abortion contraceptive (PAC) use. To address this issue, a systematic review and meta-analysis were conducted to assess the uptake of PAC and associated factors among African women who received abortion services.

Methods: Following the PRISMA guideline, all articles published between January 1, 2015, and December 30, 2023, were systematically retrieved from multiple databases. Articles reporting PAC uptake among African women were included. The pooled prevalence of Post-abortion contraceptive uptake was determined using a random effects model. The variation between the included studies was assessed using a funnel plot and I^2 heterogeneity statistics. Sources of heterogeneity: Subgroup analysis was performed by country, publication period, study design, and sub-African region.

Results: From 48 articles, a total of 84,205 women who underwent abortion services were included in the analysis. The pooled prevalence of PAC uptake in Africa was 58.78% (95% CI: 52.36–65.21), with high heterogeneity ($I^2 = 99.8\%$, 95% CI: 99.2%–99.9%; $P < 0.001$). The subgroup analysis revealed variation by country, publication period, and sub-African region. The most widely used contraceptive methods were injectables (30.27%), followed by implants (25.13%), oral contraceptive pills (22.34%), and IUDs (10.47%). Attending formal education (OR = 1.46, 95% CI = 1.03, 2.07), knowing the period of fertility (OR = 1.72, 95% CI = 1.14, 2.59), counseling about contraceptives (OR = 3.40, 95% CI = 1.82, 6.35), not having a desire for pregnancy (OR = 3.08, 95% CI = 1.74, 5.35, 95% CI = 2.55, 7.42), and possessing contraceptive knowledge (OR = 2.30, 95% CI = 1.41, 3.76) had a statistically significant combined effect on PAC uptake in Africa.

Conclusion: The uptake of PAC in Africa stands at 58.78%, which is considered low according to the World Health Organization's recommendation that all women should postpone conception for six months following an abortion. There was also a decline of 20.22% between 2020 and 2023 compared to the pooled uptake between 2015 and 2019. To address this, it is crucial to enhance women's awareness of post-abortion contraception, the conception risks after abortion, and to strengthen client-centered counseling alongside women's education.

Systematic Review Registration: <https://www.crd.york.ac.uk/PROSPERO/view/CRD42024505129>, PROSPERO CRD42024505129.

KEYWORDS

post-abortion, contraceptive, family planning (FP), abortion, systematic review & metaanalysis, Africa

Introduction

Maternal mortality and morbidity remain significant global challenges, despite ongoing efforts to meet Sustainable Development Goal (SDG) target 3.1, which aims to reduce the global maternal mortality ratio to below 70 per 100,000 live births by 2030 (1). In 2020, an estimated 287,000 maternal deaths occurred worldwide. Ninety-five percent of maternal deaths occurred in low- and low-middle-income countries, and more than two-thirds (70%) occurred in sub-Saharan Africa (SSA) (2). Pregnancies ended with unsafe abortion can lead to maternal mortality and morbidity (3). Unsafe abortion is one of the leading causes of maternal mortality worldwide, accounting for over 13% of maternal deaths, which translates to more than 38,900 lives lost annually (4, 5).

Globally, approximately half of all pregnancies are unintended, which results in induced abortion (6); from 2015 to 2019, an estimated 121 million unintended pregnancies and 73.3 million abortions were reported each year (4). Approximately 60% of unintended pregnancies and 30% of all pregnancies result in induced abortion. Furthermore, approximately 45% of all abortions are considered unsafe, with 97% of these unsafe procedures occurring in developing countries and marginalized populations (4, 7, 8). Family planning is an essential maternal and child health service package that has the potential to reduce maternal deaths by 32%, child deaths by 10%, and unwanted pregnancies by 71% (9).

Family planning significantly benefits the health of women, children, and the community at large (10, 11). As a result of modern contraceptives, from 2019 to 2020, a total of 121 million unintended pregnancies, 21 million unsafe abortions, and 125 thousand maternal deaths were averted (12). Failing to use family planning causes unintended pregnancies that result in abortion and abortion-related complications, and death (4).

The provision of post-abortion family planning (PAFP) is one of the essential integrated postabortion care services that significantly contribute to reducing unintended pregnancies, further repeated abortions, and maternal deaths (13). The WHO recommends postponing conception for at least six months after termination of pregnancy, and all women are expected to receive post-abortion contraceptives before leaving health facilities (7). However, research evidence indicates that a significant number of women who received abortion services left the health facility

without using any contraceptives, 34.2% in Ethiopia (14), 46% in Kenya (15), and 80% in Tanzania (16). Routine family planning services, such as the PAFP, should be provided for all women regardless of their socio-economic status (9, 17–19).

The WHO (7) and various national abortion guidelines (20–22) have set forth recommendations advocating for the provision of family planning services prior to discharge from healthcare facilities. These recommendations are grounded in the obligation of states to uphold sexual and reproductive health rights, which aim to postpone conception for six months and/or mitigate unintended pregnancies that may lead to repeat abortions (7, 23). Despite various efforts, a significant number of women leave these institutions without accessing essential post-abortion care services. Empirical evidence shows that between 20% and 37% of women undergo subsequent abortions, which can be attributed to the insufficient use of effective modern contraceptive methods following their initial procedure (24–26).

Although there is evidence regarding PAFP uptake at the country (27–29) and sub-continent-level (30, 31) in Africa, there is a notable lack of studies assessing its predictors. Furthermore, up-to-date data are critical for implementing intervention measures to reduce unmet family planning needs. A comprehensive understanding of the prevalence and determinants of PAFP at the continental level can foster a collaborative understanding among international stakeholders and stimulate advocacy for actions. Consequently, this systematic review and meta-analysis sought to evaluate the pooled prevalence of post-abortion contraceptive uptake and the associated predictors among women who have received abortion services in Africa. The insights derived from this research could be instrumental in developing context-specific, women-centered PAFP services for African women. Additionally, the investigation into the unintended pregnancies and the prevalence of abortions reveals that the findings could be substantially mitigate maternal morbidity and mortality within the African continent.

Methods and materials

Study protocol and eligibility

This study aimed to determine the pooled prevalence of post-abortion contraceptive (PAC) uptake and its determinants among women seeking abortion services in Africa through a systematic review and meta-analysis of both published and unpublished studies were performed.

The review included all cross-sectional and cohort studies conducted in various regions of Africa, focusing on the uptake and utilization of post-abortion contraceptives, reported in studies published in English between January 1, 2015, and December 30,

Abbreviations

IUDs, intra uterine devices; PAC, post-abortion contraceptive; PAFP, post-abortion family planning; SDG, sustainable development goal; WHO, World Health Organization.

2023. The year 2015 was deliberately chosen as the starting point for the review since it marked the beginning of the implementation of the Sustainable Development Goals (1). The decision to exclude the older studies aimed to focus on the most relevant and current data that accurately reflects contemporary practices and trends, in line with the Sustainable Development Goals. Furthermore, the review excluded articles that had inconsistent outcome measures and/or lacked sufficient outcomes. The review and meta-analysis adhered to the guidelines outlined in the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) reporting checklist (32).

Sources of information and search strategies

We searched several databases, including PubMed, Medline, Researchgate, Africa Journal Online, and Europe PMC, to retrieve relevant findings on post-abortion contraceptive uptake. We used the following mesh terms (“Abortion, Induced”), AND (“Contraceptive Agents”, OR “Family Planning Services”), AND (“Africa”), as well as a combination with specific African countries (Supplementary File S1). Additionally, we utilized Google Scholar to find unpublished articles and materials from the institutional repositories. All the search results were compiled using EndNote citation management software. Articles were last searched on January 01, 2024.

Study selection, data extraction, and quality assurance

Using the EndNote X8 citation manager, duplicated articles were removed. Initially, all the retrieved articles were evaluated against the eligibility criteria by carefully reading the articles' titles and abstracts. For an article to be considered eligible, its title and abstract had to include the outcome of interest: post-abortion contraceptive uptake, along with subjects involved, which were women who received abortion services, and the study setting, which needed to be in Africa. Articles that met these inclusion criteria based solely on their title or abstract were selected for full document review. Two investigators independently assessed the eligibility of each study. If any discrepancies arose between the two investigators, we discussed the differences and reviewed the full text jointly to reach a consensus. Factors considered during a consensus discussion were alignment with the research question, study design, population, outcomes, and the clarity of reporting. In our evaluation of unpublished literature, we considered several key factors: using a scientific way to determine sample size, the appropriateness of participant selection, the validity and reliability of the survey tool, the mechanisms in place to control for confounding factors and bias, and the ethical acceptability of the studies. These considerations were particularly important given that these articles did not provide evidence of peer review.

The reviewers independently collected the data from all accessible databases and records using a standardised form. During the data extraction, variables such as the author, year of

publication, country, study subject, study design, sample population, number of cases (participants with the outcome), prevalence, contraceptive method type, and available predictor variables were captured and recorded using Microsoft Excel 2016 (Supplementary File S2). The overall process of study identification, screening, and selection process is presented using the 2020 updated PRISMA flow diagram (Figure 1).

Measurement of the outcome

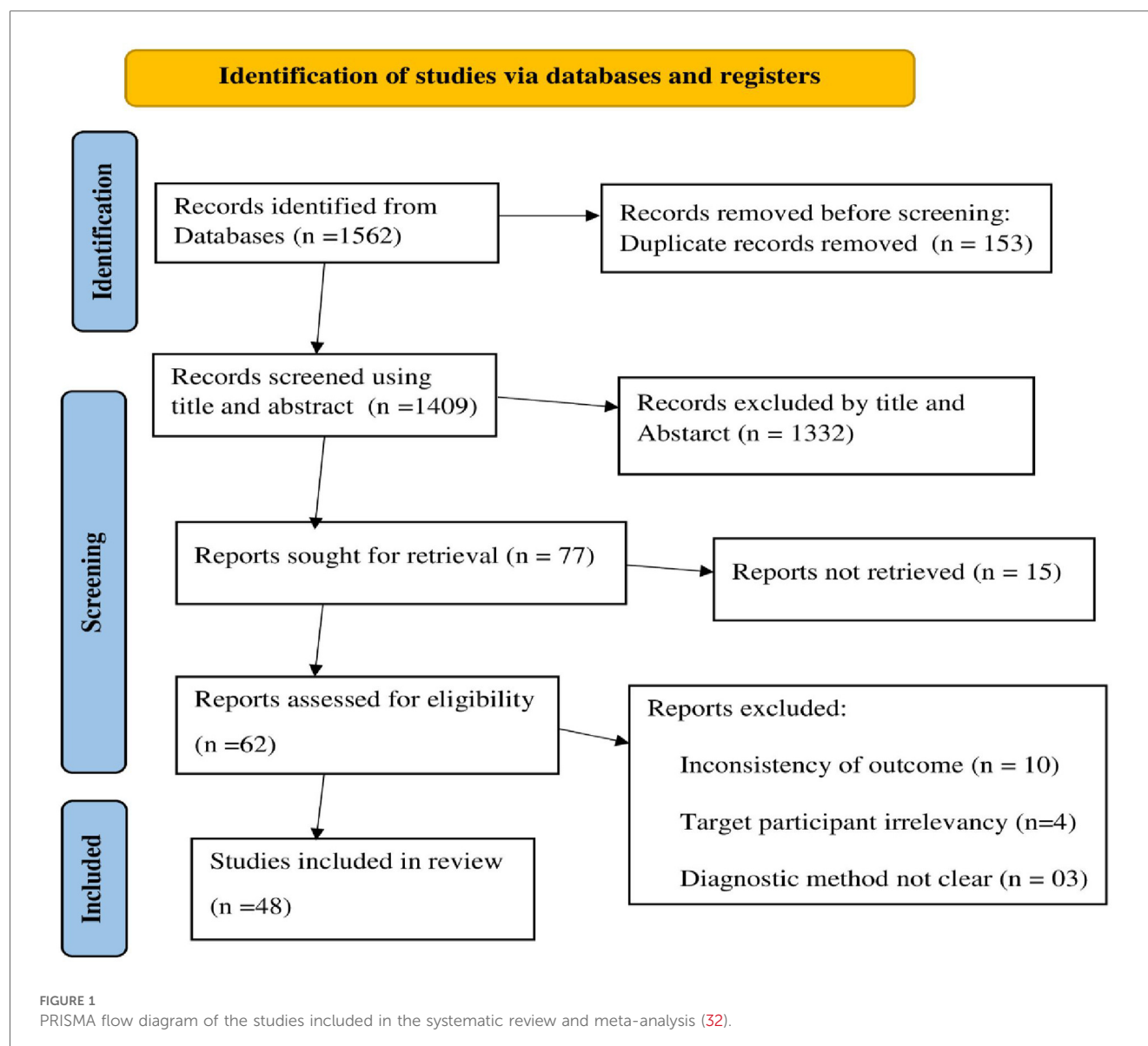
The first outcome variable of this study, the pooled prevalence of post-abortion contraceptive uptake in Africa, was calculated by dividing the total number of women who use modern contraceptives by the total number of women who received post-abortion services in the included studies (sample size) multiplied by 100. The second outcome variable of this study was the determinants of post-abortion contraceptive use in Africa, which were measured using an adjusted odds ratio. A separate meta-analysis for each determinants of PAFP uptake was done using a subset of studies that reported adjusted odd ratios (AORs). A minimum of two studies was required for inclusion in each analysis. Data for each potential determinant factor was extracted in a two-by-two format in the Excel spreadsheet, and then the adjusted odds ratio was calculated for each factor. The potential determinant factors included in the analysis were residence (rural, urban), educational status (not attend formal education, attend formal education), marital status (in-union, not in-union), the desire of pregnancy (had pregnancy desire, had not pregnancy desire), knew of the fertile period (yes, no), post-abortion contraceptive counseling (yes, no), had a history of abortion (yes, no), trimester of abortion [first (<12 wks), second (>12 wks of gestation)], history of contraceptive use (yes, no), had contraceptive knowledge (yes, no), and gravidity (primigravida, multigravida).

Data synthesis and statistical analysis

The data were imported into Stata version 15.1 from a Microsoft Excel sheet for analysis. The outcome variable, post-abortion contraceptive uptake, was calculated by dividing the number of women who use modern contraceptives by the total number of women who received post-abortion services, multiplied by 100. The pooled prevalence of post-abortion contraceptive uptake with a 95% confidence interval (95% CI) was determined using a random effects model.

The heterogeneity among the included studies was examined using I^2 statistics. Heterogeneity was considered to exist when the P -value of I^2 was less than 0.05. I^2 statistics of 25, 50, and 75% represented low, moderate, and high heterogeneity, respectively (33). An Egger regression asymmetry test for meta-analysis was used to assess publication bias. A P -value <0.05 indicated the presence of publication bias.

Sub-group analysis and meta-regression were performed to verify the sources of heterogeneity. Additionally, a sensitivity analysis was carried out to ensure the robustness of the result and



to check the influence of individual studies. To examine the influence of a single study, a pooled effect of PAC use with a 95% CI was calculated, leaving one study at a time. Meta-regression analysis was done to identify factors associated with the pooled effect of PAC uptake. The adjusted odds ratio with 95% CI was reported to show the strength of the association. Variables with a P -value < 0.05 were considered statistically significant, highlighting their potential influence on PAC utilization.

Results

Initially, a total of 1,562 articles were identified from different electronic databases, 153 of which were removed due to duplication. After screening the articles by title and abstract, 77 articles were selected for full-text retrieval. Fifteen additional articles were removed due to a lack of full-text articles or because they were published in languages other than English. Finally, of

the 62 retrieved full-text articles, 48 articles were included in the analysis (Figure 1).

Characteristics of the included studies

A total of 48 full-length articles published between January 1, 2015, and December 30, 2023, were included in this systematic review and meta-analysis. These articles originated from different countries, with a notable majority from Ethiopia (21 studies) and Ghana (6 studies). In terms of subregions, East Africa accounted for the highest number, with a total of 34 studies. The analysis encompassed data from 84,205 women who received postabortion care. On average, 1,754 women were included in each study, with sample sizes varying from 118 participants in Ethiopia to 29,056 in Ghana. Furthermore, 94% of the studies employed a cross-sectional design (Table 1).

TABLE 1 Characteristics of the 48 studies included in the systematic review and meta-analysis to estimate the pooled prevalence of postabortion contraceptive use in Africa.

S.no.	First author; year (reference)	Country	Study design	Sample size	No. of women use PAC
1	Belachew TB., et al; 2023 (34)	Ethiopia	Cross-sectional	1,236	316
2	Woldemichael D., et al; 2023 (35)	Ethiopia	Cross-sectional	272	146
3	Hinkosa L., et al; 2023 (36)	Ethiopia	Cross-sectional	221	164
4	Atuhairwe S., et al; 2023 (28)	Uganda	Cross-sectional	1,191	781
5	Sebazungu T., et al; 2023 (37)	Rwanda	Cross-sectional	250	92
6	Abebe BA., et al; 2022 (38)	Ethiopia	Cross-sectional	388	262
7	Mohammed U., et al; 2022 (39)	Ethiopia	Cross-sectional	471	348
8	Motuma VS., et al; 2022 (40)	Ethiopia	Cross-sectional	473	368
9	Atnafu E., et al; 2022 (41)	Ethiopia	cross-sectional	390	318
10	Tekle Lencha T., et al; 2022 (42)	Ethiopia	Cross-sectional	400	269
11	Baffour-Duah K., et al; 2022 (27)	South Africa	cross-sectional	12,006	8,941
12	Kalenga M., et al; 2022 (43)	Zambia	Cross-sectional	402	200
13	Fouelifack FY., et al; 2021 (44)	Cameroon	Cross-sectional	139	86
14	Muchie A., et al; 2021 (45)	Ethiopia	Cross-sectional	408	249
15	Teshome A., et al; 2021 (46)	Ethiopia	Cross-sectional	326	249
16	Agula C., et al; 2021 (47)	Ghana	Cross-sectional	251	47
17	Kayi EA., et al; 2021 (48)	Ghana	Cross-sectional	1,880	130
18	Wado YD., et al; 2021 (49)	Ethiopia	Cross-sectional	5,604	4,191
19	Satti I., et al; 2021 (50)	Sudan	Cross-sectional	1,077	223
20	Asubiojo B., et al; 2021 (51)	Tanzania	Cross-sectional	189	59
21	Malel ZJ., et al; 2021 (52)	South Sudan	Cross-sectional	285	22
22	Baynes C., et al; 2021 (16)	Tanzania	Cross-sectional	412	72
23	Atiglo DY., et al; 2020 (53)	Ghana	Cross-sectional	158	57
24	Salifu MG., et al; 2020 (54)	Ghana	Cross-sectional	3,039	1,130
25	Idris IM., et al; 2020 (55)	Eritrea	Cross-sectional	250	66
26	Madoué G., et al; 2020 (56)	Chad	Cross-sectional	135	81
27	Abate E., et al; 2020 (57)	Ethiopia	Cross-sectional	423	274
28	Millimouno TM., et al; 2019 (58)	Guinea	Cross-sectional	426	388
29	Pfitzer A., et al; 2019 (59)	Guinea	Cross-sectional	4,544	3,315
30	Abebe AM., et al; 2019 (60)	Ethiopia	Cross-sectional	118	99
31	Mekuria A., et al; 2019 (61)	Ethiopia	Cross-sectional	400	314
32	Stephens B., et al; 2019 (62)	Tanzania	Cross-sectional	8,230	6,636
33	Mutua MM., et al; 2019 (15)	Kenya	Cross-sectional	2,568	1,424
34	Makenzius M.; 2018 (63)	Kenya	Prospective-follow-up	810	609
35	Hagos G., et al; 2018 (64)	Ethiopia	Cross-sectional	409	290
36	Moges Y., et al; 2018 (65)	Ethiopia	Cross-sectional	400	246
37	Asrat M., et al; 2018 (66)	Ethiopia	Cross-sectional	552	500
38	Agaba MN. 2018 (67)	Uganda	Cross-sectional	307	238
39	Kassahun M.; 2017 (68)	Ethiopia	Cross-sectional	459	316
40	Chukwumalu K., et al; 2017 (69)	Somalia	Cross-sectional	1,111	955
41	Abamecha A., et al; 2016 (70)	Ethiopia	Cross-sectional	399	241
42	Erko EK., et al; 2016 (71)	Ethiopia	Cross-sectional	184	129
43	Onyebule OA., et al; 2016 (72)	Nigeria	Cross-sectional	480	383
44	Ibrahim WH., et al; 2015 (73)	Egypt	Quasi-experimental	276	77
45	Maxwell L., et al; 2015 (74)	Ghana	Cross-sectional	29,056	18,761
46	Rominski SD., et al; 2015 (75)	Ghana	Cross-sectional	612	341
47	Uwera J.; 2015 (76)	Kenya	Cross-sectional	174	106
48	Kokeb L., et al; 2015 (77)	Ethiopia	Cross-sectional	414	245

Post-abortion contraceptive uptake in Africa

In this systematic review encompassing 48 studies, the proportion of women using post-abortion contraceptives (PAC) varies significantly, with rates ranging from 6.92% in Ghana (48) to 91.08% in urban Guinea (58). The pooled prevalence of PAC

uptake was found to be 58.78% (95% CI: 52.36–65.21). The I^2 statistics indicated substantial heterogeneity ($I^2 = 99.8\%$, 95% CI: 99.2%–99.9%; $P < 0.001$) (Figure 2) Cochran's Q statistic was 20,014.24, with a p -value < 0.001 , and the overall effect test yielded a z of 17.930 ($p < 0.001$). Consequently, subgroup analysis based on country, study design, sample size, and sub-region within Africa was performed to identify the sources of heterogeneity.

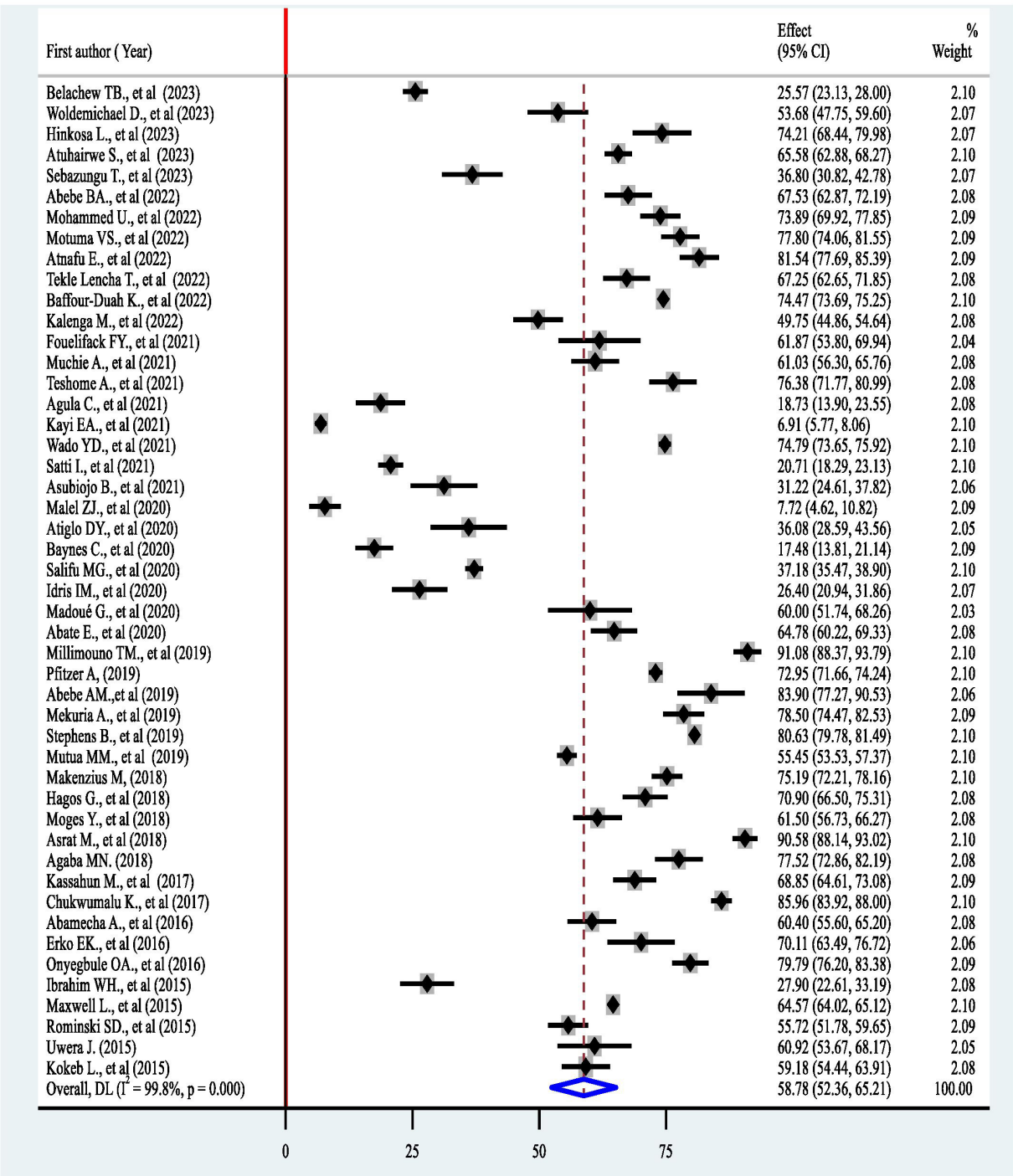


FIGURE 2
The pooled prevalence of postabortion contraceptive use in Africa.

Sub-group analysis

The subgroup analysis was performed using the following variables: country, sub-African regions, publication period, and sample size. According to the subgroup analysis by country, the highest prevalence of post-abortion contraceptive uptake (85.96%) was in Somalia, followed by 81.98% in Guinea, while the lowest

was 7.72% in South Sudan, followed by 20.71% in Sudan. The country-level I^2 statistics revealed heterogeneity between studies from the same countries ($p < 0.001$). On the other hand, the subgroup analysis of the Sub-African region showed the highest post-abortion contraceptive uptake in the southern African region (62.23%, 95% CI: 38.01–86.46) and the lowest in the West African region (51.48%, 95% CI: 32.35–70.61). However, a significant

difference was not observed between the sub-African region. Regarding the sample size, heterogeneity was not observed among the three groups of samples: samples below or equal to 400, 400–1,000, or more than 1,000 ($p=0.250$). However, there was heterogeneity within the groups in each sample (Table 2).

Publication bias

The funnel plot (Figure 3) and bias coefficient (Egger's test; $b = -0.096$, 95% CI = 0.372–0.180, $P = 0.489$) for studies published on contraceptive uptake among post-abortion women in Africa indicated no publication bias or small study effect present (Figure 3).

Sensitivity analysis

To further investigate the sources of heterogeneity in the pooled prevalence of post-abortion contraceptive use in Africa and to ensure its robustness, we execute a sensitivity analysis. According to the sensitivity analysis result, post-abortion contraceptive uptake in Africa varied between 59.92% following the removal of Kayi EA., et al. (2021) (48) and 58.09% following the removal of Millimouno

TM, et al. (2019) (58). Based on this analysis, the pooled prevalence of PAC uptake was robust and had no strong evidence that showed a single study influence (Table 3).

Types of post-abortion contraceptive use

Of a total of 48 studies, 28 (58.3%) examined the types of modern contraceptives that women received after undergoing an abortion. The pooled prevalence of post-abortion modern contraceptive uptake in these studies was 62.01%. Among the participants, 32,705 (38.84%) received short-acting modern contraceptive methods, while 19,510 (23.17%) received long-acting modern contraceptive methods. Notably, more than half of the post-abortion contraceptive users received injectables, 16,892 (20.06%) or implants, 14,113 (16.76%) (Table 4).

Factors associated with post-abortion contraceptive uptake

The meta-analysis was performed on 29 of the included articles and included 11 identified potential predictor variables. The

TABLE 2 Subgroup analysis of postabortion contraceptive use in Africa.

Subgroup	No. of included studies	Total sample size	Prevalence (95% CI)	Heterogeinity statistics		
				Cochran's Q	I ²	P value
By country				4,124.67		<0.001
Ethiopia	21	13,947	68.68 (61.27–76.08)	1,821.16	98.9%	<0.001
Uganda	02	1,498	71.39 (59.69–83.10)	18.86	94.7%	<0.001
Rwanda	01	250	36.80 (30.82–42.78)	–	–	–
South Africa	01	12,006	74.47 (73.69–75.25)	–	–	–
Zambia	01	402	49.75 (44.86–54.64)	–	–	–
Cameroon	01	139	61.87 (53.80–69.95)	–	–	–
Ghana	06	34,996	36.54 (9.74– 63.33)	8,431.67	99.9%	<0.001
Sudan	01	1,077	20.71 (18.29–23.13)	–	–	–
Tanzania	03	8,831	43.15 (4.76–91.06)	1,265.58	99.8%	<0.001
South Sudan	01	285	7.72 (4.62–10.82)	–	–	–
Eritrea	01	250	26.40 (20.94–31.86)	–	–	–
Chad	01	135	60.00 (51.74–68.26)	–	–	–
Guinea	02	4,970	81.98 (64.21–99.74)	–	–	–
Kenya	03	3,552	63.89 (49.24–78.55)	119.27	98.3%	<0.001
Somalia	01	1,111	85.96 (83.92–88.00)	–	–	–
Nigeria	01	480	79.79 (76.20–3.38)	–	–	–
Egypt	01	276	27.90 (22.61–33.19)	–	–	–
By Sub-African region				88.63		<0.001
East Africa	34	30,801	61.30 (53.93–68.67)	7,290.24	99.5%	<0.001
West Africa	09	40,446	51.48 (32.35–70.61)	10,162.00	99.9%	<0.001
North Africa	01	276	58.78 (52.36–65.21)	–	–	–
Central Africa	02	274	60.96 (55.18–66.73)	0.10	0.00	0.751
Southern Africa	02	12,408	62.23 (38.01–86.46)	95.82	99.9%	<0.001
By sample size				2.77		0.250
≤400	22	5,912	55.46 (44.42–66.50)	2,117.58	99.0%	<0.001
400–1,000	14	6,751	66.89 (56.33–77.45)	1,501.53	99.1%	<0.001
>1,000	12	71,542	55.41 (42.57–68.25)	15,825.54	99.9%	<0.001
Publication period				10.01		0.002
2015–2019	21	51,929	70.19 (65.28–75.10)	2,377.95	99.2%	<0.001
2020–2023	27	32,276	49.97 (38.44–61.49)	14,417.10	99.8%	<0.001

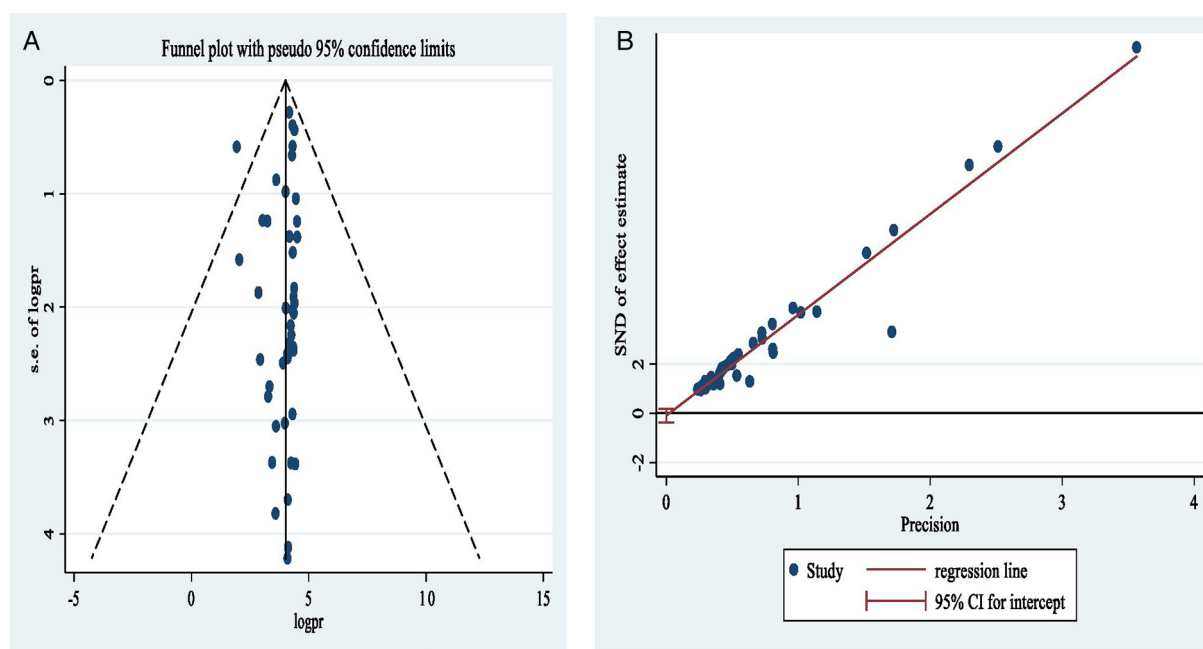


FIGURE 3
Funnel plot (A) and Egger's publication bias plot (B) of the logit event rate postabortion contraceptive uptake in Africa.

findings revealed that women who attended formal education (OR = 1.46, 95% CI = 1.03, 2.07), were married and/or in union (OR = 1.48, 95% CI = 1.01, 2.18), had awareness the period of fertility (OR = 1.72, 95% CI = 1.14, 2.59), were counseled about contraceptives (OR = 3.40, 95% CI = 1.82, 6.35), did not desire to become pregnant (OR = 3.08, 95% CI = 1.74, 5.44), had a history of contraceptive use ($R = 4.35$, 95% CI = 2.55, 7.42), and had contraceptive knowledge (OR = 2.30, 95% CI = 1.41, 3.76) had a statistically significant combined effect on post-abortion contraceptive uptake, with an overall effect of $P < 0.05$. However, residence, history of abortion, trimester of current abortion, and gravidity did not have significant combined effects on postabortion contraceptive use (Table 5).

Discussion

Africa is a continent that has a high number of the least safe abortion service categories (78) and low accessibility and quality of family planning programs (79, 80). The provision of post-abortion contraceptive services is among the comprehensive abortion care packages that help to improve the health and well-being of women and reduce the repeated burden of abortion and related complications. To the best of the authors' knowledge, this study is the first to assess the predictors of postabortion contraceptives in Africa.

In this systematic review, 58.78% (95% CI: 52.36–65.21) of post-abortion contraceptive uptake was reported, which suggests that a potentially high impact could be expected on the risk of unintended pregnancy that will cause recurrent abortion.

A similar finding was reported in a systematic review performed in Eastern Africa (67.86, 95% CI: 63.59, 72.12) (30) and Ethiopia (63.64%, 95% CI: 57.75–69.53) (29). However, the current finding was lower than that of a study performed in India (81%) (81), Nepal (79%) (82), the pooled prevalence of eight low-income countries (73%) (83), and 10 sub-Saharan and Asian countries (77%) (31). The possible reasons might be differences in the accessibility and quality of comprehensive post-abortion care services, women's knowledge of contraceptives, and women's desire for childbirth. The women's level of awareness of the fertile period, previous exposure to any contraceptive method, and current marital status might also contribute to the aforementioned differences.

According to our subgroup analysis, the lowest post-abortion contraceptive uptake was reported in South Sudan (7.7%) and Sudan (20.7%), and the highest was reported in Somalia (86%) and Guinea (82%). The reason for this great disparity in post-abortion contraceptive uptake between different countries could be the difference in national abortion and contraceptive strategies. The population culture, religion, population policy, and population stability of each country also have impacts on these differences.

According to the publication period, articles published before 2020 had a higher pooled prevalence of post-abortion contraceptive uptake (70.19%) than did articles published after 2020 (49.97%). A possible reason might be the influence of COVID-19. In the era of COVID-19, most health systems became fragile, and most routine health services were interrupted; the provision of contraceptive services was affected by the COVID-19 pandemic (84). One study revealed that at the

TABLE 3 Sensitivity analysis of pooled prevalence postabortion contraceptive use with a 95% in Africa for a single study was omitted.

Study omitted	Estimate	95% CI
Belachew TB., et al. (2023) (34)	59.5	53.10, 65.90
Woldemichael D., et al. (2023) (35)	58.89	52.39, 65.40
Hinkosa L., et al. (2023) (36)	58.46	51.96, 64.96
Atuhairwe S., et al. (2023) (28)	58.64	52.10, 65.18
Sebazungu T., et al. (2023) (37)	59.25	52.76, 65.74
Abebe BA., et al. (2022) (38)	58.6	52.10, 65.11
Mohammed U., et al. (2022) (39)	58.46	51.95, 64.97
Motuma VS., et al. (2022) (40)	58.38	51.87, 64.89
Atnafu E., et al. (2022) (41)	58.3	51.79, 64.80
Tekle Lencha T., et al. (2022) (42)	58.6	52.09, 65.11
Baffour-Duah K., et al. (2022) (27)	58.45	51.53, 65.36
Kalenga M., et al. (2022) (43)	58.98	52.47, 65.48
Fouelifack FY., et al. (2021) (44)	58.72	52.23, 65.22
Muchie A., et al. (2021) (45)	58.74	52.23, 65.25
Teshome A., et al. (2021) (46)	58.41	51.90, 64.92
Agula C., et al. (2021) (47)	59.63	53.18, 66.09
Kayi EA., et al. (2021) (48)	59.92	55.10, 64.74
Wado YD., et al. (2021) (49)	58.44	51.74, 65.14
Satti I., et al. (2021) (50)	59.6	53.24, 65.96
Asubiojo B., et al. (2021) (51)	59.36	52.88, 65.85
Malel ZJ., et al. (2020) (52)	59.88	53.55, 66.20
Atiglo DY., et al. (2020) (53)	59.26	52.77, 65.75
Baynes C., et al. (2020) (16)	59.67	53.24, 66.09
Salifu MG., et al. (2020) (54)	59.25	52.78, 65.71
Idris IM., et al. (2020) (55)	59.47	52.99, 65.95
Madoué G., et al. (2020) (56)	58.76	52.26, 65.26
Abate E., et al. (2020) (57)	58.66	52.14, 65.17
Millimouno TM., et al. (2019) (58)	58.09	51.62, 64.57
Pfitzer A., (2019) (59)	58.48	51.81, 65.15
Abebe AM., et al. (2019) (60)	58.26	51.76, 64.75
Mekuria A., et al. (2019) (61)	58.36	51.86, 64.87
Stephens B., et al. (2019) (62)	58.31	51.65, 64.98
Mutua MM., et al. (2019) (15)	58.85	52.27, 65.44
Makenzius M., (2018) (63)	58.43	51.91, 64.96
Hagos G., et al. (2018) (64)	58.53	52.01, 65.04
Moges Y., et al. (2018) (65)	58.73	52.23, 65.24
Asrat M., et al. (2018) (66)	58.1	51.63, 64.58
Agaba MN. (2018) (67)	58.39	51.88, 64.89
Kassahun M., et al. (2017) (68)	58.6	52.06, 65.08
Chukwumalu K., et al. (2017) (69)	58.2	51.70, 64.70
Abamecha A., et al. (2016) (70)	58.75	52.24, 65.26
Erko EK., et al. (2016) (71)	58.55	52.04, 65.05
Onyegbule OA., et al. (2016) (72)	58.33	51.83, 64.84
Ibrahim WH., et al. (2015) (73)	59.44	52.96, 65.92
Maxwell L., et al. (2015) (74)	58.66	51.15, 66.16
Rominski SD., et al. (2015) (75)	58.85	52.33, 65.36
Uwera J. (2015) (76)	58.74	52.24, 65.24
Kokeb L., et al. (2015) (77)	58.78	52.27, 65.28

time of the COVID-19 lockdown, women's access to contraception decreased from 70% to 60% (85). Moreover, the changing focus of the government health system and nongovernmental organizations in addressing the newly emerging and re-emerging diseases and other primary health care activities makes the provision of postabortion family planning services more challenging (86, 87).

Approximately two-thirds (64.10%, 95% CI: 53.56–74.65) of the post-abortion contraceptive acceptors used short-acting

TABLE 4 Pooled prevalence of postabortion contraceptive use by method type in Africa.

Types of postabortion contraceptives	Pooled prevalence (95% CI)	I-squared
Short-acting	38.84 (30.82, 46.86)	99.8%, $P < 0.001$
Injectable	20.06 (11.37, 28.75)	99.8%, $P < 0.001$
Pills	11.72 (9.03, 14.41)	97.9%, $P < 0.001$
Condom	3.72 (1.24, 6.20)	97.5%, $P < 0.001$
Others	3.52 (0.37, 6.68)	98.5%, $P < 0.001$
Long-acting	23.17 (14.48, 31.86)	99.8%, $p < 0.001$
Implants	16.76 (9.9623.46)	99.7%, $P < 0.001$
Intra-Uterine Devices (IUDs)	6.44 (3.72, 9.16)	97.9%, $p < 0.001$
Sterilization	0.22 (−0.12, 0.56)	0.00%, $P = 1.00$

contraceptives. Among the specific contraceptive methods used, the most widely used contraceptive methods were injectables (30.27%, 95% CI: 18.96–41.57), followed by implants (25.13%, 95% CI: 16.75–33.51), oral contraceptive pills (22.34%, 95% CI: 16.76–27.92), IUDs (10.47%, 95% CI: 7.17–13.77), and male condoms (6.78%, 95% CI: 3.00–10.55%). Sterilization was the least used contraceptive method; only 0.34% of women used it. These findings are similar to those of studies performed in Nepal, East Africa, and developing countries (30, 82, 83). However, the current findings were different from those of a study performed in Atlanta, USA; 56% of post-abortion women used IUDs, implants, or sterilization (88). In a study done in China, approximately half of the participants used long-acting post-abortion contraceptives, and the three most utilized types of contraceptives were condoms (41.3%), IUDs (40.3%), and sterilization (9.2%) (89). This difference might be due to differences in participants' knowledge of effective and safe contraceptives, the quality of counseling, or the availability of different contraceptive methods. Most women in developing countries, including Africa, face many challenges in using the most preferred contraceptive method; inadequate trained providers, limited contraceptive method mix availability, and stockouts are among them (86, 90). In addition, participants' myths and misconceptions about each contraceptive method type and provider attitude and skill in delivering the service would have an impact on the aforementioned differences.

According to the results of this systematic review and meta-analysis, women who attended formal education had greater odds of using post-partum contraceptives than women who did not. These findings were supported by other studies (91–94). This might be because education has the power to increase women's contraceptive knowledge and attitudes (95). On the other hand, contraceptive knowledge and attitudes have an impact on the use of postabortion contraceptives. In this study, women who had contraceptive knowledge had higher odds of using post-abortion contraceptives. Other previous studies performed in the USA, China, and Singapore also supported these findings (96–98).

Like in other previous studies (29, 30, 99–101), the pooled odds ratio of post-abortion contraceptive uptake was greater among women who received post-abortion contraceptive counseling than among those who did not receive it. This is because counseling

TABLE 5 Factors associated with postabortion contraceptive use in Africa.

Variables	PAFP use		AOR (95% CI)	Overall effect (<i>P</i> -value)	Number of studies	References (<i>p</i> < 0.05)	References (<i>p</i> > 0.05)
	Yes, <i>n</i> (%)	No, <i>n</i> (%)					
Residence (<i>n</i> = 5,356)				0.209	07	(40, 41)	(37, 54, 55, 61, 66)
Rural	756	740	1.00				
Urban	2,032	1,828	1.44 (0.81, 2.55)				
Marital status (<i>n</i> = 10,067)				0.101	21	(37, 40–44, 51, 54, 60, 61, 63, 65, 66, 70, 71, 76, 77)	(38, 55, 67, 68)
In-union	3,390	2,364	1.48 (1.01, 2.18)				
Not in Union	2,445	1,868	1				
Attend formal education (<i>n</i> = 13,456)				0.033	14	(40, 45, 49, 65)	(39, 41, 43, 54, 55, 66, 68, 70, 76, 77)
Yes	6,913	4,035	1.46 (1.03, 2.07)				
No	1,753	894	1				
Knowing fertile period (<i>n</i> = 3,848)				0.010	03	(54, 64)	(61)
Yes	1,331	1,779	1.72 (1.14, 2.59)				
No	403	335	1				
Counseled about contraceptives (<i>n</i> = 6,627)				<0.001	16	(28, 35, 36, 38–40, 42, 43, 45, 60, 65, 68, 70, 73, 77)	(46)
Yes	3,028	1,265	3.40 (1.82, 6.35)				
No	1,213	1,121	1				
Have pregnancy desire (<i>n</i> = 1,951)				<0.001	05	(40, 41, 73)	(43, 61)
Yes	507	401	1				
No	755	288	3.08 (1.74, 5.44)				
Have abortion history (<i>n</i> = 5,191)				0.592	14	(35, 40–42, 45, 64, 68, 70)	(43, 44, 55, 61, 66, 67)
Yes	1,302	672	1.14 (0.71, 1.82)				
No	2,205	1,012	1				
Have a history of contraceptive use (<i>n</i> = 3,878)				<0.001	12	(36, 40–43, 60, 61, 65, 71)	(37, 51, 68)
Yes	1,800	618	4.35 (2.55, 7.42)				
No	732	728	1				
Gravidity (<i>n</i> = 7,990)				0.991	7	(41, 42, 49, 55, 63, 64)	(44)
Primi gravida	2,405	822	1.00 (0.61, 1.63)				
Multi Gravida	3,423	1,340	1				
Trimester of current abortion (<i>n</i> = 32,927)				0.263	8	(44, 49, 61, 74)	(38, 43, 51, 55)
1st (<12 weeks)	19,741	8,978	1.21 (0.87, 1.67)				
2nd (>12 weeks)	2,346	1,862	1				
Have contraceptive knowledge (<i>n</i> = 3,241)				0.001	9	(35, 36, 38, 41–43)	(39, 67, 68)
Yes	1,496	629	2.30 (1.41, 3.76)				
No	702	414	1				

has the power to change the behavior of individuals by addressing the unique perceptions and attitudes of women through the use of person-centered, well-structured counseling approaches (100, 102, 103). Postabortion contraceptive counseling can enable women to make informed decisions about their fertility. In addition, counseling can enable women to understand the period of fertility (a period at risk for conception) (104). In this study, women who were aware of the fertility period had higher pooled odds of using postabortion contraceptives than women who were not aware of this period.

In this study, a history of contraceptive use was positively associated with post-abortion contraceptive use. These findings are supported by previous studies performed in Eastern Africa, Pakistan, and Nepal, as well as a systematic review performed in Ethiopia (29, 30, 101, 105). As a result of being exposed to family planning services, women would develop a positive lived

experience with different contraceptives, and they are less affected by different contraceptive myths and misconceptions. A study in Nigeria revealed that women with lower misconception scores were significantly more likely to use modern contraceptives (106, 107). Moreover, women who have a history of contraceptive use have better information about the service than women who do not; this might have a positive effect on the use of current postabortion contraceptives. A study performed in Colombia reported a history of contraceptive use as an enabler of current contraceptive use (108).

The desire for pregnancy is another important variable that is significantly associated with postabortion contraceptive uptake; the pooled odds ratio of post-abortion contraceptive uptake was greater among women who did not desire pregnancy than among their counterparts. This was similar to the findings of a study performed in China (98). However, in a study performed in Brazil, planning

of pregnancy and fertility desire were not significantly associated with postabortion contraceptive uptake (104).

Limitations of the study

This systematic review and meta-analysis have some limitations; the study didn't report the pooled prevalence of post-abortion contraceptive uptake among women who had a demand for contraceptives separately due to the unavailability of clearly stated data from the included studies. Additionally, many of the included studies were cross-sectional, which restricts the ability to infer cause-and-effect relationships due to the simultaneous measurement of exposure and outcome. While the application of the random effect model is appropriate for accounting for study variability, this approach can lead to wide confidence intervals and may not fully address the underlying sources of heterogeneity. Consequently, the pooled prevalence estimate should be interpreted considering these methodological constraints.

Conclusion

Post-abortion contraceptive uptake in Africa is low; among five women, two leave the facility without modern contraceptives. Even this figure reaches 50% or more in studies published after 2020. The main predictors identified for post-abortion contraceptive uptake were attending formal education, marital status, knowledge of the fertility period, post-abortion contraceptive counseling, history of contraceptive use, desire for pregnancy, and contraceptive knowledge. Therefore, efforts should be made to strengthen post-abortion counseling, women's education, and awareness creation about the period of fertility and contraceptives. Moreover, strengthening awareness creation programs for post-abortion women to postpone the desire for pregnancy at least six months after termination of pregnancy is paramount to reduce the cycling of abortion. These findings might also provide useful information for policymakers and programmers in developing policy briefs and evidence-based intervention modalities to improve post-abortion contraceptive use in low-income countries.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

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Author contributions

GD: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MA: Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fgwh.2025.1478797/full#supplementary-material>

SUPPLEMENTARY FILE S1
Searching strategy.docx.

SUPPLEMENTARY FILE S2
Data base.xlsx.

SUPPLEMENTARY FILE S3
PRISMA_2020_checklist.docx.

SUPPLEMENTARY FILE S4
Forest plot of the subgroup analysis.docx.

SUPPLEMENTARY FILE S5
Forest-polt of factors for PAC use in Africa.docx.

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