Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

The impact of a package of community- and facility-level activities on adolescent engagement with sexual and reproductive health services in West Africa: An interrupted time series analysis

Wendtoe Sara Compaore
The Hospital for Sick Children
Mariame O. Ouedraogo
The Hospital for Sick Children
Fousseny Konde
Save the Children International - Mali Country Office
Modupe Taiwo
Save the Children International - Sierra Leone Country Office
Ousmane Maiga
Save the Children International - Mali Country Office
Ousmane Nayaya
Save the Children International - Niger Country Office
Davyd Zombre
Not affiliated
Katie Mclaughlin
The Hospital for Sick Children
Ashley Vandermorris
The Hospital for Sick Children
Diego Bassani
diego.bassani@utoronto.ca

The Hospital for Sick Children

Research Article

Keywords: Adolescents, Sexual and Reproductive Health, Health Services Use, Mali, Niger, Sierra Leone, Interrupted time series analysis

Posted Date: May 12th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9590273/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: The authors declare no competing interests.

Abstract

Introduction:

West Africa has some of the highest adolescent fertility rates, underscoring the need for enhanced support for adolescent girls' sexual and reproductive health and rights (SRHR). This study assesses the effectiveness of a SRHR-focused project implemented since 2022 in Mali, Niger, and Sierra Leone in improving adolescent girls' use of key facility-based SRHR services.

Methods

We employed an interrupted time-series analysis, using routine data records from project-supported facilities on monthly use of antenatal care (ANC) and contraceptive services by adolescent girls from January 2019 to March 2025. We analyzed trends in these services after the start of community- and facility-level activities and over time, adjusting for key control variables. To contextualize the findings, we held interpretation workshops with key stakeholders.

Results

Project activities were followed by significant changes in the use of ANC and contraceptive services in Mali and Sierra Leone, but not in Niger. After implementation of community activities, average adjusted-monthly increases were observed in Mali for first ANC visits (2%), new contraceptive users (3%), and continuing contraceptive users (10%), while in Sierra Leone, continuing contraceptive use increased by 15% monthly. Contrastingly, after the initiation of facility-level activities, significant monthly decreases of 3% and 7% in first ANC visits were observed in Mali and Sierra Leone, respectively, while new users of contraception declined 5% monthly in Mali. Qualitative interviews suggest a perceived decline in adolescent pregnancy rates following project activities as well as a reported increase in community-based access to contraceptives among adolescents, which was not captured in the facility-level data.

Conclusions

While the project's community- activities were associated with increases in adolescent girls' use of services, facility-level activities were associated with declines in both ANC and contraceptive services. To better understand how multi-level interventions affect adolescent SRHR, further research that integrates quantitative and qualitative approaches is required.

KEY MESSAGE

What is already known on this topic?

- SRHR sensitization activities with adolescents, combined with community-level awareness-raising, can effectively increase adolescent girls' engagement with SRHR services.
- Provider training and facility equipment upgrades are effective in improving the quality of SRHR services provided to adolescents.
- Mixed-methods evidence on the combined impact of community- and facility-level interventions for adolescent girls remains scarce, especially in West Africa.

What does this study add?

- Changes in adolescent utilization of antenatal care and contraception followed the initiation of community and facility activities.
- Study findings were interpreted through participatory discussions with adolescents, providers, and key stakeholders.
- Trends in adolescent utilization of services were influenced by many contextual factors, structural barriers at the health system level, and provider attitudes.

How might this study affect research, practice, or policy?

- Findings demonstrated that both adolescent and community sensitizations, as well as privacy and confidentiality of healthcare services are important for adolescent engagement with healthcare services
- The findings highlighted that, despite targeted programming, many persistent barriers impact adolescent engagement with healthcare services, which may require system-level interventions
- Data limitations highlighted the importance of improving records availability in healthcare facilities, for monitoring and surveillance purposes

INTRODUCTION

Sexual and reproductive health and rights (SRHR) are essential for enhancing population health, advancing gender equality, and fostering economic development.[1] They encompass a broad spectrum of services, including access to contraception, maternal health care, prevention and treatment of sexually transmitted infections (STIs), prevention and care for survivors of gender-based violence, and education on safe and healthy relationships.[1] Despite their critical importance, SRHR remain insufficiently prioritized in Sub-Saharan Africa, particularly for adolescent girls aged 10–19 years. In the region, one in four adolescent girls gives birth to their first child before the age of 18, and up to half of these pregnancies are unintended.[2–4] This is compounded by persistently high unmet need for contraception among adolescents wishing to delay childbirth, averaging 55%, alongside elevated rates of unsafe abortion, gender-based violence, and STIs.[4] Maternal health service utilization also remains suboptimal: only 33% to 53% of pregnant adolescents attend four or more antenatal care (ANC) visits, and 41% to 65% deliver with a skilled birth attendant,[7] placing them at heightened risk of preventable pregnancy and birth complications[2, 8].

Adolescence is a period of significant physical, psychosocial, and emotional changes, which increases the risks and vulnerabilities of adolescent girls to poor SRHR outcomes compared to their adult counterparts.[9] Their ability to exercise their SRHR is shaped by individual factors such as socio-economic status, place of residence, marital status, and decision-making power, as well as broader social and cultural norms, including stigma around adolescent sexuality.[3, 4, 6, 10–16] At the health system level, the lack of privacy and confidentiality, as well as providers' negative attitudes, remain major obstacles to adolescents' willingness and ability to use SRHR services. In some settings, the legal and policy frameworks also do not clearly define adolescents' rights to access comprehensive SRHR information and services.[17, 18]

The African Charter on Human and Peoples' Rights on the Rights of Women in Africa (commonly referred to as "The Maputo Protocol") reflects the strong continent-wide commitment to advancing African adolescent girls' access to quality SRHR information and services.[19, 20] It emphasizes the importance of age-appropriate and culturally sensitive services, alongside parental and community involvement. However, progress towards ratification and implementation has been uneven, constrained by limited resources, competing national priorities, weak health systems, and restrictive socio-cultural and legal environments.[18] Substantial efforts are therefore still required to strengthen adolescent girls' awareness of, demand for, and access to quality SRHR services.

Evidence to date show that in-school and out-of-school activities with adolescents combined with community-level awareness-raising, can increase adolescents' engagement with SRHR services by shifting norms, improving knowledge, and fostering open communication with parents and partners.[21] However, raising awareness alone is insufficient to increase SRHR service uptake[22]. The greatest gains occur when these community-level efforts are paired with facility-level quality improvements, such as training healthcare workers and establishing adolescent-friendly spaces, which help address supply-side barriers, including negative provider attitudes and privacy concerns.[23, 24] Such integrated, multi-level interventions have demonstrated effectiveness in increasing adolescents' use of contraceptive services, STI/HIV counselling and treatment, and maternal health services.[23, 25–31]

Despite this, evidence on the combined effect of community- and facility-level interventions for adolescent girls remains limited, and most existing studies have focused on Eastern and Southern Africa, leaving a critical gap in understanding the implementation and impacts of such activity packages for adolescent girls' SRHR in West Africa, a region characterized by higher adolescent fertility rates and distinct socio-cultural norms that influence adolescent girls' access to and uptake of SRHR services.[18]

To address this gap, the Strengthening Adolescent Girls' Sexual and Reproductive Health (FOUNDATIONS) project was implemented in Mali, Niger, and Sierra Leone, beginning in 2021. This multi-country initiative seeks to support the most vulnerable adolescent girls in exercising their SRHR through a comprehensive package of supply, demand, and advocacy interventions.

This study evaluates the impact of the project's community- and facility-level activities on adolescent girls' use of ANC and contraceptive services across three diverse West African contexts and qualitatively explores the factors influencing these outcomes. Through this work, we contribute context-specific evidence to inform future policy and programming aimed at improving adolescent girls' SRHR in the region.

METHODS

Study setting

The study was conducted in the three countries supported by the project: Mali, Niger, and Sierra Leone.[32] In Mali, the supported health districts are Kadiolo, Koutiala, Kignan, Niéna, and Sikasso (Figure A1). Across the health districts, a total of 144 community (CSCom) and 5 referral (CSRef) healthcare centers were targeted by the project, out of which 57 were randomly selected for the study. Selection probability was proportional to district size but excluded areas that posed heightened security risks. In Niger, the project covers 30 integrated healthcare centers (CSIs), within the districts of Aguié, Tessaoua, Maine Soroa, and Diffa; 23 CSIs were included in this study, while 7 were excluded post-selection due to the inaccessibility stemming from the insecurity. In Sierra Leone, the program covers 39 Peripheral Healthcare Units (PHUs) in Kailahun district.

Program description

The Strengthening Adolescent Girls' Sexual and Reproductive Health project (2021–2027) seeks to improve access to sexual and reproductive health care for marginalized and vulnerable people, particularly adolescent girls and women, by implementing integrated, multi-level, evidence-based interventions across three pillars: demand, supply, and advocacy (Table A1). The demand pillar delivers interventions to empower adolescent girls in SRHR decision-making through community activities, including sensitizations and community mobilization. The supply pillar supports adolescent-friendly healthcare services by building capacity among providers, including community-based health workers, and upgrading health service equipment and infrastructure. The advocacy pillar focuses on strengthening the effectiveness of stakeholders for evidence-based advocacy. In all three countries, project implementation started with the community-level and advocacy pillars, with facility-level activities initiated months later. Implementation was gradual throughout the observation period with ongoing community, advocacy, and facility-level project activities eventually running concurrently. For this study, we focused on community- and facility-level interventions.

The change theory of the project posited that as community activities increase agency in the utilization of SRHR services among adolescents, and adolescents' impressions of service quality in healthcare facilities improve, there would be increased attendance and retention of adolescents within healthcare services over time. Given that program implementation started with community-level activities, evidence supports that over time, an increase in contraceptive service attendance by adolescents would be observed as a result of their implementation. This might later be reflected in a decreased demand for ANC services as suggested by past studies.[21] As facility activities are implemented, we anticipate an additional long-term increase in adolescent SRHR service attendance, and particularly their retention within health facilities. In alignment with previous evidence that the quality of contraceptive services can positively affect service utilization, we hypothesized that as health facilities improve their capacity to offer adolescent-friendly, respectful and high-quality SRHR services, there would be an observable increase in the monthly numbers of adolescent clients receiving contraceptive methods.[37]

Study design, data sources, and participants

We employed an interrupted time series analysis, a quasi-experimental study design, leveraging routine administrative data from project-supported healthcare facilities to investigate the impact of project activities on service uptake and utilization among adolescent girls. We specifically extracted data on the number of adolescent girls receiving specific SRHR services in project-supported facilities directly from the health facilities' registers, monthly reports, and the District Health Information System 2 (DHIS2) platform. We extracted SRHR service utilization data over 75 months, from January 2019 to March 2025. Adolescent girls were defined as girls aged 10 to 19 years (except in Niger, where we restricted to 15- to 19-year-olds due to ethics approval restrictions). In addition to extracting data on the use of SRHR services by adolescent girls, we held interpretation workshops with key stakeholders to contextualize the findings emerging from the SRHR service utilization data.

Study variables

Outcome variables

The outcome variables of interest were the use of antenatal care (ANC) and modern contraceptive services in project-supported health facilities. These variables were selected due to their suitability as proxy measures of adolescents' engagement with healthcare services. In particular, we examined the coverage of first and fourth ANC visits by pregnant adolescents, as well as new and continuing adolescent girl users of contraceptive services.

Exposure variables

To assess the changes in the outcome variables following project activities, we considered four main exposure time points (or interruptions). These were identified using the program implementation calendar and included the timing of the COVID-19 pandemic given its impact on the utilization of healthcare services. [38–40] They included: (1) the declaration of the COVID-19 pandemic by the World Health Organization in March 2020, (2) the initiation of community-level activities, (3) the initiation of facility-level activities and (4) the most complete community-level package – defined as the point in time when the most recent output for community-level activities had been initiated to assess a dose response. Precise information on the implementation of program activities (i.e., month/year of implementation and the number of beneficiaries) was reported retrospectively by in-country implementation partners. Due to data limitations, the impact of the COVID-19 pandemic could not be investigated in Niger, and the most complete package could not be investigated in Sierra Leone.

Control variables

The following contextual and environmental variables were included for adjustments in the analyses: the characteristics and catchment populations of healthcare facilities, the number and qualifications of healthcare workers, and geographical location. Due to their unavailability in the facility archives, for Niger

and Sierra Leone, catchment populations were estimated using the WorldPop population count datasets.[41] Geospatial datasets, including the following key environmental variables, were also included: mean temperature, aridity index, rurality, major insecurity events, and seasonality.[42–45] These variables were aggregated for the area corresponding to a 5km radius around health facilities for Niger and Mali, and a 5 to 15km radius in Sierra Leone, depending on facility type (i.e., 5km for maternal and child health posts, 8 km for health posts and 15km for community healthcare centers).[46]

Statistical analysis

Descriptive analysis

For each health facility, we obtained the monthly counts of adolescent girls using ANC and modern contraceptive services. We examined the distribution of outcome variables over time, with careful attention to missing values, duplicates, and outliers. Where possible, we used multiple data sources (i.e., facility registers, monthly reports, DHIS2) to obtain complete outcome data for the study period (i.e., January 2019 to March 2025). However, data gaps due to poor record archiving in health facilities, as well as the lack of age-disaggregated information, were also noted, particularly in Niger and Sierra Leone. When missing monthly data could not be recovered, we applied complete-case analysis, and facilities with extensive missing outcome data were excluded. Duplicate entries and monthly outliers (i.e., adolescent counts exceeding those reported for women 15–49 years) were removed. We summarized the outcomes using descriptive statistics (i.e., mean, standard deviation).

Statistical modelling

We employed a multilevel retrospective interrupted time-series (ITS) design, with integrated spline regressions. Due to type of data (i.e., count data) and overdispersion, negative binomial models were applied. The unit of analysis was the facility-month. We used mixed effects models to model the project activities' effects on each outcome with adjustments for the COVID-19 pandemic, facility characteristics and environmental variables, while incorporating facility-level variations in coefficients and intercepts. We examined the coefficients following each interruption, comparing post-interruption trends to those immediately preceding them. The basic equation for estimating the change in the outcome was:

$$Outcome_{ir} = \beta_0 + \beta_1 preCOV19 + \beta_2 duringCOV19 + (\beta_3)\, TrendCommunityActivities +$$

$$(\beta_4)\, TrendFacilityActivities \; + \; (\beta_5)\, MostCompleteCommunityActivities +$$

$$\sum_j \alpha_j \cdot \left(Immediate\, effects\right)_j + \sum_k \alpha_k \cdot \left(Covariates\right)_k + random \cdot \; intercept_i +$$

$$random \cdot \; effects(\beta_3,\, \beta_4)_i + residuals_i$$

Specifically, the coefficient (β_2) after the onset of COVID-19 was compared to the pre-COVID-19 period (β_1); the coefficient after the initiation of community activities (β_3) was compared to the preceding period (β_3); the coefficient after the start of facility activities (β_4) was compared to the period following initiation of community activities (β_3); and the coefficient after the implementation of the most complete community-

level package (β_5) was compared to the period following the initiation of facility activities. Immediate (α_j) and covariate (α_k) effects were assessed. Covariates referred to facility characteristics, environmental variables impacting service attendance, and parameters of time series, namely temperature, rurality, aridity index, seasonality, facility type, and district. The implementation status of each intervention component, and its number of beneficiaries, were also tested to assess the impact of specific project activities on trends. Models adjusted for the adolescent (10–19) population for contraception and the total population for ANC services, as estimates of adolescent pregnancy rates were unavailable. Coefficients were expressed as incidence rate ratios (IRRs) or incidence ratios (IRs) when the adolescent population-at-risk was unknown. The analyses were performed using Stata MP 19, R 4.5.1.

Qualitative interpretation

To contextualize the trends identified through the interrupted time-series analyses, we conducted interpretation workshops across the three study countries with key stakeholder groups, including local implementing partners, health care providers, decision-makers, and community representatives.

These workshops were audio recorded, and were transcribed using Microsoft Word's Transcribe feature. Research team members (WSC and MOO) reviewed and corrected the transcripts for accuracy. Anonymized transcripts were then imported into NVivo 15 for systematic analysis..

We applied an inductive thematic approach, which enabled the team to explore the data without imposing predefined categories and to surface themes, insights, and explanatory patterns emerging directly from stakeholder discussions. This approach strengthened our ability to link qualitative insights to the service-use trends observed in the interrupted time-series analysis. We focused on the explanatory factors underlying the quantitative trends, the contributions of specific project activities to observed changes, the contextual influences shaping implementation and outcomes, the barriers and facilitators to adolescent engagement with services, and stakeholder recommendations for strengthening future programming.

Ethics

Ethical clearance for the evaluation was granted by The Hospital for Sick Children Research Ethics Board (REB #: 2025-3243-33672), the Comité National d'Éthique pour la Santé et les Sciences de la vie (CNESS) of Mali (REB #: 2025-002 /MSDS-CNESS), the Comité National d'Éthique pour la Recherche en Santé (CNERS) of Niger (REB #: 09/2025/CNERS), and the Sierra Leone Ethics and Scientific Review Committee (REB #: 016/03/2025).

Health facility in-charges provided informed consent for their facility data to be collected. In Niger, ethics approval granted the research team access to data on adolescents aged 15 to 19 years, whereas in Mali and Sierra Leone, ethical clearance covered adolescents aged 10 to 19 years. Participants in the interpretation workshops provided informed consent.

Patient and public involvement

Patients were not included in this study.

RESULTS

Descriptive statistics

Across the 75 months of the study period, the average number of months with available data ranged from 24 to 27 months in Niger, 52 to 59 in Sierra Leone, and 73 in Mali (Table 1). Monthly averages for adolescent girls attending their first ANC visit were 9.0, 15.4, and 3.6 in Mali, Niger, and Sierra Leone, respectively. Four ANC visit attendance was consistently lower on average in the three settings. In Mali, the average monthly number of new adolescent girl users of modern contraceptives was 8.9, compared with 8.2 in Niger and 8.1 in Sierra Leone. The monthly number of continuing adolescent clients for contraceptive methods was lower. Summary characteristics on program activities and control variables are also presented in Table 1.

Table 1
Descriptive statistics by country of implementation

	Mali (57)	**Niger (23)**	**Sierra Leone (39)**
Facility type (N, %)			
Community healthcare center (CSCom)	52 (91.2)	-	-
Reference healthcare center (CSRef)	5 (8.8)	-	-
Integrated health centers (CSI)	-	23 (100.0)	-
Community healthcare center (CHC)	-	-	6 (15.4)
Community health post (CHP)	-	-	28 (71.8)
District hospital	-	-	1 (2.5)
Maternal community health post (MCHP)	-	-	4 (10.2)
Mean number of months with available data per facility (months)			
First antenatal care visits	73.3	26.6	59.3
Fourth antenatal care visits	73.3	25.0	58.4
First visit for contraception ('new users')	73.3	24.7	52.3
Follow-up Visit for Contraception ('continuing users')	73.2	23.6	52.6
Mean monthly number of clients by facility[a] (number, SD)			
Monthly average of adolescent first ANC consultations (mean (SD)	9.0 (7.4)	15.4 (6.7)	3.6 (2.1)
Monthly average of adolescent fourth ANC consultations (mean (SD)	3.2 (4.7)	4.6 (3.5)	2.8 (1.9)
Monthly average of adolescent girl new contraceptive users (mean (SD)	8.9 (9.7)	8.2 (5.2)	8.1 (7.2)
Monthly average of adolescent girl continuing contraceptive users (mean (SD)	3.3 (4.7)	6.3 (6.9)	1.6 (1.6)
Activities in Healthcare Facilities (number, SD or %)			
Mean number of providers trained or coached	3.0 (0.7)	3.1 (4.6)	1.2 (1.0)
Mean number HWs having received clinical training	2.8 (2.5)	3.1 (2.6)	1.5 (0.8)
Mean number of providers having received VCAT training	2.4 (1.3)	7.2 (6.8)	Not initiated

[a]Notes: Age range: adolescents aged 10–19 for Mali & Sierra Leone, 15–19 for Niger)

	Mali (57)	Niger (23)	Sierra Leone (39)
Facility type (N, %)			
Mean number (SD) of providers trained on supply chain management	2.0 (0.0)	6.4 (6.1)	6.5 (1.2)
Number of facilities equipped or rehabilitated	57 (100)	23 (100)	15 (38.5)
Number (%) of facilities having received supply chain training	54 (94.7)	23 (100.0)	39 (100.0)
Mean adolescent girls involved in guided visits	Not initiated	178.20 (86.17)	137.0 (169.3)
Adolescent Beneficiaries of community-level activities			
Mean total number of adolescent girls involved (10–19)	Distribution unavailable by facility	893.2 (708.2)	92.6 (14.5)
Number of health care providers (number, SD)			
Mean total number of skilled healthcare workers	5.2 (6.2)	9.3 (18.6)	2.1 (1.2)
Mean total number of community healthcare workers	0.3 (1.1)	0.7 (1.8)	1.0 (3.1)
Environmental factors			
Mean aridity index value (SD)	27.5 (4.4)	8.2 (1.1)	69.5 (3.5)
Mean temperature (SD)	28.3 (0.4)	28.5 (0.3)	26.4 (.36)
Number of months with insecurity events (%)	13 (17.3)	35 (46.7)	2 (2.67)
Number of facilities within 5 km of an insecurity event (%)	15 (26.3)	5 (17.0)	6 (15.4)
Urbanicity level			
Rural	46 (80.6)	23 (100.0)	39 (100.0)
Urban	11 (19.3)	0 (0.0)	0 (0.0)
[a]Notes: Age range: adolescents aged 10–19 for Mali & Sierra Leone, 15–19 for Niger)			

Participants characteristics

A total of 22, 18, and 15 stakeholders took part in the interpretation workshops in Mali, Niger, and Sierra Leone, respectively. Stakeholders included local implementing actors, healthcare workers from project-supported facilities, representatives of district-level, regional, and national health offices, and community representatives such as religious and community leaders and adolescents.

Quantitative analysis of the effects of project activities on SRHR outcomes

Antenatal care (ANC) consultations

Across all three countries, there was minimal change in adolescent girls' use of first ANC visits prior to the start of the project. In Mali and Sierra Leone, where our time series extend back to January 2019, we observed that adolescent attendance of first ANC visits did not change significantly following the declaration of the pandemic in March 2020. However, immediate level drops of 17% (IR: 0.83 ;0.69–0.99) and 30% (IR: 0.70 ;0.51–0.96) were observed in fourth ANC visit counts. In Sierra Leone, specifically, this immediate drop was followed by a 7% (IR: 0.93 ;0.89–0.97) monthly decline in fourth ANC consultations by adolescent girls. The impact of the pandemic could not be assessed in Niger due to significant missingness in the 2019 data.

The initiation of community-level activities in Mali and Niger was associated with statistically significant monthly increases in adolescent ANC service use, on average 2% per month (IR: 1.02 ;1.00-1.04) and 8% per month (IR: 1.08;1.01–1.14) increases in the number of pregnant adolescent girls attending their first and fourth ANC visits, respectively. In Sierra Leone, community-level activities were followed by non-significant monthly declines in ANC first and fourth visits. In contrast, the start of facility-level activities was associated with decreases in adolescent utilization of ANC services in Sierra Leone, including a 7% (IR: 0.93 ;0.90-.97) monthly decline in first ANC visits. In Mali, facility-level activities were also associated with 3% (IR: 0.97;0.96–0.99) monthly decreases in the number of first ANC consultations. However, an immediate increase in ANC fourth visits was observed following facility-level activities in Mali and Sierra Leone, with 38% (IR: 1.38;1.04–1.83) and 32% (IR: 1.32 ;1.01–1.73), respectively. No significant changes in adolescent ANC were observed after facility-level activities in Niger.

Contraception services

The pandemic had a significant impact on contraceptive service utilization by adolescent girls, with 17% (IRR: 0.83 ;0.70–0.98) fewer new users in Mali immediately after the onset of the pandemic, followed by a gradual 2% (IRR: 1.02 ;1.00-1.04) increase per month starting in March 2020. In Sierra Leone, there was an immediate (38%) (IRR: 0.62 ;0.49–0.80) reduction in service attendance at the onset of the pandemic, accompanied by a further 4% per month reduction (IRR: 0.96 ;0.94–0.99). A sharper level drop of 65% (IRR: 0.45 ;0.27–0.76) was observed in continuing users of contraception in Sierra Leone at the onset of pandemic. In Mali, however, there was an increase in the number of adolescent girls returning to facilities for contraceptive methods (IRR: 1.04 ;1.01–1.07), compared to the pre-pandemic trend.

The start of community activities in Mali was associated with an increase of 3% (IRR: 1.03 ;1.00-1.06) per month in the number of new adolescent girl users of contraceptive methods. In Sierra Leone, there was an immediate increase of 47% (IRR: 1.47 ;1.22–1.78) following the initiation of community-level activities. For continuing adolescent girl users of contraceptive methods, monthly increases of 10% (IRR: 1.10 ;1.04–1.15),

11% (IRR: 1.11 ;1.05–1.18), and 15% (IRR: 1.15 ;1.06–1.24) were reported for Mali, Niger, and Sierra Leone, respectively, after the onset of community-level activities. In Niger, the most comprehensive community package was followed by a 12% (IRR: 0.88 ;0.80–0.97) monthly decrease in the number of new adolescent girl clients attending contraceptive services.

Across all three countries, statistically significant decreases in the number of adolescent girls accessing modern contraception services were observed after the initiation of facility-level activities. In Mali, new adolescent girl clients attended contraceptive method services at a 5% lower rate per month (IRR: 0.95 ;0.93–0.98) after the initiation of facility-activities compared to the previous period.

For continuing users of contraception, respective decreases of 9% (IRR: 0.91 ;0.86–0.96) in Mali, 10% (IRR: 0.90 ;0.82–0.98) in Niger, and 17% (IRR: 0.83 ;0.76–0.91) in Sierra Leone per month characterized the time period following the implementation of facility-level activities, as compared to the previously described increases. An immediate drop of 39% (IRR: 0.61 ;0.38–0.97) was observed the month following the initiation of facility activities in Sierra Leone.

Table 2
Results of Segmented Interrupted Time-Series Analyses of Adolescent Utilization of Healthcare Services in Intervention Communities

	First Antenatal Care Visits	**Fourth Antenatal Care Visits**	**Contraception - New Users**	**Contraception - Continuing Users**
Mali (10–19 years old)				
Time-series	2019–2025	2019–2025	2019–2025	2019–2025
N facilities with data	57	57	57	57
Avg. N of months with data per facility	73.3	73.3	73.3	73.2
Pre-COVID (pre-March 2020)	0.99 (0.99-1.00)	1.01 (0.99–1.03)	0.98 (0.97-1.00)	**0.95 (0.93–0.97)**
Immediate effect COVID (March 2020)	0.96 (0.87–1.06)	**0.83 (0.69–0.99)**	**0.83 (0.70–0.98)**	0.90 (0.66–1.22)
During COVID (March 2020 to start of project)	1.00 (0.99–1.01)	0.99 (0.97–1.01)	**1.02 (1.00-1.04)**	**1.04 (1.01–1.07)**
Immediate effect of community-activities	1.06 (0.94–1.20)	0.98 (0.77–1.25)	1.19 (0.96–1.47)	1.28 (0.86–1.91)
Long-term impact of community-activities	**1.02 (1.00-1.04)**	0.99 (0.92–1.05)	**1.03 (1.00-1.06)**	**1.10 (1.04–1.15)**
Immediate effect of facility-activities	1.01 (0.86–1.20)	**1.38 (1.04–1.83)**	1.11 (0.84–1.46)	1.24 (0.79–1.94)
Long-term impact of facility-activities	**0.97 (0.96–0.99)**	1.01 (0.95–1.07)	**0.95 (0.93–0.98)**	**0.91 (0.86–0.96)**
Immediate effect – complete community activities package	1.00 (0.87–1.14)	1.04 (0.82–1.32)	0.82 (0.67–1.02)	0.78 (0.52–1.17)
Long-term impact of the complete community activities package	0.99 (0.96–1.03)	0.97 (0.92–1.03)	0.97 (0.92–1.03)	0.96 (0.87–1.07)
Niger (15–19 years old)				
Time-series	2020–2025	2021–2025	2020–2025	2020–2025
Number of facilities with data	23	23	23	23
Average number of months with data per facility	26.6	25.0	24.7	23.6
Pre-Implementation	0.99 (0.99-1.00)	0.97 (0.94-1.00)	1.01 (1.00-1.03)	**0.96 (0.93–0.98)**

	First Antenatal Care Visits	Fourth Antenatal Care Visits	Contraception - New Users	Contraception - Continuing Users
Mali (10–19 years old)				
Immediate effect of community-activities	0.96 (0.74–1.23)	1.19 (0.69–2.06)	1.14 (0.84–1.56)	1.40 (0.81–2.41)
Long-term impact of community-activities	0.99 (0.97–1.02)	**1.08 (1.01–1.14)**	0.97 (0.94-1.00)	**1.11 (1.05–1.18)**
Immediate effect of facility-activities	1.10 (0.83–1.45)	1.16 (0.68–1.97)	0.99 (0.72–1.35)	0.87 (0.51–1.49)
Long-term impact of facility-activities	1.00 (0.96–1.04)	0.93 (0.85-1.00)	1.05 (0.99–1.11)	**0.90 (0.82–0.98)**
Immediate effect of complete community-level package	1.05 (0.77–1.43)	1.09 (0.62–1.90)	1.12 (0.73–1.72)	0.86 (0.48–1.54)
Long-term impact of complete community-level package	0.95 (0.88–1.03)	1.07 (0.93–1.23)	**0.88 (0.80–0.97)**	1.12 (0.96–1.31)
Sierra Leone (10–19 years old)				
Time-series	2019–2025	2019–2025	2019–2025	2019–2025
N facilities with data	37	35	39	36
Avg. N of months with data per facility	59.3	58.4	52.3	52.6
Pre-COVID (pre-March 2020)	0.99 (0.98–1.01)	**1.09 (1.05–1.13)**	**1.04 (1.01–1.07)**	1.04 (0.98–1.10)
Immediate effect COVID (March 2020)	1.05 (0.82–1.33)	**0.70 (0.51–0.96)**	**0.62 (0.49–0.80)**	**0.45 (0.27–0.76)**
During COVID (March 2020 to start of project)	1.01 (0.99–1.03)	**0.93 (0.89–0.97)**	**0.96 (0.94–0.99)**	0.96 (0.90–1.01)
Immediate effect of community-activities	0.98 (0.81–1.19)	1.09 (0.87–1.37)	**1.47 (1.22–1.78)**	0.78 (0.50–1.24)
Long-term impact of community-activities	1.01 (0.99–1.03)	0.97 (0.93–1.01)	0.99 (0.96–1.02)	**1.15 (1.06–1.24)**
Immediate effect of facility-activities	1.10 (0.89–1.36)	**1.32 (1.01–1.73)**	0.87 (0.69–1.11)	**0.61 (0.38–0.97)**
Long-term impact of facility-activities	**0.93 (0.90-.97)**	0.97 (0.93–1.02)	0.98 (0.94–1.02)	**0.83 (0.76–0.91)**

Values in grey are not included in final models. Adjusted coefficients presented for visualization purposes.

Qualitative results

Several themes emerged from the interpretation workshops with key stakeholders, mainly concerning the alignment between trends in adolescents' use of ANC and contraception services and their field experiences, the contributions of project activities to these trends, and the contextual factors that underpin them.

Antenatal care (ANC) consultations

Stakeholders noted that the overall trends in ANC reflected their experiences in their communities. In Mali, some reported a significant decline in adolescent pregnancy rates and post-abortion care cases in healthcare facilities, which may partly explain the consistent decrease in first ANC visits, with the progression of project activities (Quote AQ1, Table 3). In Niger, it was noted that the lack of change in first ANC visits among adolescents aligned with the region's socio-cultural context (Quote AQ2, Table 3). Although no increase in first ANC visits was observed in Niger, an increase in fourth ANC visits was recorded, which some participants linked to the project's sensitization efforts, organized guided visits to health facilities, and healthcare worker training (Quote AQ5 – Table 3). These activities helped adolescents better understand the available services, their rights, and how to access the facilities. In Mali and Sierra Leone, where long-term decreases in ANC were appreciated, participants emphasized the project's role in raising awareness about safe sexual practices and contraceptive methods, which ultimately may have contributed to a reduction in teenage pregnancies (Quotes AQ4 and AQ6, Table 3).

While the contributions of the project activities were highlighted, stakeholders also reflected on the contextual factors shaping the use of ANC services by adolescent girls, such as low decision-making power, negative cultural norms, service costs, stockouts of essential medical supply, and distance to the health facilities. These were identified as persisting barriers to adolescent engagement with ANC services. In Niger, where a lack of clear trends in first ANC visits was observed, stakeholders noted that adolescents in communities also rely on smaller health structures (e.g., health huts), closer to them, where data are not consistently collected (Quote AQ8, Table 3). In Mali, it was noted that communities still turn to traditional birth attendants, who are seen as more culturally acceptable. This may result in fewer adolescent girls receiving ANC services at health facilities. In the three countries, concerns about privacy and confidentiality, as well as provider attitudes, continue to shape the use of ANC services in facilities.

Contraception services

In all three settings, there was an acknowledgment by stakeholders that the trends may not fully capture the extent to which adolescent girls use modern contraceptive methods, as several community-based cadres of contraceptive distribution are missing from the health facility data, underestimating the extent to which adolescents use contraceptive services. Multiple access points to contraceptives exist outside healthcare facilities, such as pharmacies, community healthcare workers, rural maternities, private or commercial establishments (boutiques, supermarkets, fuel stations), and NGOs. In Niger, there was little change in the

number of new contraceptive users, which aligns with stakeholders' views that positively changing contraception use remains difficult within this age group (Quote CQ2, Table 3).

However, some positive developments were observed among new and ongoing contraceptive users, partly due to the project activities. As noted, training healthcare workers helped clarify their attitudes and values regarding the provision of contraception services to adolescents (Quotes CQ4 and CQ5, Table 3). It was also emphasized that community sensitization and mobilization activities encourage adolescents to seek health services. A long-term decline in contraceptive use by returning users, especially after facility-level initiatives began, may be linked to the types of contraceptive options available to adolescents, notably the access to long-acting methods in Mali and Sierra Leone.

Several key factors affecting adolescent contraceptive use were also discussed. These include concerns about confidentiality and privacy (Quote CQ7), lack of decision-making power (Quote CQ8), and provider-driven promotion of abstinence, especially for younger, unmarried girls (Quote CQ9; Table 3).

Table 3
Quotations from Stakeholders during the interpretation workshops

Theme	Quotation number	Quote
Antenatal Care		
Alignment between trends and stakeholders' field experiences	AQ1	"Since my arrival (in the health district in November 2023) to now, I have noted a reduction of (care seeking related to) voluntary interruptions of pregnancies among young girls, as well as unintended pregnancies, there has also been a decline." - Healthcare worker (Mali)
	AQ2	"Do (adolescent girls) actually come to use health facilities (for ANC)? They have no decision-making power. It is the mother-in-law, the grandmother, the husband (who decides). On her own, she will not come, and will wait until the sixth or seventh month to come" – Healthcare worker (Niger)
	AQ3	"For ANC1 (…) I see a significant decline. For the ANC1, I can categorically say as an in-charge that the data is truly reflective of what is happening at our PHU." – Healthcare worker (Sierra Leone)
Effectiveness of project activities	AQ4	"When awareness-raising activities are carried out and adolescents become informed about unwanted pregnancies, STIs, (…), and when they begin to adopt safe behaviors, use family planning methods, and protect themselves, it is clear that, rates of antenatal care visits will decrease" - Healthcare system actor (Mali)
	AQ5	"At the beginning, adolescents didn't come. And even when they did come, they were somewhat chased away. Now, with the project, with the trainings, the capacity-building, they now have better access to health centres" - Healthcare worker (Niger)
	AQ6	"When we talk about first ANC, it speaks to pregnancy. Our activities generally, for us if we are to see a gain, we want to see a decline (in ANC). So, at the start of the activities, most of the information that is being (provided) is to use family planning commodities which will prevent pregnancy and result in a decrease in ANC. So, I think if we achieved that decrease it might be a result of some of the messaging that we have used." – Project implementer (Sierra Leone)
Contextual factors underlying the trends	AQ7	"In communities, especially in remote areas, people say: 'You have to be a woman. (…) Back then, we didn't have all these things (health services and infrastructure); we managed with what we had, we didn't expose ourselves (to healthcare workers).' For adolescent girls, this can lead (them) to think that going for antenatal care (…) would mean that you are weak. So, to show that she is strong, she won't go." – Adolescent (Mali)
	AQ8	"Someone who lives 15 km away, when there is a health post 2 km or 5 km away, will they go to the CSI that is 15 km away? Even if we raise awareness, they will stay nearby. If they don't have a means of transportation, or the money for a taxi and all that, they prefer to stay close rather than travel 15 km just for a consultation. As a result, a large proportion is absorbed by the local health huts" – Health system actor (Niger)

Theme	Quotation number	Quote
Antenatal Care		
	AQ9	“Normally, the ANC1 is higher than ANC4. (…) even in my facility, I realized that we only have 9% for ANC4 and for ANC1 it was 35%. Some of these (pregnant adolescents) have problem in terms of movement. The majority of them, when they come for ANC1, there are packages that we do give them. Then for the further ANC (visits), those packages are actually less, so it hinders their attendance rate. Some of them stay (away from the facilities)”. – Healthcare worker (Sierra Leone)
Contraception		
Alignment between trends and stakeholders’ field experiences	CQ1	“I would say that for contraception, it is difficult to see many adolescents (captured in the data), because (contraceptive methods) are now provided at all levels – at pharmacies, in private clinics, and elsewhere, and the data are not always reported at the level of health centers” – Healthcare worker (Mali)
	CQ2	“For married adolescent girls, why are there not many cases of them coming for family planning consultations? Generally, this is the age group where people go in search of gold or money, so for long periods the husbands are not there. So when you explain to them about coming to use family planning, the response is, ‘My husband isn’t here. Why would I take family planning?’ Otherwise, you risk rising suspicion in your community.” – Health system actor (Niger)
	CQ3	“For certain family planning commodities, there are other NGOs (…) which (come to) our facilities. For mine, they visit my facility once a month, and it is on market days ... During that time, they are (…) all types of contraceptives (distributed) for adolescents. (…) We are not capturing that data to report to the district health office because we are not getting those commodities from them.” - Healthcare worker (Sierra Leone)
Effectiveness of project activities	CQ4	“In our facility, (…), previously, before the (project) training, (some healthcare workers) didn’t take adolescents seriously. But after the training, they changed their attitudes. They started seeing adolescents.” – Program implementer (Mali)
	CQ5	“At one point, people thought that to come to the (health centre), you needed the father’s approval, the mother’s approval. But with this project, they are told whenever they need it: go through your mentor, or go directly to the health office. You will be listened to and you will be cared for.” - Healthcare worker (Niger)
	CQ6	“For me, the first perception at community level for the Foundations project, it has increased community awareness on family planning for adolescents, more especially the adolescent girls... Then it has actually increased community stakeholders' awareness in guiding their community on the impact of teenage pregnancy.” - Healthcare worker (Sierra Leone)
Social norms and contextual factors underlying the trends	CQ7	“During the last supervision, we saw that the condoms at the distribution sites (in health facilities) were expired. (…) Young people don’t come; they prefer to get them from shops… We conducted small focus discussions with adolescents during the supervision (…) and they said that when they go to the distribution

Theme	Quotation number	Quote
Antenatal Care		
		sites, everyone is there and they are seen, but they need a private space to step aside." - Program Implementer (Mali)
	CQ8	"For there to be sustainable development, these contraception issues really need to be addressed (…). As community actors, we see the barriers. There are cultural taboos and religious taboos that block the project's progress. We have been talking about contraception for years, but it doesn't end. It is true that some people are strongly opposed, but for them it may be a lack of awareness, a lack of knowledge." - Community actor (Niger)
	CQ9	"(Adolescents) that we normally advise on abstinence are those that are not actually involved in the activity. So, when they come we observe their characteristics, but even with all that, you still have to put abstinence first, because the sexual intercourse it can play with their education, it exposes them to even infections and other things, right? For them to have proper concentration, you can see if they are actually sexually involved, you take them and also advise them that it is not too good for them now to involve into sexual activities." – Healthcare worker (Sierra Leone)

DISCUSSION

This study examined the effects of the FOUNDATIONS project, a multi-level initiative implemented in Mali, Niger, and Sierra Leone, on the use of key SRHR services by adolescent girls. By integrating an interrupted time-series analysis design with qualitative insights from key stakeholders, the study provides a nuanced understanding of how community and facility-level activities shaped trends of ANC and contraceptive service utilization across diverse contexts.

In Mali and Sierra Leone, we observed an overall increase in ANC first visits by pregnant adolescents following the initiation of the project's community activities, although this increase was statistically significant only in Mali. In both contexts, we also found statistically significant long-term reductions in first ANC consultations, particularly after facility-level activities began. For the attendance of fourth ANC visits, we again noted improvements after community activities, but these effects were only sustained in Niger. For modern contraceptive services, the evidence was mixed across the three settings for first-time adolescent girl users. Among continuing users, we found increases after the community-level activities that were sustained over time, but decreases followed the introduction of facility-level activities in all three countries.

The qualitative interpretation workshops conducted with key stakeholders helped contextualize these findings and identify factors that may explain the observed trends, including the contributions of project activities. The discussions also highlighted and corroborated the pathways linking ANC and contraceptive services and how the project reinforced them. For first ANC visits, the observed trend (an initial increase followed by a long-term decline) aligned with the timing and focus of project implementation. Early on, community-level activities (e.g., in-school and out-of-school sensitizations and community mobilizations)

may have promoted adolescent girls' autonomy over their SRHR, likely leading to not only an immediate rise in first ANC consultations among pregnant girls but also greater use of modern contraceptives among non-pregnant girls. As adolescent girls became sensitized about the importance of using contraception and their right to access these services in health facilities, more of them were expected to seek contraceptive counselling and methods from facility-based providers. As noted by the interviewed stakeholders, over time, increased contraceptive use would be expected to reduce unintended pregnancies, contributing to fewer first ANC visits over time. This interpretation is consistent with the broader literature reporting a pooled 34% (RR 0.66, 95% CI 0.50 to 0.87) decrease in unintended pregnancies as a result of the implementation of complex multiple interventions combining adolescent SRHR education with the promotion of contraceptive services (with or without distribution of methods).[21]

In light of the findings around ANC service use, the trends among first-time adolescent users of contraceptives were particularly noteworthy. Given the project's strong focus on contraception, we expected to see a long-term increase in use. However, qualitative findings suggest that these declines may reflect limitations in facility data, which do not fully capture contraceptive use by adolescent girls, as a non-negligible part of the demand is absorbed by community healthcare workers, private establishments, pharmacies, and non-governmental organizations. Due to structural challenges in healthcare facilities, such as stockouts, providers' negative attitudes, cost inaccessibility, and lack of safe spaces for adolescents, there was a preference for community-based and free-of-cost contraceptive services. These findings echo prior studies documenting adolescents' reliance on pharmacies and informal outlets for contraceptive access.[48, 49] These findings underscore the need for safe, adolescent-friendly spaces staffed with trained health workers who can provide accessible, confidential contraceptive services. The project's key efforts have focused on creating these spaces and addressing the attitudes of providers, yet structural barriers still impede adolescent engagement with contraceptive services. Studies in Mali reported that community healthcare facilities (which provide up to 62% of adopted modern contraceptive methods nationally) often lack opening hours, costs, and levels of confidentiality and privacy that are appropriate for adolescents and youth to access contraceptive services.[11, 12] In Niger and Sierra Leone, the most recent Service Availability and Readiness Assessment (SARA) reported that 22% and 25% of facilities providing modern contraceptive methods, lacked service providers trained in contraception, and 37% and 11%, did not provide contraceptive services to unmarried adolescents.[13, 14, 16, 50] Stakeholders further noted that some providers tended to recommend abstinence, which may deter adolescents from seeking facility-based contraceptive care.

In contrast, the initial increase in contraceptive service use among adolescent girls classified as return users after the initiation of community-level activities suggests that these activities may have encouraged adolescents already engaged with the healthcare system to return for additional contraceptive services. The subsequent decline in this trend may be linked to the type of contraceptive methods prescribed to adolescents. In Mali and Sierra Leone, stakeholders highlighted adolescents' preference for long-acting reversible contraceptives (LARC), which may explain the stabilization or decline in return visits over time. This pattern is consistent with evidence that LARC can reduce the frequency of facility visits, even when overall contraceptive coverage improves [51].

While this study advances the body of evidence on effective multi-level interventions to improve adolescent girls' SRHR, it is important to acknowledge its limitations. First, the analysis relied on health facility data on service use, which are subject to issues of completeness, timeliness, and accuracy.[52, 53] Data quality concerns were more pronounced in Niger, and to a lesser extent in Sierra Leone, resulting in shorter time series and potentially attenuated effect estimates. A second limitation is that the project activities are expected to have a potential latency period [34, 35], which may not have provided enough time to fully assess the trends in the use of SRHR services as the project progresses. Program intervention components were designed to be synergistic; thus, certain effects may not be identifiable until a level of completeness in implementation is achieved. On a related note, the complexity and interdependence of intervention components made it infeasible to quantitatively isolate the effects of individual activities. Qualitative data were therefore important for interpreting the results and identify contextual influences. Finally, we had to exclude some project-supported facilities in Mali and Niger from the analysis due to geopolitical insecurity. The exclusion of these facilities may have introduced a bias in our results. As indicated during the workshop in Niger for instance, service provision is severely affected by insecurity, with health facilities operating on restricted hours, which not only limit the provision of services but also the collection of complete data in these settings. Despite these limitations, the study provides important evidence on how multi-level interventions can influence adolescent girls' engagement with SRHR services in diverse settings.

CONCLUSIONS

Adolescent girls are among the population groups most vulnerable to unmet needs in SRHR services. This multi-country retrospective assessment of adolescent girls' engagement with selected SRHR services in West Africa in the context of a large multi-level program showed that community-level activities positively impacted trends in adolescent girls' use of facility-level ANC and contraceptive services. However, the long-term effects of facility-level activities on adolescent retention rates require further investigation and a longer observation period. Trends were also shaped by various contextual factors, including supply chain disruptions, concerns about privacy and confidentiality, social and cultural norms, and the limited capacity of facilities to capture adolescents' engagement with contraceptive services in communities.

Declarations

Competing Interests:

The authors declare no competing interests.

Funding:

Research was funded under the FOUNDATIONS, a project funded by Global Affairs Canada and delivered by Save the Children Canada. Funders did not influence study conceptualization, results, interpretation, or manuscript redaction. Results, analyses, conclusions, and statements described herein are the sole responsibility of the authors, and do not reflect the opinions or endorsements of GAC or Save the Children.

Acknowledgments:

The Strengthening Adolescent Girls' Sexual and Reproductive Health project was implemented in Mali, Niger, and Sierra Leone, beginning in 2021. Funded by Global Affairs Canada, FOUNDATIONS is delivered by Save the Children Canada in partnership with Save the Children International (Mali, Niger, Sierra Leone), the International Rescue Committee (IRC), Equipop, ODI and SickKids.

Data availability statement:

The quantitative data may be obtained from the countries' Ministries of Health, and are not publicly available. The qualitative data cannot be shared due to informed consent procedures. The statistical code is available from the corresponding author (DGB) upon reasonable request.

References

1. WHO WHO (2024) Sexual and reproductive health and rights
2. UNICEF (2024) Early childbearing and teenage pregnancy rates by country - UNICEF DATA. November, Published Online First
3. Ameyaw EK, Budu E, Sambah F et al (2019) Prevalence and determinants of unintended pregnancy in sub-Saharan Africa: A multi-country analysis of demographic and health surveys. PLoS ONE 14:e0220970. 10.1371/journal.pone.0220970
4. Rose C, Neufeld K, Wazinski C et al (2024) Africa's Future is Young! Young People's Priorities for their Reproductive and Sexual Self-Determination. Berlin Institute for Population and Development
5. Michael TO, Ojo TF, Ijabadeniyi OA et al (2024) Prevalence and factors associated with contraceptive use among sexually active adolescent girls in 25 sub-Saharan African countries. PLoS ONE 19:e0297411
6. Sully EA, Biddlecom A, Darroch JE et al (2020) Adding It Up: Investing in Sexual and Reproductive Health 2019
7. Tolossa T, Gold L, Dheresa M et al (2024) Adolescent maternal health services utilization and associated barriers in Sub-Saharan Africa: A comprehensive systematic review and meta-analysis before and during the sustainable development goals. Heliyon 10. 10.1016/j.heliyon.2024.e35629
8. Maharaj NR (2022) Adolescent pregnancy in sub-Saharan Africa – a cause for concern. Front Reproductive Health 4:984303. 10.3389/frph.2022.984303
9. on Reproductive (2010) Health in Crises IWG. Adolescent Reproductive Health
10. Starrs AM, Ezeh AC, Barker G et al (2018) Accelerate progress - sexual and reproductive health and rights for all: report of the Guttmacher Lancet Commission. Lancet 391:2642–2692. 10.1016/S0140-6736(18)30293-9
11. Division de la Planification Familiale (2019) Direction Générale de la Santé et de l'Hygiène Publique. Sous-Direction de la Santé de la Reproduction du Ministère de la Santé et des Affaires Sociales. Plan d'Action National Budgétisé de Planification Familiale du Mali

12. Barden-O'Fallon J, Traore A, Tounkara M (2020) Attitudes and opinions of young people in Mali on Family Planning, barriers to contraceptive use, and suggestions for programming. Afr J Reprod Health 24:106–114. 10.29063/ajrh2020/v24i2.10
13. Fleming PJ, Shakya H, Farron M et al (2020) Knowledge, attitudes, and practices related to family planning and gender equity among husbands of adolescent girls in Niger. Glob Public Health 15:666–677. 10.1080/17441692.2019.1692890
14. Samandari G, Grant C, Brent L et al (2019) It is a thing that depends on God: barriers to delaying first birth and pursuing alternative futures among newly married adolescent girls in Niger. Reprod Health 16:109. 10.1186/s12978-019-0757-y
15. Sambah F, Aboagye RG, Seidu A-A et al (2022) Long-acting reversible contraceptives use among adolescent girls and young women in high fertility countries in sub-Saharan Africa. Reprod Health 19:209. 10.1186/s12978-022-01494-8
16. Sserwanja Q, Nuwabaine L, Kamara K et al (2023) Determinants of quality contraceptive counselling information among young women in Sierra Leone: insights from the 2019 Sierra Leone demographic health survey. BMC Womens Health 23. 10.1186/s12905-023-02419-8
17. Onabanjo J, Fund UNP, for Development SA et al (2017) A review of 23 countries in East and Southern Africa Harmonizing the Legal Environment for Adolescent Sexual and Reproductive Health and Rights
18. UNFPA West, Central Africa Regional Office (2017) Review of adolescent and youth policies, Strategies and laws in selected countries in West Africa
19. Maputo Protocol at 20 (2023) Twenty Years of the Maputo Protocol: Where Are We Now? 3
20. African Union Commission (2016) Universal Access to Comprehensive Sexual and Reproductive Health Services in Africa - Maputo Plan of Action 2016–2030
21. Oringanje C, Meremikwu MM, Eko H et al (2016) Interventions for preventing unintended pregnancies among adolescents. Cochrane database Syst reviews 2:CD005215. 10.1002/14651858.CD005215.pub3
22. UNFPA WCARO (2020) Adolescent and Youth Sexual and Reproductive Health and Rights Services Adolescent and Youth Sexual and Reproductive Health and Rights Services Key elements for implementation and scaling up services in West and Central Africa
23. Denno DM, Hoopes AJ, Chandra-Mouli V (2015) Effective strategies to provide adolescent sexual and reproductive health services and to increase demand and community support. J Adolesc Health 56:S22–41. 10.1016/j.jadohealth.2014.09.012
24. Mbizvo MT, Kasonda K, Muntalima N-C et al (2023) Comprehensive sexuality education linked to sexual and reproductive health services reduces early and unintended pregnancies among in-school adolescent girls in Zambia. BMC Public Health 23:348. 10.1186/s12889-023-15023-0
25. Aninanya GA, Debpuur CY, Awine T et al (2015) Effects of an adolescent sexual and reproductive health intervention on health service usage by young people in Northern Ghana: a Community-Randomised Trial. PLoS ONE 10:e0125267. 10.1371/journal.pone.0125267
26. Barden-O'Fallon J, Evans S, Thakwalakwa C et al (2020) Evaluation of mainstreaming youth-friendly health in private clinics in Malawi. BMC Health Serv Res 20:79. 10.1186/s12913-020-4937-9

27. Rosenberg NE, Bhushan NL, Vansia D et al (2018) Comparing youth-friendly health services to the standard of care through girl power-Malawi: A quasi-experimental cohort study. J Acquir Immune Defic Syndr 79:458–466. 10.1097/QAI.0000000000001830
28. Fikree FF, Abshiro WK, Mai MM et al (2017) Strengthening youth friendly health services through expanding method choice to include long-acting reversible contraceptives for Ethiopian youth. Afr J Reprod Health 21:37–48. 10.29063/ajrh2017/v21i3.3
29. Chipako I, Singhal S, Hollingsworth B (2024) Impact of sexual and reproductive health interventions among young people in sub-Saharan Africa: a scoping review. Front Glob Womens Health 5:1344135. 10.3389/fgwh.2024.1344135
30. Larke N, Cleophas-Mazige B, Plummer ML et al (2010) Impact of the MEMA kwa Vijana adolescent sexual and reproductive health interventions on use of health services by young people in rural Mwanza, Tanzania: results of a cluster randomized trial. J Adolesc Health 47:512–522. 10.1016/j.jadohealth.2010.03.020
31. Embleton L, Boal A, Sawarkar S et al (2024) Characterizing models of adolescent and youth-friendly health services in sub-Saharan Africa: a scoping review. Int J Adolesc Med Health 36:203–236. 10.1515/ijamh-2024-0001
32. Loaiza E, Liang M (2013) Adolescent pregnancy: A Review of the Evidence Adolescent Pregnancy. A Review Of The Evidence UNFPA, New York. 1 Contents
33. Openstreetmap (2025) Copyright And License
34. Kühne F, Ehmcke R, Härter M et al (2015) Conceptual decomposition of complex health care interventions for evidence synthesis: a literature review. J Eval Clin Pract 21:817–823. 10.1111/jep.12384
35. Campbell NC, Murray E, Darbyshire J et al (2007) Designing and evaluating complex interventions to improve health care. BMJ 334:455–459. 10.1136/bmj.39108.379965.BE
36. Zombré D, Diarra D, Touré L et al (2024) Improving healthcare accessibility for pregnant women and children in the context of health system strengthening initiatives and terrorist attacks in Central Mali: a controlled interrupted time series analysis. BMJ Glob Health 7:e012816. 10.1136/bmjgh-2023-012816
37. Fruhauf T, Zimmerman L, Kibira SPS et al (2018) Measuring family planning quality and its link with contraceptive use in public facilities in Burkina Faso, Ethiopia, Kenya and Uganda. Health Policy Plan 33:828–839. 10.1093/heapol/czy058
38. Silberg C, Moreau C, Karp C et al (2024) Trends in adolescent sexual and reproductive health outcomes before and into the COVID-19 pandemic in Burkina Faso and Kenya: Evidence from panel data. J Adolesc Health 75:344–352. 10.1016/j.jadohealth.2024.04.023
39. Bolarinwa OA, Odimegwu C, Ajayi KV et al (2024) Barriers and facilitators to accessing and utilising sexual and reproductive health services during the COVID-19 pandemic in Africa: a systematic review and meta-analysis. BMC Health Serv Res 24:1554. 10.1186/s12913-024-12028-2
40. Groenewald C, Isaacs N, Isaacs D (2022) Adolescent sexual and reproductive health during the COVID-19 pandemic: A mini review. Front reproductive health 4:794477. 10.3389/frph.2022.794477

41. Tatem AJ (2017) WorldPop, open data for spatial demography. Sci Data 4:170004. 10.1038/sdata.2017.4
42. Raleigh Clionadh L, Håvard rewH et al (2010) Introducing ACLED: An Armed Conflict Location and Event Dataset. J Peace Res 47:651–660. 10.1177/0022343310378914
43. Harris I, Osborn TJ, Jones P et al (2020) Version 4 of the CRU TS monthly high-resolution gridded multivariate climate dataset. Sci Data 7:109. 10.1038/s41597-020-0453-3
44. Funk C, Peterson P, Landsfeld M et al (2015) The climate hazards infrared precipitation with stations—a new environmental record for monitoring extremes. Sci Data 2:150066. 10.1038/sdata.2015.66
45. Melchiorri M, Rivero I, Florio P et al (2024) GHSL Urban Centre Database 2025
46. Government of Sierra Leone. Health facility assessment on availability of reproductive health commodities and services in sierra leone (2019) 2019
47. Azungah T (2018) Qualitative research: deductive and inductive approaches to data analysis. Qualitative Res J 18:383–400. 10.1108/QRJ-D-18-00035
48. Chandra-Mouli V, Akwara E (2020) Improving access to and use of contraception by adolescents: What progress has been made, what lessons have been learnt, and what are the implications for action? Best Pract Res Clin Obstet Gynaecol 66:107–118. https://doi.org/10.1016/j.bpobgyn.2020.04.003
49. Chandra-Mouli V, McCarraher DR, Phillips SJ et al (2014) Contraception for adolescents in low and middle income countries: needs, barriers, and access. Reprod Health 11:1. 10.1186/1742-4755-11-1
50. Ali M, Farron M, Ramachandran Dilip T et al (2018) Assessment of family planning Service Availability and readiness in 10 African countries. Glob Health Sci Pract 6:473–483. 10.9745/GHSP-D-18-00041
51. Negash WD, Belachew TB, Asmamaw DB (2022) Long acting reversible contraceptive utilization and its associated factors among modern contraceptive users in high fertility sub-Saharan Africa countries: a multi-level analysis of recent demographic and health surveys. Archives Public Health 80:224. 10.1186/s13690-022-00977-1
52. Thabethe S, Mathews V (2024) Quality of routine health data in DHIS2 in South Africa: Eastern Cape province from 2017–2020. SA J Inform Manage 26:1–12. 10.4102/sajim.v26i1.1903
53. Rumisha SF, Lyimo EP, Mremi IR et al (2020) Data quality of the routine health management information system at the primary healthcare facility and district levels in Tanzania. BMC Med Inf Decis Mak 20:340. 10.1186/s12911-020-01366-w

Figures

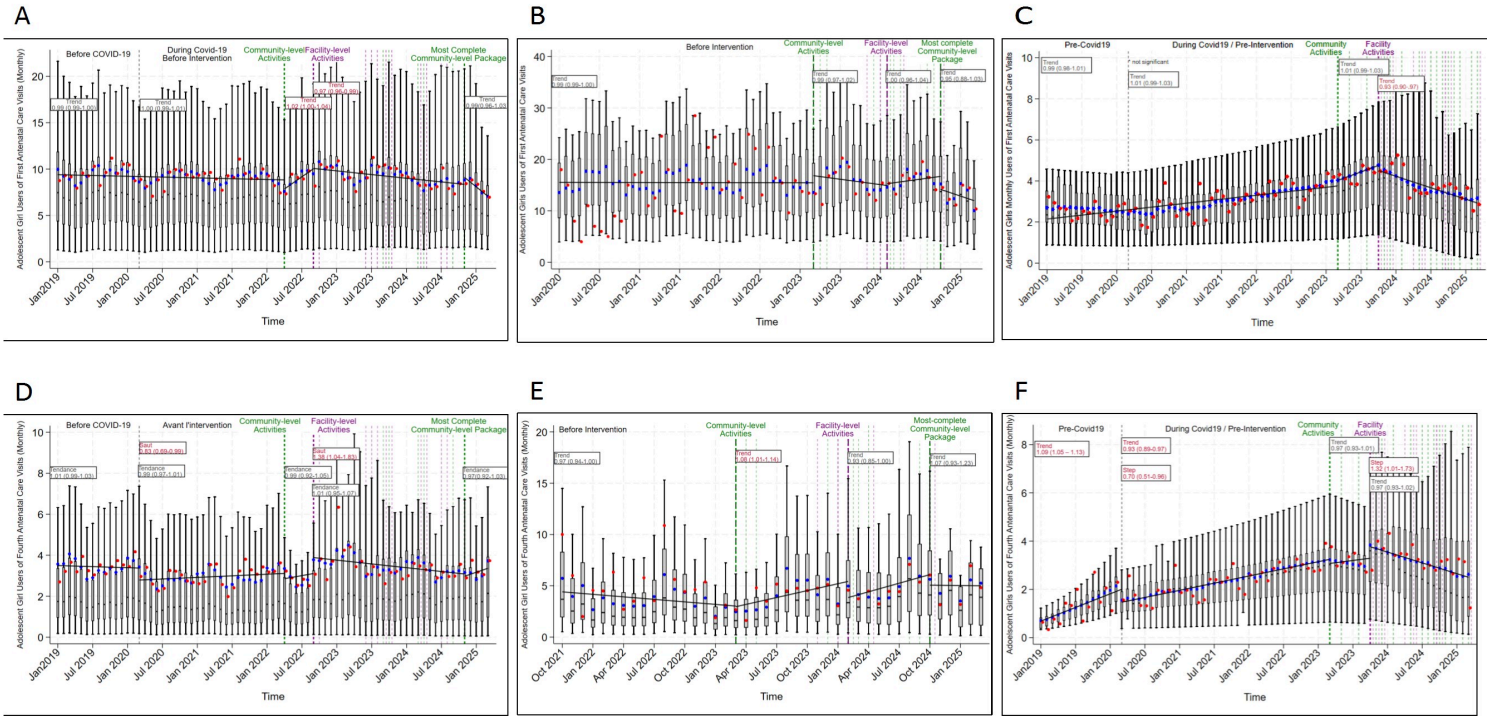


Figure 1

Trends in antenatal care first and fourth visits by adolescent girls in project-supported health facilities between January 2019 and March 2025. (A) First antenatal care visits in Mali (B) First antenatal care visits in Niger (C) First antenatal care visits in Sierra Leone (D) Fourth antenatal care visits in Mali (E) Fourth antenatal care visits in Niger (F) Fourth antenatal care visits in Sierra Leone.

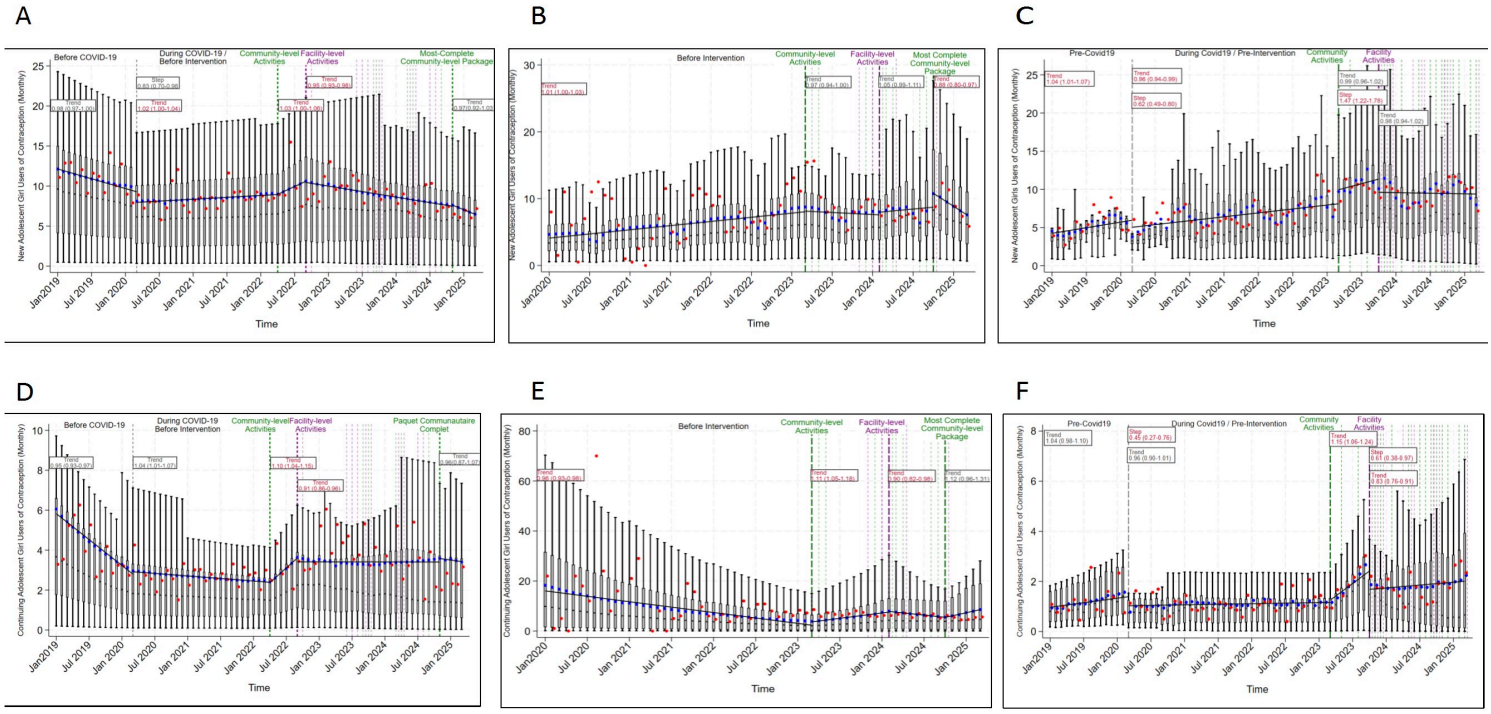


Figure 2

Trends in new and continuing adolescent girl users of modern contraceptive services in project-supported health facilities between January 2019 and March 2025. (A) New users of family planning in Mali (B) New users of family planning in Niger (C) New users of family planning in Sierra Leone (D) Continuing users of family planning in Mali (E) Continuing users of family planning in Niger (F) Continuing users of family planning in Sierra Leone.

Supplementary Files

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

- SupplementaryMaterialAppendixSectionITSAApril2026v1.docx