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The Impact of Armed Conflict in Northern Nigeria on Reproductive Autonomy and Unmet Need for Family Planning: A Difference-in-Differences Propensity Score Matching Approach

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ABSTRACT

Background and Aims: In Northern Nigeria, entrenched patriarchal norms, high maternal mortality rates, low contraceptive use, and a fragile healthcare system exacerbated by conflict pose significant challenges to reproductive autonomy and family planning. This study investigates the impact of conflict exposure on women's unmet family planning needs and reproductive autonomy, including contraceptive decision-making, discussing condom use, and declining sexual advances.

Methods: This study employs a kernel-based difference-in-differences model using data from the Nigerian Demographic and Health Survey (2008, 2013, 2018) linked with conflict incident data from the Armed Conflict Location and Events Database.

Results: Results suggest that conflict exposure is generally associated with women's reproductive autonomy, with effects varying over time and between urban and rural settings. Specifically, urban conflict exposure before 2013 was found to be associated with an increased ability for women to refuse sexual advances and a reduction in unmet family planning needs. Conflict exposure during 2014–2018 is found to be associated with an increased ability for women to request condom use and an increased ability to refuse sex.

Conclusion: The diverse outcomes, which predominantly show positive associations between conflict exposure and women's reproductive autonomy, may be attributed to the presence of humanitarian assistance, changed fertility preferences and altered gender norms during conflict.

1 | Introduction

Armed conflict in various regions in Nigeria has exacerbated pre-existing low levels of health services coverage and caused a severe humanitarian crisis that continues to the present day [1]. The consequences extend beyond the direct harm caused by violence; they have severely impacted political stability, healthcare, and socioeconomic conditions in the country [2]. Women and children are particularly prone to prolonged and more severe health repercussions, as armed conflicts may challenge fundamental women's rights and impede the progress of reducing maternal and child mortality [3, 4].

The maternal mortality rate in Nigeria remains a significant concern. According to the World Health Organization (WHO), Nigeria has the fifth highest maternal mortality rate globally,

Summary

- Patriarchal norms, high maternal mortality, low contraceptive use, and conflict exacerbate challenges to women's reproductive autonomy in Northern Nigeria.
- Conflict exposure is associated with increased reproductive autonomy, including greater ability to refuse sexual advances, request condom use, and reduce unmet family planning needs.
- Humanitarian aid, changing fertility preferences, and evolving gender norms during conflict may support women's reproductive autonomy, highlighting potential intervention points for improving family planning access.

with an estimated 917 deaths per 100,000 live births in 2017 [5]. Although access to and effective utilization of modern contraception is found to be a highly cost-effective method to reduce maternal mortality, the utilization of any method to delay or prevent unwanted pregnancy remains low in Nigeria [6]. Globally, it has been found that satisfying unmet needs for family planning could lead to a 29% reduction in maternal mortality [7].

Next to the direct effects of family planning on health outcomes, family planning has significant intrinsic value and indirect benefits. Fulfilling women's family planning needs is closely related to female emancipation, reproductive autonomy, choice, and rights [8]. It is essential to ensure the protection of women's rights during conflict, which are intrinsically linked to a woman's capacity to make independent decisions about her own body, sexuality, and sexual experiences [9, 10]. Reproductive autonomy, defined as '*having the power to decide about and control matters associated with contraceptive use, pregnancy, and childbearing*' [11], is an essential element within women's rights and may be altered by conflict.

There is a lack of evidence on the effects of conflict on unmet need for family planning or reproductive autonomy, despite its relevance and importance. An exception is the cross-sectional study by Svallfors et al. [12] that explored the correlation between armed conflict and attitudes toward reproductive autonomy in Nigeria. The study found that conflict is associated with greater support for contraception and safe abortion, but also a higher likelihood of believing early marriage can protect girls. Although the findings are noncausal, they suggest that conflict may act both as a facilitator and a threat to women's reproductive autonomy. Other studies have mainly focussed on the impacts of conflict on related concepts, such as the impact on access to health care. Studies in Nigeria demonstrate adverse effects of the Boko Haram insurgency on maternal healthcare access [13, 14]. However, Tyndall et al. [15] found a notable improvement in health status among segments of the population amid ongoing armed conflict in Nigeria due to the presence of humanitarian organizations. Despite these mixed effects, it may be possible to extrapolate these findings, hypothesizing a link between changes in sexual and reproductive health services and unmet need for family planning.

Furthermore, conflict situations may alter women's preferred family size in various ways due to the threat of harm and instability, reduced economic opportunities and possibly loss of family and social support [16, 17]. Studies on conflict's impact on fertility yield varied findings. Urdal and Che [18] found that armed conflicts are associated with higher fertility rates in low-income countries. In Nigeria, Rotondi and Rocca [19] also found that Boko Haram's attacks increased fertility rates, potentially as a mechanism to protect against unforeseen shocks in the future. Conversely, Thiede et al. [20] observed slight declines in preferred family size and the likelihood of recent childbearing due to conflict in sub-Saharan Africa.

Research on conflict's impact on gender-based violence (GBV) consistently indicates that conflict increases the risk for GBV and intimate partner violence (IPV), as demonstrated in several settings [21–24]. In Nigeria, the Boko Haram insurgency is also found to increase the likelihood of women facing physical and sexual IPV and controlling behaviors [25]. The findings demonstrating that conflict increases the probability of GBV and IPV could be used to hypothesize that conflict reduces women's reproductive autonomy along with it, as several studies found a correlation between IPV and reproductive autonomy [26, 27]. However, Koenig et al. [28] found that the relationship between women's autonomy and domestic violence is highly context-specific.

Furthermore, Svallfors and Billingsley [8] found that armed conflict in Colombia reduced modern contraceptive use, suggesting potential changes in fertility demands or constrained access. Similarly, a study in Mali found that armed violence is related to a lower probability of using modern contraception and also a higher risk of unwanted pregnancies [29]. In contrast, Williams et al. [17] found evidence for increased contraceptive use during the Nepalese civil war, highlighting context-specific effects. The opposing results indicate the influence of context on contraceptive behaviors during conflict. Fluctuations in contraceptive demand may contribute to unmet family planning needs, while shifts in marriage probabilities suggest potential impacts on reproductive autonomy in conflict-affected areas like Northern Nigeria. Increased demand for family planning during conflict may elevate the frequency of unmet needs. However, the opposite pathway is also plausible, as some studies suggest heightened fertility and replacement effects, potentially reducing the demand for family planning and consequently lowering unmet needs.

Understanding how women's unmet need for family planning and reproductive autonomy is affected by conflict is essential to develop adequate strategies to ensure women's reproductive health and rights. This is especially important in Nigeria, a country plagued by conflict, with current high maternal mortality rates and low rates of modern contraceptive use [5, 6]. Therefore, this study aims to investigate the impact of conflict exposure in Northern Nigeria on women's unmet need for family planning and reproductive autonomy by conducting a kernel-based difference in differences analysis.

1.1 | Context

Nigeria's diverse population has been grappling with long-standing conflicts arising from religious, ethnic, and resource-related tensions [30]. While these challenges impact many parts of the country, the northern regions have been overly affected. One of the most enduring and prominent conflicts is the Boko

Haram insurgency, initiated in 2009 in Borno State and spreading across Northern Nigeria. The jihadist militant group seeks to establish a pure Islamic state under strict interpretation of sharia law, leading to intensified attacks like bombings and targeting educational institutions, contributing to a complex humanitarian crisis in Northern Nigeria [31].

While imposing restrictions on women, Boko Haram paradoxically also offers them access to Islamic education and financial empowerment. Some women grappling with poverty, corruption, early marriage, and illiteracy perceive Boko Haram as a potential means to advance their freedoms or alleviate hardships, appreciating the religious and moral support the group provides [32]. However, women and girls also face targeted violence, including kidnapping, forced marriages, sexual violence, and exploitation as suicide bombers. The impact on women is further exacerbated by their majority status among internally displaced persons in the North East, where women are often left behind as heads of households with limited resources and support [32].

2 | Methodology

2.1 | Data Sources

This research utilized two sources of secondary data. Firstly, data from three waves (2008, 2013, and 2018) of the Nigeria Demographic and Health Survey (NDHS) women's questionnaire, a nationally representative cross-sectional survey, were used. The NDHS is administered to women aged 15-49 in randomly selected households across Nigeria, selected through a stratified two-stage cluster design [33]. The various outcome variables of this study are compared between 2008 and 2013 for the short-term effects and between 2008 and 2018 for the long-term effects. The NDHS sample is combined with the Armed Conflict Location and Event Data set (ACLED) to provide information on conflict incidents. ACLED comprehensively covers various types of incidents, such as battles, protests, riots, explosions, violence against civilians and strategic developments, without any threshold for the number of fatalities for the incident to be included. [34] The ACLED encompasses events during civil wars, unstable periods, demonstrations, and regime collapses in Africa, South Asia, Southeast Asia, and the Middle East, providing extensive details on both fatal and nonfatal events, including dates, actors, locations, and fatalities [34].

To determine conflict exposure, all fatal incidents within 4 years before the respective NDHS survey are assigned to the 2008, 2013 and 2018 NDHS clusters. The sample includes only the Northern regions of Nigeria (North West, North Central and North East) because they share various socio-cultural similarities, even though the Northeastern region is more exposed to conflict than the Northwestern region [14].

2.2 | Measures

2.2.1 | Exposure to Conflict

Conflict exposure, the primary independent variable in this research, lacks a standardized definition, leading to varied measurement approaches in different studies. In this study, a woman is categorized as exposed to conflict if the household cluster is situated within 15 km of at least eight conflict incidents with one or more fatalities over 4 years. Geo-coordinates are used to match fatal events from the ACLED data set with the NDHS household clusters by calculating the distance between the household cluster and each event.

A slightly larger radius compared to previous studies is chosen because of the random displacement of geo-coordinates of NDHS clusters to safeguard the privacy of respondents, where rural clusters are displaced up to 5 km, and urban clusters op 2 km [35]. By choosing a larger radius, the random displacement is a smaller percentage of the total radius, and a relatively high minimum number of conflict incidents is chosen because of this larger radius. Setting eight conflict incidents as the minimum ensures an average exposure of at least two incidents per year for conflict-exposed clusters.

2.2.2 | Unmet Need for Family Planning

In this study, the definition of the DHS is used where women are defined as having an unmet need for family planning when they are not currently using a method of contraception and want to stop or delay childbearing [36]. Unmet need for family planning is constructed out of two measures: unmet need for spacing and unmet need for limiting. These definitions are more elaborately described elsewhere [36]. If women have an unmet need for either limiting or spacing, they are characterized as having an unmet need for family planning. Since the categories are mutually exclusive, unmet need for family planning is a binary variable (0 = no unmet need, 1 = unmet need).

2.2.3 | Reproductive Autonomy

Three indicators measure women's reproductive autonomy: women's ability to refuse sex, women's ability to ask to use a condom, and women's decision-making autonomy regarding contraceptive use. These indicators only apply to women who are married or are living with a partner due to the NDHS questionnaire structure. Additionally, the question on contraceptive decision-making is only asked to married women who are currently using contraception [33].

The ability to refuse sex refers to the question, “Can you say no to your husband/partner if you do not want to have sexual intercourse?,” and the ability to ask to use a condom relates to the question, “Could you ask your husband/partner to use a condom if you wanted him to?.” Both questions have three answer options: yes, no, and depends/not sure [33]. Both questions are coded as a binary variable (0 = no and depends/not sure, 1 = yes). Women's decision-making autonomy regarding contraceptive use refers to the question, “Would you say that (not) using contraception is mainly your decision, mainly your husband's/partner's decision, or did you both decide together” [33]. This question is coded as a binary variable (0 = husband's/partner's decision, 1 = joint or women's decision).

2.2.4 | Covariates

Several relevant control variables are included to account for heterogeneity among respondents. The selection of control variables is based on previous studies on the determinants of unmet need for family planning and reproductive autonomy in Nigeria and include marital status (currently married or other), education level (no education or at least incomplete primary education), literacy (literate or illiterate), religion (Islam or other), employment status (currently working or not currently working), and type of area (urban or rural).

2.3 | Data Analysis

Data is analyzed using Stata 17, with the Difference-in-Differences (DiD) technique combined with Propensity Score Matching (PSM). This approach does not require longitudinal data; instead, it can be applied using data from repeated cross-sections, such as the NDHS data [37]. Sampling weights are applied to ensure representativeness.

DiD is a quasi-experimental approach, where the difference in outcomes between pre-and post-intervention is calculated for both treatment and control groups, and these two 'differences' are then subtracted from each other. Although there were tensions and instances of violence in Northern Nigeria in 2008, the number of violent incidents increased substantially from 2009 onwards, partly due to the Boko Haram insurgency [38]. Therefore, in this study, pre-intervention applies to data from 2008 (t_0), before the escalation of the conflict, and post-intervention applies to data from 2013 (t_1) and 2018 (t_2). The treatment group comprises respondents exposed to conflict (as defined above), and the control group comprises those not exposed. This method allows controlling for differences between the treatment and control groups and for time-varying factors (that are the same for both groups). This technique allows for causal inference, even when randomization is not employed. Unmet need for family planning and the three indicators for reproductive autonomy are modeled as a function of conflict exposure and other relevant determinants of access to family planning as described above, as specified in equation (1):

$$FP_{ict} = \beta_0 + \beta_1 Confperiod_{it} + \beta_2 Confexp_{ct} + \beta_3 Confperiod_{it} \cdot Confexp_{ct} + \beta_4 X_{ict} + \varepsilon_{ict}, \quad (1)$$

where FP_{ict} is a measure of unmet need for family planning or reproductive autonomy for women i residing in cluster c at time t. Four binary outcomes are considered: unmet need for family planning, the ability to ask to use a condom, the ability to refuse sex, and decision-making agency for contraceptives. $Confperiod_{it}$ is a binary variable for the survey period (0 = 2008, 1 = 2013 or 2018). $Confexp_{ct}$ is a measure of conflict exposure, and β_3 is our parameter of interest as it captures the interaction between $Confperiod_{it} \cdot Confexp_{ct}$, which is the causal effect of exposure to conflict on the outcome variables. X_{ict} represents a vector of control variables, and ε_{ict} is the random error term.

A kernel-based propensity score matching (PSM) technique is applied to ensure that women exposed to conflict and those not exposed are comparable, conditional on observable characteristics. Using a Gaussian kernel density function, the PSM method estimates each woman's likelihood of experiencing conflict exposure during the conflict period. Afterwards, the three control groups (women residing in conflict areas before the conflict, women residing in non-conflict areas before the conflict, and women residing in non-conflict areas during the conflict) are matched to the group of women who are exposed to conflict in the period during the conflict. The sample is matched on individual characteristics using the following variables: type of area (urban or rural), religion (Islam or other), education level (no education or at least incomplete primary education), marital status (currently married or other), employment status (currently working or not currently working), and literacy level (literate or illiterate). Variables unlikely to be affected by conflict are selected to avoid bias [37]. A bandwidth of 0.06 is used for the matching, as previous studies indicated that this bandwidth optimizes the trade-off between variance and bias [39]. In the results section, the kernel-based matching results are described.

After matching, equation (1) is estimated on the common support of the matched sample. This common support includes women residing in conflict areas for whom counterfactuals were found in each of the three control groups. To ensure comparability, the method assigns weights based on the propensity scores to all observations in the three control groups. The balanced sample is used in the DiD model (specified in Equation 1), applied with the weights derived from the PSM, to estimate the average treatment effect of exposure conflict on the various outcomes. This approach allows examination of the impact of conflict exposure on different outcome variables while addressing potential biases arising from observable differences between the exposed and nonexposed groups. Results of the balancing tests after matching are provided in appendix A.

2.3.1 | Robustness Checks

Several robustness checks are performed to ensure the reliability of the results. Firstly, heterogeneous impacts are explored by disaggregating between urban and rural areas. Secondly, various radii and numbers of conflict incidents are used to check whether greater or lesser intensity affects the size of the effect (10-km, 25-km, 50-km and 4 and 8 conflict incidents) Thirdly, a check in the exposure time is conducted, by using 2 years of conflict exposure. For the 2018 NDHS cluster, an analysis with 8 years of exposure is conducted, classifying women as conflict-exposed if eight or more fatal incidents occurred within a 15-km radius in both the first and second 4 years, totaling sixteen or more incidents over 8 years. Fourthly, a check with an additional variable to match (child wish) on is conducted, as well as a check with a narrower bandwidth in the matching procedure (0.01 instead of 0.06). Furthermore, additional analyses using Coarsened Exact Matching (CEM) are conducted as a check for the quality of the matching (results in Appendix B). Lastly, one DiD analysis without matching is performed to check for potentially biased controls. Results of the balancing tests for the robustness checks are provided in Appendix C.

2.3.2 | Assumptions

Certain assumptions underlie this methodology. It assumes that respondents did not migrate in the 4 years preceding the survey, as they are categorized as conflict-exposed if fatal incidents occurred within a 15-km radius of their current location. This is especially problematic if respondents move across areas with and without conflict. Selection bias over time may arise due to changes in sample composition before and during the conflict, and migration driven by law enforcement operations or fleeing conflict may influence the sample composition in conflict-affected areas. The lack of information about respondents' prior locations in the NDHS data raises concerns about selection bias in our analysis across groups and time. Additionally, using DiD requires assuming a parallel trend, meaning outcomes change similarly in conflict and non-conflict areas in the absence of conflict. While there is no direct test for this, using PSM ensures comparability in observed characteristics, reducing the risk of violation.

3 | Results

3.1 | Descriptive Results

Table 1 summarizes the key statistics for outcome and control variables at different time points, distinguishing between conflict-exposed and nonexposed clusters in 2013 and 2018. In 2008, this distinction was not applicable due to the conflict starting later. It is important to note that the treatment and control groups for 2008 differ for the 2013 and 2018 analyses based on conflict locations in 2009–2013 and 2014–2018. Before the conflict escalated in 2008, 17% of women had unmet family planning needs, decreasing to 12.9% in 2013% and 12.6% in 2018. Notably, in 2013, conflict-exposed women had a higher unmet need (14%) compared to nonexposed women (8%), evening out by 2018 due to increased unmet needs among the conflict-exposed.

The percentage of women jointly deciding on contraception usage with their partner increased from 2008 to 2013 and 2018. In 2013, a greater proportion of women exposed to conflict indicated they decided themselves about using contraception compared to women not exposed to conflict. However, by 2018, this difference becomes negligible. The proportion of married women able to ask their partner to use a condom increased from 24% in 2008 to 31% in 2018. Notable disparities existed between conflict-exposed and nonexposed groups in 2013 and 2018, with higher percentages in the conflict-exposed group being able to ask their partner to use a condom. The ability to decline sexual advances followed a fluctuating pattern. In 2008, 45% said they could refuse, increasing in 2013, particularly in the conflict-exposed group. By 2018, this had decreased in both groups. However, the proportion of women being able to refuse sex with their partner remains higher among women exposed to conflict compared to those not exposed to conflict. Northern Nigeria witnessed shifts with decreased unmet family planning needs and increased reproductive autonomy. However, disparities persist, as conflict-exposed women often demonstrate equal or higher reproductive autonomy but face comparable or lower unmet family planning needs.

As shown in Table 1, there are pronounced distinctions in general characteristics between the groups exposed and not exposed to conflict. The varying trends in urban/rural residence, education, marriage, employment, and literacy indicate a changing nature of the conflict. These trends potentially indicate a shift in conflict incident locations, where pre-2013 conflicts primarily affected educated, literate women in urban areas, while later on also more uneducated, married, working and illiterate women were exposed to conflict. These differences likely foster divergent trends in family planning and reproductive autonomy, underscoring the necessity for matching.

3.2 | Impact of Conflict on Unmet Need for Family Planning

Table 2 presents the DiD results on the matched samples, both overall and disaggregated for rural/urban areas. The findings indicate that when comparing 2013 to 2008, exposure to conflict seems to be negatively associated with the probability of unmet need for family planning. This means that the likelihood of a woman having an unmet need for family planning was lower in the group exposed to conflict than in the group not exposed to conflict, with a difference of 4.8 percentage points (statistically significant at the 1% level). The results of the robustness checks are in the same direction and exhibit the expected changes in effect size. Figure 1 visually captures the shifts in unmet family planning needs (with Kernel weights applied). However, the disaggregated results show no statistically significant effect of conflict on unmet need for family planning in rural areas, despite the considerably larger sample size in these regions compared to urban areas. The overall significant impact appears to be primarily driven by the effect observed in urban areas.

The results of comparing 2018 to 2008 illustrate similar differences in unmet family planning needs between conflict exposed and nonexposed groups at both time points, indicating no significant impact from exposure to the conflict overall (see Figure 1). Nevertheless, when disaggregated by type of area, a very small yet positive impact of conflict on unmet need for family planning is found in rural areas, although this is only significant at the 10% level. This possibly suggests that exposure to conflict during the later years (between 2014 and 2018) is associated with a slight increase in the probability of unmet family planning needs in 2018, specifically within rural regions.

These findings underline that earlier conflict exposure (pre-2013) appears to be more associated to unmet family planning needs than exposure after 2014. Additionally, the impact of earlier exposure seems confined to urban areas, while the impact of later exposure only affects rural areas. Surprisingly, earlier conflict exposure seems to alleviate unmet family planning needs, while later exposure paradoxically seems to elevate the likelihood of such needs.

3.3 | Impact of Conflict on Reproductive Autonomy

In the following sections, the findings on the impact of conflict on reproductive autonomy, measured by contraceptive decision-

TABLE 1 | Descriptive statistics by year.

Variable	Description	2008		2013		2018	
				Exposed	Not exposed	Exposed	Not exposed
Unmet need for family planning	1 if woman has unmet need for family planning, 0 otherwise	16.9%	(0.003)	8.0%	13.6%	13.0%	12.5%
				(0.010)	(0.004)	(0.008)	(0.003)
Decides about use contraception	1 if contraception use is mainly woman's (or joint) decision, 0 otherwise	78.3%	(0.018)	89.5%	78.6%	84.2%	84.5%
				(0.033)	(0.024)	(0.025)	(0.014)
Able to ask condom	1 if woman is able to ask partner to use a condom, 0 otherwise	24.2%	(0.008)	44.2%	30.3%	46.8%	28.7%
				(0.027)	(0.010)	(0.021)	(0.009)
Able to refuse sex	1 if woman is able to refuse sex with partner, 0 otherwise	44.8%	(0.009)	74.7%	49.4%	64.6%	41.1%
				(0.029)	(0.011)	(0.021)	(0.009)
Urban	1 if woman resides in urban area, 0 otherwise	24.3%	(0.021)	94.7%	18.5%	72.1%	21.9%
				(0.036)	(0.016)	(0.039)	(0.014)
Muslim	1 if religion is Islam, 0 otherwise	72.4%	(0.014)	70.7%	77.4%	71.8%	79.9%
				(0.065)	(0.016)	(0.037)	(0.013)
Educated	1 if woman has had any education, 0 if no education	38.1%	(0.014)	74.2%	36.4%	70.9%	39.4%
				(0.039)	(0.015)	(0.022)	(0.013)
Married	1 if woman is currently married, 0 otherwise	82.4%	(0.007)	61.9%	82.4%	78.3%	60.9%
				(0.024)	(0.007)	(0.007)	(0.016)
Working	1 if woman is currently working, 0 otherwise	53.9%	(0.009)	51.0%	58.5%	56.6%	58.6%
				(0.023)	(0.010)	(0.015)	(0.008)
Literate	1 if woman is literate, 0 otherwise	29.4%	(0.014)	70.7%	28.8%	62.7%	28.5%
				(0.042)	(0.014)	(0.022)	(0.011)
N	Total observations			2,128	20,257	4,195	21,245
	%			9.5	90.5	16.5	83.5

Note: Population estimates, sampling weights are applied. Linearized standard errors below population estimates in parentheses.

TABLE 2 | Results DiD analysis with Kernel matching, 2008–2013 and 2008–2018.

Indicator		2008–2013			2008–2018		
		DiD	Rob. SE	*N*	DiD	Rob. SE	*N*
Unmet need FP	Overall	−0.048***	(0.012)	41,724	0.002	(0.010)	45,046
	Rural	−0.023	(0.027)	30,906	0.026**	(0.014)	32,915
	Urban	−0.051***	(0.015)	10,818	−0.011	(0.014)	12,131
Contraceptive autonomy[a]	Overall	0.159***	(0.057)	1893	−0.008	(0.038)	2657
	Rural	0.222***	(0.093)	626	−0.122***	(0.058)	1653
	Urban	0.172***	(0.065)	974	0.059	(0.050)	1163
Able to ask condom[b]	Overall	0.043**	(0.022)	32,917	0.090***	(0.016)	34,912
	Rural	0.046	(0.043)	24,997	0.160***	(0.021)	26,884
	Urban	0.038	(0.027)	7379	0.056***	(0.024)	8027
Able to refuse sex[b]	Overall	0.166***	(0.022)	33,380	0.139***	(0.016)	34,913
	Rural	−0.074	(0.048)	24,998	0.119***	(0.023)	26,882
	Urban	0.190***	(0.026)	7304	0.162***	(0.024)	8030

Note: Unmet need FP = 1 if woman has unmet need for family planning, contraceptive autonomy = 1 if woman decided (or together with partner) about use contraception, able to ask condom = 1 if woman is able to ask partner to use condom, able to refuse sex = 1 if woman is able to refuse sex with her partner.
[a]Sample includes only women who are married or are living together with a partner and who are using contraception.
[b]Sample includes only women who are married or are living together with a partner.
*$p < 0.01$; **$p < 0.1$; ***$p < 0.05$.

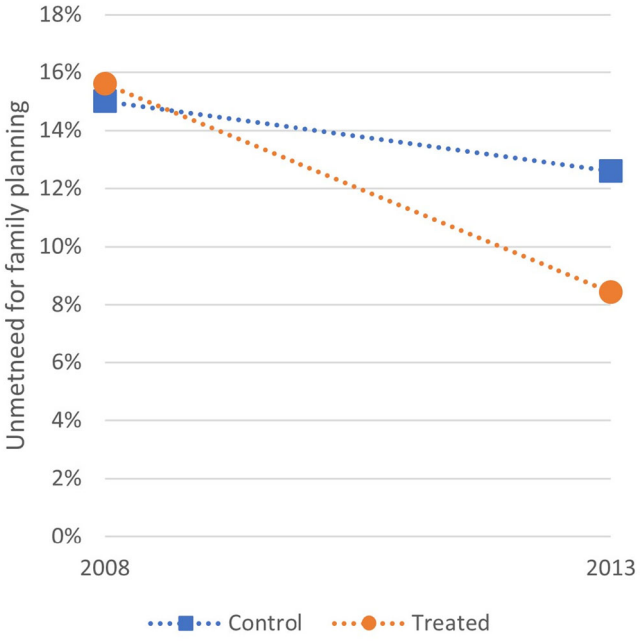

FIGURE 1 | Mean percentage of women with an unmet need for family planning in 2008 and 2013, Kernel weights applied.

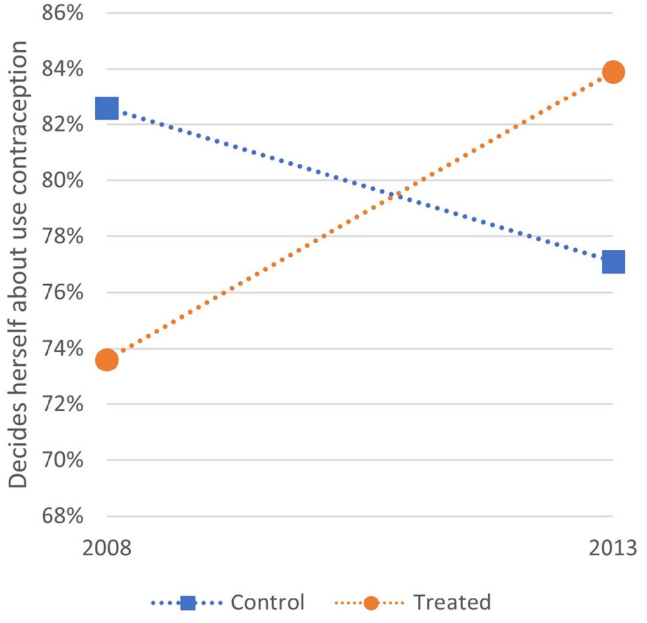

FIGURE 2 | Mean percentage of women deciding themselves (or jointly with partner) about use contraception in 2008 and 2013, Kernel weights applied.

making, the ability to ask to use a condom and the ability to refuse sex, are described.

3.3.1 | Impact of Conflict on Contraceptive Decision-Making

Exposure to conflict before 2013 seems to be positively associated with contraceptive decision-making, meaning that exposure to conflict is associated with a 15.9 percentage points higher probability (significant at 1% level) of women to decide themselves or jointly with their partner, about their contraception use, as opposed to their partner deciding alone (see Table 2). This is illustrated in Figure 2. However, the robustness checks show mixed results. The sample sizes are relatively small, due to only including married women who use contraception. Large and statistically significant effects are only found in the analyses with less than 150 observations in the treated group at T0, and can therefore not be considered robust. Due to the small sample sizes, disaggregated effects by urban/rural areas are less reliable.

The results from comparing 2008 to 2018 portray a different narrative, where the differences between the groups are similar at both time points, indicating no differences in trends between the groups. This is also reflected in Table 2, where no statistically significant difference is found between the differences overall. However, when disaggregated by area, an adverse effect is found in rural areas, where exposure to conflict appears to decrease the probability of women deciding about their contraception use by 12.2 percentage points (statistically significant at the 5% level). However, the small sample size of the disaggregated analysis limits the reliability of this finding.

3.3.2 | Impact of Conflict on the Ability to Ask Condom

In 2008, a larger share of women in the group not exposed to conflict was able to ask their partner to use a condom compared to the group exposed to conflict. However, in 2013, this reversed, and a slightly higher share of women who were exposed to conflict in the past 4 years were able to ask to use a condom compared to the group not exposed. This results in a small and statistically significant impact (at the 10% significance level) when comparing 2008 to 2013, where conflict exposure is associated with a 4 percentage points higher probability of women being able to request condom use by 4 percentage points. The disaggregated effects for rural and urban areas are in the same direction but are both not statistically significant, potentially due to the decrease in sample size. The results of the robustness checks are also in the same direction, yet varying in whether the small effects are statistically significant or not (see Table 3).

Furthermore, the analysis of 2008–2018 also reveals positive effects, yet of greater magnitude (see Figure 3). The overall effects are statistically significant after disaggregation in rural and urban areas during this time frame. In rural contexts, exposure to conflict is associated with an increased likelihood of women being capable of requesting condom usage by 16 percentage points (significant at the 1% level) and an increased probability of 6 percentage points in urban areas (significant at the 5% level). The results of the robustness checks all indicate positive and statistically significant effects, although the checks with a smaller/larger radius and more/less conflict incidents do not move in the direction as expected (see Table 3). Although less clear between 2008 and 2013, exposure to conflict seems to be associated with an increased women's reproductive autonomy in terms of being able to ask their partner to use a condom.

3.3.3 | Impact of Conflict on the Ability to Refuse Sex

Overall, exposure to conflict seems to be strongly associated with the ability to refuse sex, with an increased probability for women being able to refuse sex with their partner of 17 percentage points (significant at the 1% level) compared to those not exposed to conflict in earlier years (see Table 2). However, disaggregation reveals that this effect may entirely be driven by urban areas, as within these areas, the effect of exposure to conflict is found to be even larger, 19 percentage points (statistically significant at 1%), while in rural areas, a negative, nonsignificant effect is found. The robustness checks are also strongly positive, and behave in the direction as expected. These results indicate that in urban areas, exposure to conflict between 2008 and 2013 is associated with an increased women's reproductive autonomy in terms of the probability of women's ability to refuse sex with their partner of 19 percentage points, while conflict before 2013 does not seem to be associated to women's ability to refuse sex in rural areas.

However, the analysis comparing 2018 to 2008 indicates a strong correlation between exposure to conflict and a higher ability to refuse sex in both rural and urban areas, of 12 and 16 percentage points, respectively (both statistically significant at 1% level). Even though exposure to conflict in earlier years does not seem to have an impact on women in rural areas regarding their ability to refuse sex, exposure to conflict in later years (between 2014 and 2018) is significantly associated with a higher ability of women to refuse sex in these areas. Overall, exposure to conflict seems strongly associated with a higher probability of a woman being able to refuse sex with her partner (see Figure 4), and these findings are supported by the robustness checks as well (Table 3).

4 | Discussion

This study examined the impact of conflict exposure in northern Nigeria on women's unmet need for family planning and reproductive autonomy, utilizing a difference-in-differences (DiD) approach with Kernel matching. The findings regarding unmet need for family planning revealed a nuanced relationship. Conflict exposure between 2009 and 2013 is associated with a small decrease in the probability of unmet need for family planning in urban areas, possibly indicating that conflict may have contributed to a greater awareness and demand for family planning services in urban communities. Also, foreign donor aid to conflict areas may have resulted in a greater supply of family planning tools like condoms. Surprisingly, over the subsequent period from 2014 to 2018, conflict exposure in rural areas is associated with an increased probability of unmet needs of three percentage points compared to 2008. The differential impact of conflict in rural settings might explain the contrasting effects. These regions may have faced greater healthcare services and infrastructure disruptions during this period, leading to reduced access to family planning resources and a greater unmet need. It might also be that foreign aid was reduced after a while, resulting in a lower supply of family planning instruments compared to the first phase of the armed conflict.

In addition, this study explored the effects of exposure to conflict on reproductive autonomy. The results of the analysis for the first indicator of this concept, contraceptive decision-making, suggest mixed but predominantly positive associations between conflict exposure from 2009 to 2013 and the probability of women participating in the contraceptive decision-making process. However, for women exposed to conflict between 2014 and 2018, a decrease in the probability of active contraceptive decision-making by twelve percentage points in rural areas was found, although the sample size for this analyses was relatively small. Similar to the unmet need for family planning, the conflict in 2014–2018 only seems to be associated to

TABLE 3 | Results of robustness checks of DiD analysis with Kernel PSM matching, 2008–2013 and 2008–2018.

		2008–2013			2008–2018		
Indicator	**Rob. checks**	**DiD**	**Rob. SE**	***N***	**DiD**	**Rob. SE**	***N***
Unmet need FP	Reference	−0.048***	(0.012)	41,724	0.002	(0.010)	45,046
	No matching	−0.063***	(0.013)	42,208	−0.003	(0.010)	45,285
	BW 0.01	−0.040***	(0.013)	41,724	−0.0004	(0.010)	45,046
	Extra control	−0.032**	(0.013)	38,349	−0.0006	(0.010)	43,122
	10 km	−0.055***	(0.015)	24,800	−0.008	(0.010)	45,046
	25 km	−0.031***	(0.011)	41,724	−0.012	(0.008)	45,046
	50 km	−0.014*	(0.008)	41,724	0.005	(0.008)	45,046
	4 incidents	−0.030***	(0.012)	41,724	−0.007	(0.009)	40,986
	16 incidents	−0.090***	(0.015)	41,284	−0.013	(0.011)	44,703
	2 years exp.	−0.086***	(0.014)	36,336	−0.007	(0.012)	40,554
	8 years exp.				−0.011	(0.011)	45,046
Contraceptive autonomy[a]	Reference	0.159***	(0.057)	1893	−0.008	(0.038)	2657
	No matching	0.240***	(0.055)	2040	0.027	(0.043)	2828
	BW 0.01	0.172***	(0.058)	1893	0.006	(0.038)	2657
	Extra control	0.137**	(0.056)	1839	−0.013	(0.038)	2803
	10 km	0.054	(0.068)	1315	−0.0005	(0.040)	2762
	25 km	0.049	(0.049)	1909	−0.043	(0.034)	2818
	50 km	0.045	(0.042)	2015	0.038	(0.041)	2815
	4 incidents	0.052	(0.050)	1949	−0.008	(0.035)	2817
	16 incidents	0.324***	(0.081)	1330	−0.020	(0.043)	2657
	2 years exp.	0.237***	(0.071)	1399	−0.047	(0.044)	2654
	8 years exp.				0.019	(0.043)	2818
Able to ask condom[b]	Reference	0.043*	(0.022)	32,917	0.090***	(0.016)	34,912
	No matching	0.035	(0.023)	33,729	0.106***	(0.017)	35,093
	BW 0.01	0.040*	(0.023)	32,917	0.081***	(0.016)	34,912
	Extra control	0.047**	(0.023)	33,176	0.088***	(0.016)	34,798
	10 km	0.035	(0.026)	20,020	0.086***	(0.018)	34,912
	25 km	0.023	(0.019)	32,449	0.059***	(0.013)	34,900
	50 km	−0.013	(0.013)	33,208	0.127***	(0.013)	34,912
	4 incidents	0.039*	(0.021)	33,376	0.068***	(0.014)	34,900
	16 incidents	0.045*	(0.026)	33,376	0.073***	(0.019)	34,912
	2 years exp.	0.011	(0.024)	32,917	0.091***	(0.022)	34,845
	8 years exp.				0.047**	(0.019)	30,182
Able to refuse sex[b]	Reference	0.166***	(0.022)	33,380	0.139***	(0.016)	34,913
	No matching	0.253***	(0.022)	33,732	0.181***	(0.017)	35,093
	BW 0.01	0.153***	(0.022)	33,380	0.138***	(0.017)	34,913
	Extra control	0.170***	(0.022)	33,181	0.136***	(0.016)	34,800
	10 km	0.234***	(0.025)	20,021	0.183***	(0.018)	33,984
	25 km	0.095***	(0.018)	33,380	0.070***	(0.014)	34,901
	50 km	0.089***	(0.013)	33,377	0.085***	(0.013)	34,913
	4 incidents	0.155***	(0.020)	28,451	0.120***	(0.015)	34,901
	16 incidents	0.215***	(0.025)	32,921	0.114***	(0.019)	34,913

(Continues)

TABLE 3 | (Continued)

Indicator	Rob. checks	2008–2013 DiD	2008–2013 Rob. SE	2008–2013 *N*	2008–2018 DiD	2008–2018 Rob. SE	2008–2018 *N*
	2 years exp.	0.191***	(0.024)	33,380	−0.014	(0.021)	30,169
	8 years exp.				0.156***	(0.019)	30,183

Note: Reference uses a 15 km radius, minimum of 8 fatal conflict incidents, bandwidth (BW) of 0.06, and within 4 years. Extra control includes desire for children as additional matching variable. Unmet need FP = 1 if woman has unmet need for family planning, contraceptive autonomy = 1 if woman decided (or together with partner) about use contraception, able to ask condom = 1 if woman is able to ask partner to use condom, able to refuse sex = 1 if woman is able to refuse sex with her partner.
[a]Sample includes only women who are married or are living together with a partner and who are using contraception.
[b]Sample includes only women who are married or are living together with a partner.
*$p < 0.01$; **$p < 0.05$; ***$p < 0.1$.

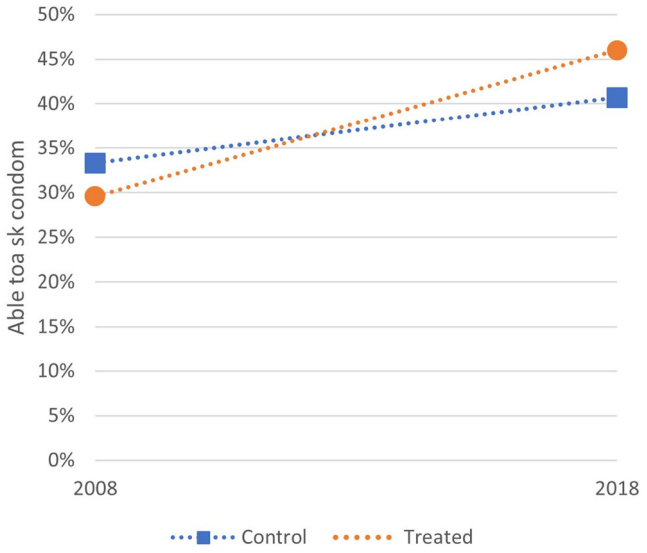

FIGURE 3 | Mean percentage of women able to ask their partner to use a condom in 2008 and 2018, Kernel weights applied.

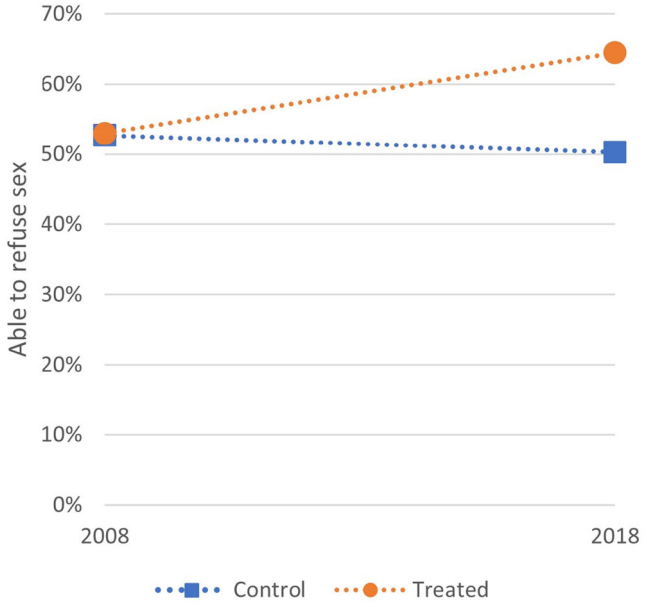

FIGURE 4 | Mean percentage of women able to refuse sex in 2008 and 2018, Kernel weights applied.

contraceptive decision-making in rural areas, in the opposite direction as the effects for women exposed to conflict in 2009–2013. This may be explained by disruptions in traditional social structures during earlier conflict, leading to greater reproductive autonomy. Similarly, in a previous study [40] the positive impact of conflict on the likelihood of premarital first sex was explained as a result of social disruptions and changing social norms during conflict. However, during conflict in the later period, conservative religious and cultural values may have partially reasserted themselves in conflict-affected rural areas where adherence to traditional values may be stronger.

Examining the ability to ask partners to use condoms, the study showed a significant association with conflict exposure during 2014–2018. Conflict in these years was strongly associated with an increased likelihood of women in rural areas being able to ask their partner to use a condom, by more than fifteen percentage points. This suggests that conflict may have an empowering effect on women's ability to assert their preferences regarding condom use, particularly during the latter period of 2014–2018. A possible explanation for this could be the presence of humanitarian assistance, NGOs promoting gender equality or changing gender norms during the conflict. Furthermore, the analysis of the ability to refuse sex indicated a strong positive association with conflict in both rural and urban areas. Conflict during 2009–2013-was associated with a 20 percentage point increase in the ability of women to refuse sex in urban settings, while conflict during 2014–2018 was associated with an increased ability for women to refuse sex in both rural and urban areas.

Although differential effects are based on the type of area and the timing of exposure, conflict seems to increase women's reproductive autonomy and decrease their unmet need for family planning. Various pathways may explain the direction of the results found in this study. Even though various studies found a negative impact of conflict on access to sexual, reproductive and maternal healthcare services, our study reveals a partially positive impact, acknowledging that unmet family planning needs depend on factors beyond healthcare accessibility [13, 14]. However, Chi et al. [16] noted the adverse effects of conflict on maternal and reproductive health services but also observed improved perceived healthcare access for a specific population segment attributed to NGO involvement. Similarly, Tyndall et al. [15] found enhanced health status in a specific population during conflict in northeastern Nigeria, credited to local and international humanitarian efforts. Orach and De Brouwere [41] reported that displaced populations, like IDPs and refugees, often have better healthcare access due to international aid. While distinct from family planning, a similar pattern may explain improved reproductive autonomy in conflict-exposed women, emphasizing the role of increased humanitarian aid.

Notably, Nigeria's substantial development assistance [42] may include reproductive health education, empowering women with information on family planning methods and rights. The reduced unmet need for family planning in urban areas during conflict (2009–2013) may be due to heightened awareness and improved access, as conflict-driven disruptions lead to foreign aid that prioritizes healthcare, leading to better family planning resource availability. Humanitarian organizations prioritizing healthcare during conflicts might contribute to temporary surges in awareness and access to family planning resources in affected areas.

The current study's results may be partially influenced by changed fertility preferences, aligning with established research on altered fertility rates in conflict-affected populations [18, 20, 43]. For example, Rotondi and Rocca's study [19] focusing on Boko Haram's impact in Nigeria found increased fertility linked to conflict exposure. Combining this with our study's finding of reduced unmet need for family planning in urban areas during conflict suggests a potential shift in fertility preferences. This shift may indicate a decreased need for family planning, possibly driven by a preference for more children as a coping strategy amid insecurity, seeking enhanced social and economic security, or replacing lost members during the conflict [18, 44]. However, our findings contradict an earlier study by Torrisi, who found that armed violence in Mali is related to a lower probability of using modern contraception and also a higher risk of unwanted pregnancies, indicating an increased unmet need for family planning [29].

Furthermore, the present study's findings may be associated with shifting gender norms during conflict, as tumultuous times can challenge or disrupt traditional gender roles and norms, prompting women to assume new roles and responsibilities within their households [45]. A study by Ibanez et al. [46] indicates that women's labor force participation increased due to various conflict-related factors, and Eseosa Ekhator-Mobayode et al. [25] show that women who are displaced due to conflict often become the primary breadwinner for their families. Additionally, several studies indicate that when women are employed, they are more likely to be involved in decision-making processes at home [47, 48]. With an increased role in the household and economic activities, women may gain more control over their reproductive choices, including family planning and contraceptive decisions. Limited data on female employment in Nigeria's conflict areas suggest increased economic activity, potentially enhancing women's decision-making autonomy [49, 50]. The positive association of conflict and reproductive autonomy in this study may also stem from the profound influence of conflict on individuals' perspectives and adaptive strategies. During conflict, women may prioritize their reproductive health and family planning decisions as a means of seeking control and security amidst upheaval and uncertainty. This may lead to a desire for greater control over one's sexuality, possibly manifesting in the ability to make decisions about contraception, negotiate condom use with partners, and refuse unwanted sexual advances, serving as coping mechanisms amid challenging circumstances. By proactively managing their reproductive health needs, women may experience an increased sense of control and autonomy over their bodies and lives, contributing to empowering them to navigate the difficulties posed by conflict. This could be described as a risk-aversion strategy, which is also noted by Svallfors et al. [12] as an explanation for their finding an association between armed conflict and more support for contraception, safe abortion, and early marriage. However, further research is needed to validate this mechanism.

Several limitations of this study need to be acknowledged. First, the displacement of geo-coordinates of DHS data may have resulted in attenuation bias in the DiD regressions. A larger radius was used to mitigate this, but exploring alternative ways to measure conflict exposure without exact geo-coordinates could be beneficial. Second, the focus was solely on conflict incidents within Nigeria, overlooking the impact of Boko Haram activities in neighboring countries. Including data from these countries in future research would enhance the analysis. Thirdly, the displacement caused by conflicts in Nigeria has led to over three million people being forcibly displaced, with the northeast region being significantly affected [51, 52]. Unfortunately, data on the previous residence locations of DHS respondents was unavailable for all time points, introducing potential biases. Kernel propensity score matching was used to address this, but migration-related biases may persist in the case of selective migration. Furthermore, propensity score construction faced limitations due to scarce variables unaffected by conflict. Balancing tests revealed statistically significant differences in covariates between exposed and unexposed groups, which potentially impact the analysis's reliability despite being smaller than ten percentage points. Although a rigorous design has been used to analyze causal effects, due to the nature of the data (observational, repeated cross-sectional), there is a possibility that our findings are a result of other co-occurring changes in the conflict areas. Lastly, the binary measurement of women's reproductive autonomy and unmet need for family planning oversimplifies their complex nature. While allowing for large sample sizes and national representativity, future research could benefit from qualitative approaches to better understand the relationship between conflict and these concepts.

In conclusion, the results of this study indicate that the relationship between conflict exposure and reproductive autonomy and unmet need for family planning is multifaceted and contingent upon specific contextual factors. However, the findings from this study seem to indicate predominantly positive effects of conflict, with a negative association with unmet need for family planning and positive association with reproductive autonomy. These findings may indicate that during times of heightened tension and disruption caused by conflict, societal norms and power dynamics may transform, potentially leading to increased recognition of women's autonomy in sexual decision-making. In addition, this study highlights different trends between urban and rural areas. Differences between urban and rural areas may be partially attributed to differential social norms, access to resources and opportunities for women to access support networks and educational resources in both areas. Moreover, the timing of conflict exposure appears to be crucial in determining its impact on women's unmet need for family planning and reproductive autonomy. The different effects observed between earlier and later exposure to conflict indicate that the long-term consequences of conflict may evolve.

It is essential to thoroughly understand the underlying mechanisms in the relationship between conflict, unmet need for family planning, and reproductive autonomy. Further research is highly recommended to understand better the differential effects across areas and timing of conflict exposure, to eventually develop comprehensive strategies which can improve women's sexual and reproductive health and rights, also during times of conflict.

Author Contributions

Lieke Vilier: conceptualization (lead), data curation (lead), formal analysis (lead), methodology (equal), project administration (lead), visualization (lead), writing–original draft preparation (lead), writing–review and editing (lead). **Wim Groot:** conceptualization (supporting), formal analysis (supporting), methodology (equal), supervision (lead), writing–review and editing (supporting).

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Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

ACLED data is openly available at https://acleddata.com/data-export-tool/. DHS data are available in the DHS Program. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the authors with the permission of the DHS Program.

Transparency Statement

The lead author Lieke Vilier affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Appendix A: Balance Tests Main Analysis
Table A1, Table A2, Table A3, Table A4.

TABLE A1 | Balancing test on outcome unmet need for family planning.

	2008		2013		2008		2018	
Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Urban	0.0787***	(0.0115)	3.97e−06	(0.00641)	0.0563***	(0.0105)	0.0163*	(0.00846)
Muslim	−0.0426***	(0.0130)	-0.0186	(0.0125)	−0.0369***	(0.0104)	−0.0476***	(0.00827)
Educated	0.0357***	(0.0118)	0.00864	(0.0109)	0.0264***	(0.00938)	0.0549***	(0.00814)
Married	−0.0231*	(0.0129)	−0.0379***	(0.0128)	−0.0373***	(0.00987)	−0.0302***	(0.00897)
Working	−0.0532***	(0.0134)	−0.0369***	(0.0132)	−0.0181*	(0.0104)	0.0193**	(0.00906)
Literate	0.0347***	(0.0126)	0.00712	(0.0114)	0.0177*	(0.0102)	0.0596***	(0.00889)
n	19,606		22,118		19,606		25,440	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and t-test are estimated by linear regression. *, **, *** significant at 10%, 5%, and 1%.

TABLE A2 | Balancing test for the outcome contraceptive autonomy.

	2008		2013		2008		2018	
Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Urban	0.0587	(0.0373)	0.0131	(0.0158)	0.0337	(0.0387)	0.0260	(0.0259)
Muslim	−0.0776	(0.0496)	0.0161	(0.0349)	−0.0366	(0.0385)	−0.0151	(0.0287)
Educated	−0.00156	(0.0298)	0.00460	(0.0145)	0.00106	(0.0327)	0.00450	(0.0204)
Married	0.00644	(0.0144)	0.00540*	(0.00307)	−0.00776	(0.0105)	0.00130	(0.00663)
Working	0.0179	(0.0480)	−0.0351	(0.0342)	−0.0321	(0.0343)	0.00163	(0.0247)
Literate	0.0164	(0.0343)	0.00671	(0.0253)	0.00665	(0.0375)	0.000969	(0.0255)
n	844		1049		844		1813	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and t-test are estimated by linear regression. *, **, *** significant at 10%, 5% and 1%.

TABLE A3 | Balancing test for the outcome ability to ask condom.

	2008		2013		2008		2018	
Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Urban	0.0894***	(0.0145)	1.32e−05	(0.00949)	0.0685***	(0.0125)	0.0225**	(0.0108)
Muslim	−0.0388***	(0.0149)	−0.0538***	(0.0147)	−0.0449***	(0.0119)	−0.0544***	(0.0100)
Educated	0.0373**	(0.0156)	0.0143	(0.0152)	0.0323***	(0.0121)	0.0677***	(0.0109)
Married	−0.00196	(0.0029-8)	−0.00463*	(0.00269)	0.000130	(0.0018-2)	6.22e−05	(0.00220)
Working	−0.0661***	(0.0160)	−0.0104	(0.0155)	−0.00795	(0.0118)	0.0325***	(0.0106)
Literate	0.0293*	(0.0162)	0.0195	(0.0156)	0.0183	(0.0124)	0.0584***	(0.0114)
n	15,934		16,983		15,934		18,978	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and *t*-test are estimated by linear regression. *, **, *** significant at 10%, 5% and 1%.

TABLE A4 | Balancing test for the outcome ability to refuse sex.

	2008		2013		2008		2018	
Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Urban	0.0894***	(0.0145)	1.38e−05	(0.00957)	0.0684***	(0.0125)	0.0225**	(0.0108)
Muslim	−0.0384**	(0.0149)	−0.0539***	(0.0147)	−0.0452***	(0.0119)	−0.0544***	(0.0100)
Educated	0.0373**	(0.0156)	0.0131	(0.0152)	0.0324***	(0.0121)	0.0677***	(0.0109)
Married	−0.00195	(0.00298)	−0.00461*	(0.00269)	0.000135	(0.00181)	6.22e−05	(0.00220)
Working	−0.0659***	(0.0160)	−0.0109	(0.0154)	−0.00772	(0.0118)	0.0325***	(0.0106)
Literate	0.0294*	(0.0162)	0.0197	(0.0156)	0.0182	(0.0124)	0.0584***	(0.0114)
n	15,935		17,445		15,935		18,978	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and t-test are estimated by linear regression. *, **, *** significant at 10%, 5% and 1%.

Appendix B: Results Analyses With Coarsened Exact Matching (CEM)

Table B1.

TABLE B1 | Results of robustness checks of DiD analysis with Kernel PSM matching, 2008–2013 and 2008–2018.

		2008–2013			2008–2018		
Indicator	**Rob. checks**	**DiD**	**Rob. SE**	***N***	**DiD**	**Rob. SE**	***N***
Unmet need FP	CEM reference	−0.043***	(0.012)	41,637	−0.001	(0.010)	45,015
	Extra control	−0.027**	(0.012)	40,900	−0.001	(0.009)	44,894
	10 km	−0.048***	(0.014)	40,369	−0.013	(0.011)	44,964
	25 km	−0.031***	(0.011)	41,681	−0.011	(0.008)	45,039
	50 km	−0.017**	(0.008)	41,714	0.002	(0.009)	45,032
	4 inc	0.001	(0.015)	41,637	−0.01	(0.009)	45,015
	16 inc	−0.080***	(0.015)	41,637	−0.018	(0.011)	45,015
	2 years exp.	−0.075***	(0.013)	41,407	−0.003	(0.012)	45,001
	8 years exp.				−0.012	(0.011)	45,004
Contraceptive autonomy[a]	CEM reference	0.157***	(0.056)	2006	−0.025	(0.039)	2819
	Extra control	0.147***	(0.055)	1942	−0.017	(0.039)	2803
	10 km	0.069	(0.065)	1953	−0.023	(0.048)	2812
	25 km	0.053	(0.048)	2013	−0.060*	(0.035)	2819
	50 km	0.039	(0.043)	2015	0.02	(0.046)	2819
	4 inc	−0.071	(0.061)	2006	−0.048	(0.038)	2819
	16 inc	0.308***	(0.079)	2006	−0.028	(0.044)	2819
	2 years exp.	0.231***	(0.071)	2003	−0.056	(0.044)	2819
	8 years exp.				0.009	(0.045)	2819
Able to ask condom[b]	CEM reference	0.048**	(0.022)	33,312	0.078***	(0.016)	34,891
	Extra control	0.048**	(0.022)	32,731	0.074***	(0.016)	34,775
	10 km	0.031	(0.026)	32,595	0.075***	(0.019)	34,854
	25 km	0.021	(0.018)	33,356	0.058***	(0.013)	34,912
	50 km	−0.028**	(0.013)	33,376	0.110***	(0.013)	34,911
	4 inc	0.042*	(0.026)	33,312	0.051***	(0.016)	34,891
	16 inc	0.051**	(0.026)	33,312	0.072***	(0.018)	34,891
	2 years exp.	0.017	(0.024)	33,299	0.079***	(0.021)	34,891
	8 years exp.				0.051***	(0.018)	34,891
Able to refuse sex[b]	CEM reference	0.158***	(0.021)	33,316	0.129***	(0.016)	34,892
	Extra control	0.161***	(0.021)	32,736	0.125***	(0.016)	34,777
	10 km	0.227***	(0.025)	32,599	0.173***	(0.020)	34,855
	25 km	0.083***	(0.018)	33,360	0.070***	(0.013)	34,913
	50 km	0.068***	(0.013)	33,380	0.071***	(0.014)	34,912
	4 inc	0.140***	(0.024)	33,316	0.094***	(0.016)	34,892
	16 inc	0.206***	(0.025)	33,316	0.128***	(0.019)	34,892
	2 years exp.	0.184***	(0.023)	33,303	0.019	(0.021)	34,892
	8 years exp.				0.154***	(0.018)	34,892

Note: Reference uses a 15 km radius, minimum of 8 fatal conflict incidents, bandwidth (BW) of 0.06, and within 4 years. Extra control includes desire for children as additional matching variable. Unmet need FP = 1 if woman has unmet need for family planning, contraceptive autonomy = 1 if woman decided (or together with partner) about use contraception, able to ask condom = 1 if woman is able to ask partner to use condom, able to refuse sex = 1 if woman is able to refuse sex with her partner.

[a]Sample includes only women who are married or are living together with a partner and who are using contraception.

[b]Sample includes only women who are married or are living together with a partner.

*$p < 0.01$; **$p < 0.05$; ***$p < 0.1$.

Appendix C: Balance tests robustness checks

Table C1, Table C2, Table C3, Table C4, Table C5, Table C6, Table C7, Table C8, Table C9.

TABLE C1 | Balancing test for robustness check with a bandwidth of 0.01.

		2008		2013		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.00607	(0.0113)	−9.31e−08	(0.00641)	0.0228**	(0.0105)	7.25e−08	(0.00847)
	Muslim	−0.0389***	(0.0131)	−0.0267**	(0.0125)	−0.00845	(0.0105)	−0.00497	(0.00842)
	Educated	0.0149	(0.0124)	0.000721	(0.0108)	−0.0233**	(0.00955)	−0.00211	(0.00803)
	Married	−0.0142	(0.0130)	−0.00522	(0.0131)	0.00188	(0.0101)	−0.00819	(0.00903)
	Working	−0.018	(0.0136)	−0.000569	(0.0133)	−0.0144	(0.0105)	0.00876	(0.00912)
	Literate	−0.00077	(0.0130)	−0.00265	(0.0113)	−0.0216**	(0.0103)	0.00579	(0.00881)
	n	19,606		22,118		19,606		25,440	
Contraceptive autonomy	Urban	0.00654	(0.0400)	2.41e−07	(0.0156)	−0.0123	(0.0389)	−0.00106	(0.0258)
	Muslim	0.00661	(0.0504)	0.00527	(0.0358)	−0.00938	(0.0389)	−0.00400	(0.0291)
	Educated	−0.0136	(0.0312)	0.00462	(0.0149)	−0.00310	(0.0326)	0.000456	(0.0206)
	Married	0.00805	(0.0245)	0.000230	(0.000156)	−0.00595	(0.0132)	0.000385	(0.00730)
	Working	0.0142	(0.0516)	0.00183	(0.0357)	−0.0146	(0.0360)	−0.0106	(0.0248)
	Literate	0.0124	(0.0372)	0.00408	(0.0288)	0.00543	(0.0374)	−0.0198	(0.0256)
	n	844		1049		844		1813	
Able to ask condom	Urban	0.00371	(0.0143)	−5.79e−08	(0.00951)	0.0281**	(0.0126)	−6.17e−07	(0.0108)
	Muslim	−0.0474***	(0.0148)	−0.000908	(0.0156)	0.0125	(0.0121)	−0.00572	(0.0103)
	Educated	0.0173	(0.0161)	0.00698	(0.0152)	−0.0287**	(0.0122)	0.00561	(0.0109)
	Married	−0.0002	(0.00187)	0.000583	(0.00362)	0.000473	(0.00212)	−0.00407**	(0.00198)
	Working	−0.0317*	(0.0166)	−0.0325**	(0.0154)	−0.00718	(0.0120)	0.0125	(0.0107)
	Literate	−0.00117	(0.0165)	0.00139	(0.0156)	−0.0277**	(0.0125)	0.00238	(0.0114)
	n	15,934		16,983		15,934		18,978	
Able to refuse sex	Urban	0.00377	(0.0142)	9.25e−08	(0.00959)	0.0280**	(0.0125)	−6.73e−07	(0.0108)
	Muslim	−0.0466***	(0.0148)	−0.00123	(0.0156)	0.0126	(0.0121)	−0.00572	(0.0103)
	Educated	0.0169	(0.0161)	0.00568	(0.0152)	−0.0288**	(0.0122)	0.00561	(0.0109)
	Married	−0.00022	(0.00193)	0.000578	(0.00360)	0.000462	(0.00210)	−0.00407**	(0.00198)
	Working	−0.0313*	(0.0166)	−0.0331**	(0.0154)	−0.00702	(0.0120)	0.0125	(0.0107)
	Literate	−0.00108	(0.0165)	0.00167	(0.0156)	−0.0279**	(0.0125)	0.00238	(0.0114)
	n	15,935		17,445		15,935		18,978	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and *t*-test are estimated by linear regression. *, **, *** significant at 10%, 5%, and 1%.

TABLE C2 | Balancing test for robustness check with extra matching variable: Desire for children.

		2008		2013		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.0767***	(0.0115)	2.39e−05	(0.00597)	0.0563***	(0.0105)	0.0181**	(0.00849)
	Muslim	−0.0423***	(0.0131)	−0.0201	(0.0127)	−0.0375***	(0.0104)	−0.0405***	(0.00840)
	Educated	0.0368***	(0.0119)	0.0118	(0.0110)	0.0280***	(0.00941)	0.0477***	(0.00811)
	Married	−0.0220*	(0.0129)	−0.0201	(0.0132)	−0.0359***	(0.00993)	−0.0241***	(0.00909)
	Working	−0.0528***	(0.0134)	−0.0216	(0.0134)	−0.0175*	(0.0104)	0.0246***	(0.00917)
	Literate	0.0351***	(0.0127)	0.0123	(0.0115)	0.0180*	(0.0102)	0.0578***	(0.00894)
	Child wish	−0.00592	(0.0108)	0.0147	(0.0119)	−0.00870	(0.00824)	−0.00350	(0.00719)
	n	19,499		18,850		19,499		23,623	
Contraceptive autonomy	Urban	0.0586	(0.0377)	0.0103	(0.0160)	0.0360	(0.0391)	0.0260	(0.0259)
	Muslim	−0.0734	(0.0497)	0.00773	(0.0358)	−0.0360	(0.0387)	−0.0215	(0.0283)
	Educated	−0.00215	(0.0302)	0.0166	(0.0162)	0.00238	(0.0328)	0.0124	(0.0209)
	Married	0.00590	(0.0145)	0.00910*	(0.00537)	−0.00809	(0.0105)	0.00123	(0.00651)
	Working	0.0134	(0.0475)	−0.0263	(0.0356)	−0.0312	(0.0346)	0.000975	(0.0243)
	Literate	0.0146	(0.0347)	0.0167	(0.0262)	0.00481	(0.0378)	0.00679	(0.0255)
	Child wish	−0.0204	(0.0408)	0.00253	(0.0277)	−0.00645	(0.0312)	0.0148	(0.0219)
	n	828		1011		828		1975	
Able to ask condom	Urban	0.0864***	(0.0145)	0.000113	(0.00963)	0.0686***	(0.0125)	0.0258**	(0.0108)
	Muslim	−0.0408***	(0.0150)	−0.0463***	(0.0148)	−0.0437***	(0.0120)	−0.0521***	(0.0100)
	Educated	0.0395**	(0.0157)	0.0226	(0.0153)	0.0350***	(0.0121)	0.0670***	(0.0109)
	Married	−0.00199	(0.00299)	−0.00402	(0.00274)	3.23e−05	(0.00188)	0.000156	(0.00220)
	Working	−0.0645***	(0.0161)	−0.00633	(0.0156)	−0.00826	(0.0118)	0.0305***	(0.0106)
	Literate	0.0305*	(0.0163)	0.0307*	(0.0157)	0.0193	(0.0124)	0.0636***	(0.0114)
	Child wish	−0.00498	(0.0146)	0.0345**	(0.0160)	−0.00437	(0.0113)	−0.0197*	(0.0102)
	n	15,820		17,356		15,820		18,978	
Able to refuse sex	Urban	0.0865***	(0.0145)	0.000113	(0.00963)	0.0685***	(0.0125)	0.0258**	(0.0108)
	Muslim	−0.0404***	(0.0150)	−0.0463***	(0.0148)	−0.0440***	(0.0120)	−0.0521***	(0.0100)
	Educated	0.0394**	(0.0157)	0.0226	(0.0153)	0.0350***	(0.0121)	0.0670***	(0.0109)
	Married	−0.00198	(0.00299)	−0.00402	(0.00274)	3.73e−05	(0.00188)	0.000156	(0.00220)
	Working	−0.0644***	(0.0161)	−0.00634	(0.0156)	−0.00804	(0.0118)	0.0305***	(0.0106)
	Literate	0.0305*	(0.0162)	0.0307*	(0.0157)	0.0192	(0.0124)	0.0636***	(0.0114)
	Child wish	−0.00496	(0.0146)	0.0345**	(0.0160)	−0.00448	(0.0112)	−0.0197*	(0.0102)
	n	15,822		17,359		15,822		18,978	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and *t*-test are estimated by linear regression. *, **, *** significant at 10%, 5%, and 1%.

TABLE C3 | Balancing test for robustness check with 10-km radius.

		2008		2013		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.0717***	(0.00861)	0[1]	(0)	0.0547***	(0.0109)	0.00160	(0.00777)
	Muslim	−0.0238*	(0.0138)	−0.0194	(0.0125)	−0.0371***	(0.0125)	−0.0248***	(0.00921)
	Educated	0.0360**	(0.0141)	0.0344***	(0.0124)	0.0576***	(0.0117)	0.0576***	(0.00904)
	Married	−0.0382**	(0.0148)	−0.0397***	(0.0145)	−0.0657***	(0.0123)	−0.0385***	(0.0103)
	Working	−0.0487***	(0.0155)	−0.0343**	(0.0148)	−0.0321**	(0.0128)	0.0147	(0.0105)
	Literate	0.0458***	(0.0145)	0.0461***	(0.0129)	0.0535***	(0.0123)	0.0673***	(0.00998)
	n	18,674		6,126		19,606		25,440	
Contraceptive autonomy	Urban	0.0298	(0.0300)	0[1]	(0)	0.0372	(0.0352)	0.000800	(0.0244)
	Muslim	−0.0271	(0.0636)	−0.0906*	(0.0475)	−0.0329	(0.0538)	−0.0611**	(0.0310)
	Educated	−0.0252	(0.0447)	−0.00579	(0.0208)	−0.0172	(0.0405)	0.0187	(0.0238)
	Married	0.0137	(0.0228)	−0.00215	(0.00990)	0.00214	(0.0156)	−0.00852	(0.00735)
	Working	0.0327	(0.0620)	−0.0700	(0.0465)	−0.0102	(0.0510)	0.00821	(0.0273)
	Literate	−0.0152	(0.0357)	−0.00944	(0.0337)	0.00287	(0.0403)	0.0158	(0.0284)
	n	702		613		787		1,975	
Able to ask condom	Urban	0.0972***	(0.0119)	0[a]	(0)	0.0467***	(0.0135)	0.00419	(0.0104)
	Muslim	−0.0141	(0.0149)	−0.0245	(0.0154)	−0.0278*	(0.0144)	−0.0540***	(0.0111)
	Educated	0.0223	(0.0185)	0.0309*	(0.0176)	0.0658***	(0.0155)	0.0812***	(0.0125)
	Married	−0.00270	(0.00337)	0.00183	(0.00245)	−0.00188	(0.00175)	0.000854	(0.00221)
	Working	−0.0611***	(0.0188)	−0.0331*	(0.0179)	−0.0268*	(0.0153)	0.0377***	(0.0124)
	Literate	0.0279	(0.0188)	0.0547***	(0.0179)	0.0565***	(0.0157)	0.0801***	(0.0132)
	n	15,934		4,086		15,934		18,978	
Able to refuse sex	Urban	0.0970***	(0.0119)	0[1]	(0)	0.0487***	(0.0133)	0.00419	(0.0104)
	Muslim	−0.0139	(0.0149)	−0.0245	(0.0154)	−0.0178	(0.0144)	−0.0540***	(0.0111)
	Educated	0.0222	(0.0185)	0.0309*	(0.0176)	0.0700***	(0.0158)	0.0812***	(0.0125)
	Married	−0.00267	(0.00336)	0.00183	(0.00245)	−0.00201	(0.00183)	0.000854	(0.00221)
	Working	−0.0610***	(0.0188)	−0.0331*	(0.0179)	−0.0334**	(0.0156)	0.0377***	(0.0124)
	Literate	0.0277	(0.0188)	0.0547***	(0.0179)	0.0602***	(0.0160)	0.0801***	(0.0132)
	n	15,935		4,086		15,006		18,978	

Note: *, **, *** significant at 10%, 5%, and 1%. Difference in means of selected covariates on the matched sample (treatment minus control), means and t−test are estimated by linear regression.
[a]Difference is zero because rural areas predict non-exposure perfectly; variable urban is omitted and observations are not used in the analysis.

TABLE C4 | Balancing test for robustness check with 25-km radius.

		2008		2013		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.0580***	(0.0113)	0.000151	(0.00946)	0.0358***	(0.00887)	0.0342***	(0.00793)
	Muslim	−0.0752***	(0.0116)	−0.0472***	(0.0102)	−0.0314***	(0.00878)	0.0149*	(0.00794)
	Educated	0.0455***	(0.0106)	0.0352***	(0.00971)	0.0199**	(0.00824)	0.0292***	(0.00677)
	Married	−0.0262**	(0.0111)	−0.0331***	(0.0103)	−0.0177**	(0.00825)	−0.0164**	(0.00769)
	Working	−0.0539***	(0.0117)	−0.0307***	(0.0107)	−0.0183**	(0.00849)	−0.000285	(0.00759)
	Literate	0.0395***	(0.0112)	0.0372***	(0.0101)	0.0170*	(0.00874)	0.0244***	(0.00760)
	n	19,606		22,118		19,606		25,440	
Contraceptive autonomy	Urban	0.0361	(0.0384)	0.00343	(0.0234)	0.0110	(0.0375)	0.0323	(0.0254)
	Muslim	−0.104***	(0.0395)	0.000480	(0.0321)	−0.0124	(0.0329)	0.0227	(0.0239)
	Educated	0.0308	(0.0226)	0.00133	(0.0127)	0.0279	(0.0300)	0.0242	(0.0181)
	Married	0.0154	(0.0153)	0.00824*	(0.00448)	−0.00458	(0.00874)	0.00445	(0.00557)
	Working	0.0206	(0.0378)	−0.0174	(0.0348)	−0.0340	(0.0278)	−0.0426**	(0.0196)
	Literate	0.0427	(0.0283)	−0.00460	(0.0212)	0.0286	(0.0355)	0.0219	(0.0229)
	n	844		1065		844		1974	
Able to ask condom	Urban	0.0666***	(0.0138)	0.000508	(0.0120)	0.0383***	(0.00983)	0.0263***	(0.00963)
	Muslim	−0.0817***	(0.0132)	−0.0709***	(0.0115)	−0.0313***	(0.00986)	0.00662	(0.00960)
	Educated	0.0437***	(0.0136)	0.0417***	(0.0125)	0.0276***	(0.00990)	0.0429***	(0.00907)
	Married	−0.00182	(0.00233)	−0.00174	(0.00186)	−0.000656	(0.00168)	0.00460**	(0.00231)
	Working	−0.0557***	(0.0137)	−0.00766	(0.0122)	−0.00764	(0.00908)	0.00637	(0.00866)
	Literate	0.0302**	(0.0140)	0.0482***	(0.0129)	0.0193*	(0.00984)	0.0279***	(0.00965)
	n	15,007		17,442		15,934		18,966	
Able to refuse sex	Urban	0.0659***	(0.0137)	0.000508	(0.0120)	0.0381***	(0.00983)	0.0263***	(0.00963)
	Muslim	−0.0688***	(0.0131)	−0.0709***	(0.0115)	−0.0311***	(0.00986)	0.00662	(0.00960)
	Educated	0.0461***	(0.0135)	0.0417***	(0.0125)	0.0276***	(0.00990)	0.0429***	(0.00907)
	Married	−0.00182	(0.00229)	−0.00174	(0.00186)	−0.000658	(0.00168)	0.00460**	(0.00231)
	Working	−0.0608***	(0.0135)	−0.00769	(0.0122)	−0.00744	(0.00907)	0.00637	(0.00866)
	Literate	0.0314**	(0.0139)	0.0482***	(0.0129)	0.0193**	(0.00984)	0.0279***	(0.00965)
	n	15,935		17,445		15,935		18,966	

Note: *, **, *** significant at 10%, 5%, and 1%. Difference in means of selected covariates on the matched sample (treatment minus control), means and *t*-test are estimated by linear regression.

TABLE C5 | Balancing test for robustness check with 50-km radius.

		2008		2013		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.0327***	(0.00883)	0.00169	(0.00823)	0.00775	(0.00868)	−0.0148*	(0.00782)
	Muslim	−0.0352***	(0.00840)	−0.0356***	(0.00754)	−0.0456***	(0.00995)	−0.0509***	(0.00837)
	Educated	0.00609	(0.00831)	0.0517***	(0.00798)	0.00629	(0.00917)	0.0451***	(0.00750)
	Married	−0.00399	(0.00784)	−0.0101	(0.00757)	−0.00887	(0.00917)	−0.00586	(0.00767)
	Working	−0.0219**	(0.00852)	−0.00194	(0.00815)	−0.00958	(0.00910)	−0.00263	(0.00749)
	Literate	0.000699	(0.00863)	0.0478***	(0.00826)	−0.0208**	(0.00973)	0.0201**	(0.00802)
	n	19,606		22,118		19,606		25,440	
Contraceptive autonomy	Urban	0.047	(0.0374)	0.0479*	(0.0291)	0.0975**	(0.0472)	0.000512	(0.0279)
	Muslim	−0.0607*	(0.0348)	0.0484*	(0.0279)	−0.00670	(0.0381)	−0.0746***	(0.0284)
	Educated	0.0193	(0.0235)	0.00726	(0.0169)	0.0451	(0.0402)	0.0576**	(0.0235)
	Married	0.0108	(0.0101)	−0.00925*	(0.00553)	0.00631	(0.0118)	−0.00486	(0.00647)
	Working	0.00171	(0.0316)	−0.00389	(0.0290)	0.00685	(0.0415)	−0.00502	(0.0228)
	Literate	0.00603	(0.0302)	−0.0126	(0.0223)	0.0145	(0.0471)	0.0489*	(0.0273)
	n	844		1171		843		1972	
Able to ask condom	Urban	0.0338***	(0.00976)	0.00242	(0.00958)	0.00700	(0.00875)	−0.0163*	(0.00878)
	Muslim	−0.0401***	(0.00895)	−0.0488***	(0.00797)	−0.0387***	(0.0107)	−0.0473***	(0.00935)
	Educated	0.00776	(0.00968)	0.0625***	(0.00953)	0.0118	(0.0103)	0.0493***	(0.00912)
	Married	0.00133	(0.00150)	−0.00292**	(0.00127)	0.00138	(0.00174)	0.00146	(0.00277)
	Working	−0.0283***	(0.00934)	0.0136	(0.00892)	−0.00499	(0.00900)	−0.00442	(0.00803)
	Literate	−0.00240	(0.00968)	0.0568***	(0.00960)	−0.0176*	(0.0103)	0.0187**	(0.00926)
	n	15,934		17,274		15,934		18,978	
Able to refuse sex	Urban	0.0338***	(0.00976)	0.00241	(0.00955)	0.00725	(0.00875)	−0.0163*	(0.00878)
	Muslim	−0.0399***	(0.00896)	−0.0472***	(0.00798)	−0.0384***	(0.0107)	−0.0473***	(0.00935)
	Educated	0.00760	(0.00968)	0.0628***	(0.00950)	0.0120	(0.0103)	0.0493***	(0.00912)
	Married	0.00133	(0.00150)	−0.00291**	(0.00126)	0.00137	(0.00174)	0.00146	(0.00277)
	Working	−0.0282***	(0.00934)	0.0146	(0.00890)	−0.00490	(0.00900)	−0.00442	(0.00803)
	Literate	−0.00223	(0.00968)	0.0569***	(0.00957)	−0.0174*	(0.0103)	0.0187**	(0.00926)
	n	15,935		17,442		15,935		18,978	

Note: *, **, *** significant at 10%, 5%, and 1%. Difference in means of selected covariates on the matched sample (treatment minus control), means and t-*t*est are estimated by linear regression.

TABLE C6 | Balancing test for robustness check with four fatal conflict incidents nearby.

		2008		2013		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.0631***	(0.0111)	3.45E−05	(0.00722)	0.0470***	(0.00996)	0.0230***	(0.00798)
	Muslim	−0.019	(0.0121)	−0.0487***	(0.0116)	−0.0119	(0.00987)	−0.00952	(0.00751)
	Educated	0.0280***	(0.0102)	0.0348***	(0.00952)	0.00303	(0.00881)	0.0268***	(0.00729)
	Married	−0.0254**	(0.0118)	−0.0473***	(0.0119)	−0.0246***	(0.00944)	−0.00667	(0.00782)
	Working	−0.0338***	(0.0122)	−0.0332***	(0.0121)	−0.0501***	(0.00968)	0.0233***	(0.00788)
	Literate	0.0205*	(0.0112)	0.0307***	(0.0101)	0.000589	(0.00965)	0.0241***	(0.00789)
	n	19,606		22,118		15,546		25,440	
Contraceptive autonomy	Urban	0.0452	(0.0363)	0.00689	(0.0207)	0.039	(0.0370)	0.0533**	(0.0255)
	Muslim	−0.0585	(0.0438)	0.00538	(0.0335)	−0.0248	(0.0350)	0.0354	(0.0252)
	Educated	−0.00416	(0.0271)	−0.004	(0.0161)	−0.00393	(0.0320)	−0.00855	(0.0180)
	Married	0.00267	(0.0130)	−0.0119	(0.00780)	0.00124	(0.0110)	0.000951	(0.00482)
	Working	−0.0293	(0.0355)	−0.0541	(0.0345)	−0.0222	(0.0309)	0.0112	(0.0210)
	Literate	−0.00036	(0.0326)	−0.00918	(0.0227)	0.00323	(0.0356)	−0.0027	(0.0231)
	n	844		1105		843		1974	
Able to ask condom	Urban	0.0747***	(0.0138)	4.71E−05	(0.00990)	0.0490***	(0.0111)	0.0218**	(0.00983)
	Muslim	−0.02	(0.0139)	−0.0653***	(0.0136)	−0.0277***	(0.0107)	−0.0136	(0.00895)
	Educated	0.0346**	(0.0137)	0.0364***	(0.0134)	0.0167	(0.0109)	0.0394***	(0.00956)
	Married	−0.0005	(0.00255)	−0.00754***	(0.00252)	−0.0003	(0.00166)	0.00296*	(0.00176)
	Working	−0.0445***	(0.0142)	−0.0144	(0.0141)	−0.00091	(0.0103)	0.0315***	(0.00909)
	Literate	0.0212	(0.0145)	0.0355**	(0.0140)	0.00902	(0.0110)	0.0259***	(0.00988)
	n	15,934		17,442		15,934		18,966	
Able to refuse sex	Urban	0.0743***	(0.0138)	4.60E−05	(0.00905)	0.0490***	(0.0111)	4.60E−05	(0.00905)
	Muslim	−0.0203	(0.0139)	−0.0616***	(0.0141)	−0.0278***	(0.0107)	−0.0616***	(0.0141)
	Educated	0.0343**	(0.0137)	0.0285**	(0.0133)	0.0169	(0.0109)	0.0285**	(0.0133)
	Married	−0.00048	(0.00255)	−0.00785***	(0.00265)	−0.0003	(0.00166)	−0.00785***	(0.00265)
	Working	−0.0443***	(0.0142)	−0.0038	(0.0147)	−0.00082	(0.0103)	−0.0038	(0.0147)
	Literate	0.0209	(0.0145)	0.0301**	(0.0141)	0.00915	(0.0110)	0.0301**	(0.0141)
	n	15,935		12,516		15,935		12,516	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and t−test are estimated by linear regression. *, **, *** significant at 10%, 5%, and 1%.

TABLE C7 | Balancing test for robustness check with 16 fatal conflict incidents nearby.

	Covariate	2008		2013		2008		2018	
		Difference	SE	Difference	SE	Difference	SE	Difference	SE
Unmet need FP	Urban	0.123***	(0.0130)	0.000217	(0.00587)	0.0703***	(0.0122)	0.0222**	(0.0101)
	Muslim	−0.00715	(0.0144)	0.0247*	(0.0136)	−0.107***	(0.0122)	−0.0726***	(0.00975)
	Educated	0.0489***	(0.0145)	0.0142	(0.0133)	0.0722***	(0.0111)	0.0504***	(0.00985)
	Married	−0.0232	(0.0145)	−0.0632***	(0.0150)	−0.0485***	(0.0115)	−0.0421***	(0.0106)
	Working	−0.0618***	(0.0156)	−0.0670***	(0.0155)	−0.0183	(0.0122)	0.0268**	(0.0108)
	Literate	0.0340**	(0.0153)	0.0154	(0.0139)	0.0513***	(0.0121)	0.0573***	(0.0106)
	n	19,606		21,678		19,606		25,097	
Contraceptive autonomy	Urban	0.0924***	(0.0318)	0[a]	(0)	0.0370	(0.0424)	0.0315	(0.0297)
	Muslim	−0.0252	(0.0690)	−0.000369	(0.0352)	−0.0906**	(0.0417)	−0.0413	(0.0330)
	Educated	−0.0174	(0.0515)	−0.00168	(0.0179)	0.0253	(0.0395)	0.00606	(0.0240)
	Married	−0.00169	(0.0193)	0.000376	(0.000334)	0.00112	(0.0119)	0.00368	(0.00698)
	Working	−0.0312	(0.0619)	−0.0164	(0.0402)	0.000193	(0.0382)	0.0162	(0.0281)
	Literate	−0.0141	(0.0541)	−0.0318	(0.0323)	0.0110	(0.0444)	0.00119	(0.0294)
	n	720		610		844		1813	
Able to ask condom	Urban	0.149***	(0.0163)	0.000541	(0.00878)	0.0911***	(0.0148)	0.0404***	(0.0129)
	Muslim	−0.0143	(0.0165)	−0.0519***	(0.0171)	−0.106***	(0.0144)	−0.0666***	(0.0123)
	Educated	0.0593***	(0.0183)	0.0260	(0.0178)	0.0754***	(0.0144)	0.0559***	(0.0130)
	Married	−0.000112	(0.00304)	−0.00320	(0.00384)	0.000354	(0.00200)	0.00107	(0.00247)
	Working	−0.0730***	(0.0185)	−0.00582	(0.0181)	−0.00340	(0.0142)	0.0448***	(0.0125)
	Literate	0.0336*	(0.0187)	0.0341*	(0.0183)	0.0432***	(0.0147)	0.0557***	(0.0135)
	n	15,934		17,442		15,934		18,978	
Able to refuse sex	Urban	0.149***	(0.0163)	0.000527	(0.00873)	0.0907***	(0.0147)	0.0404***	(0.0129)
	Muslim	−0.0139	(0.0164)	−0.0517***	(0.0172)	−0.106***	(0.0144)	−0.0666***	(0.0123)
	Educated	0.0593***	(0.0183)	0.0270	(0.0179)	0.0755***	(0.0143)	0.0559***	(0.0130)
	Married	−9.66e−05	(0.00303)	−0.00320	(0.00384)	0.000364	(0.00200)	0.00107	(0.00247)
	Working	−0.0726***	(0.0185)	−0.00534	(0.0181)	−0.00288	(0.0142)	0.0448***	(0.0125)
	Literate	0.0337*	(0.0187)	0.0339*	(0.0183)	0.0431***	(0.0147)	0.0557***	(0.0135)
	n	15,935		16,986		15,935		18,978	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and *t*-test are estimated by linear regression. *, **, *** significant at 10%, 5%, and 1%.
[a]Difference is zero because rural areas predict non-exposure perfectly; variable urban is omitted and observations are not used in the analysis.

TABLE C8 | Balancing test for robustness check with 2 years of exposure and four incidents nearby.

		2008		2013		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.112***	(0.0130)	2.67e−05	(0.00529)	0.0884***	(0.0130)	0.0783***	(0.0123)
	Muslim	−0.00118	(0.0133)	0.0361***	(0.0132)	−0.0994***	(0.0126)	−0.0306**	(0.0125)
	Educated	0.0424***	(0.0133)	0.00649	(0.0127)	0.141***	(0.0113)	0.0993***	(0.0105)
	Married	−0.0144	(0.0138)	−0.0565***	(0.0144)	−0.0675***	(0.0123)	−0.0449***	(0.0120)
	Working	−0.0585***	(0.0145)	−0.0770***	(0.0150)	−0.00991	(0.0128)	−0.0194	(0.0121)
	Literate	0.0303**	(0.0141)	0.00639	(0.0133)	0.122***	(0.0127)	0.0940***	(0.0121)
	n	19,606		16,730		19,606		20,948	
Contraceptive autonomy	Urban	0.0775	(0.0549)	0[a]	(0)	0.0436	(0.0440)	−0.000684	(0.0346)
	Muslim	−0.0480	(0.0583)	−0.000254	(0.0380)	−0.0310	(0.0368)	−0.0419	(0.0321)
	Educated	0.0117	(0.0415)	0.00280	(0.0178)	0.0148	(0.0363)	0.0272	(0.0231)
	Married	−0.00322	(0.0194)	0.00349	(0.00217)	−0.00589	(0.0106)	0.00208	(0.0116)
	Working	−0.0276	(0.0562)	−0.00161	(0.0354)	−0.0237	(0.0367)	0.0146	(0.0286)
	Literate	0.0283	(0.0469)	−0.0134	(0.0294)	0.00447	(0.0421)	−0.00489	(0.0320)
	n	789		610		843		1,811	
Able to ask condom	Urban	0.128***	(0.0161)	8.61e−05	(0.00968)	0.108***	(0.0161)	0.108***	(0.0153)
	Muslim	−0.00706	(0.0152)	−0.0297*	(0.0158)	−0.124***	(0.0159)	−0.0704***	(0.0154)
	Educated	0.0544***	(0.0171)	0.00960	(0.0169)	0.161***	(0.0153)	0.155***	(0.0142)
	Married	0.000313	(0.00295)	−0.00463	(0.00313)	−0.000664	(0.00179)	−0.00109	(0.00364)
	Working	−0.0734***	(0.0176)	−0.00881	(0.0170)	0.0260*	(0.0151)	0.0651***	(0.0137)
	Literate	0.0337*	(0.0177)	0.0162	(0.0173)	0.122***	(0.0160)	0.123***	(0.0154)
	n	15,934		16,983		15,867		18,978	
Able to refuse sex	Urban	0.128***	(0.0161)	8.79e−05	(0.00975)	0.108***	(0.0160)	0.0823***	(0.0157)
	Muslim	−0.00689	(0.0152)	−0.0300*	(0.0158)	−0.124***	(0.0159)	−0.0437***	(0.0159)
	Educated	0.0543***	(0.0171)	0.00839	(0.0169)	0.161***	(0.0153)	0.117***	(0.0141)
	Married	0.000327	(0.00295)	−0.00462	(0.00312)	−0.000653	(0.00178)	0.000157	(0.00387)
	Working	−0.0731***	(0.0176)	−0.00943	(0.0169)	0.0271*	(0.0151)	0.115***	(0.0145)
	Literate	0.0336*	(0.0177)	0.0165	(0.0172)	0.121***	(0.0160)	0.0991***	(0.0158)
	n	15,935		17,445		15,915		14,254	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and t−test are estimated by linear regression. *, **, *** significant at 10%, 5%, and 1%.

[a]Difference is zero because rural areas predict non−exposure perfectly; variable urban is omitted and observations are not used in the analysis.

TABLE C9 | Balancing test for robustness check with 8 years of exposure with 16 fatal conflict incidents.

		2008		2018	
	Covariate	**Difference**	**SE**	**Difference**	**SE**
Unmet need FP	Urban	0.0681***	(0.0115)	0.00220	(0.00827)
	Muslim	−0.0521***	(0.0119)	−0.0361***	(0.00907)
	Educated	0.0370***	(0.0109)	0.0399***	(0.00912)
	Married	−0.0354***	(0.0113)	−0.0247**	(0.0101)
	Working	−0.0409***	(0.0120)	−0.00423	(0.0103)
	Literate	0.0244**	(0.0117)	0.0514***	(0.00982)
	n	19,606		25,440	
Contraceptive autonomy	Urban	0.0453	(0.0386)	0.00618	(0.0238)
	Muslim	−0.0758*	(0.0439)	−0.0580*	(0.0317)
	Educated	−0.000564	(0.0318)	−0.000385	(0.0241)
	Married	0.00127	(0.0111)	0.00380	(0.00611)
	Working	−0.0198	(0.0359)	−0.00687	(0.0282)
	Literate	0.00986	(0.0384)	0.00337	(0.0275)
	n	844		1974	
Able to ask condom	Urban	0.0837***	(0.0141)	0.00649	(0.0106)
	Muslim	−0.0336**	(0.0134)	−0.0547***	(0.0117)
	Educated	0.0428***	(0.0139)	0.0491***	(0.0125)
	Married	−0.00184	(0.00206)	0.00302	(0.00220)
	Working	−0.0418***	(0.0139)	0.0277**	(0.0130)
	Literate	0.0253*	(0.0143)	0.0591***	(0.0133)
	n	15,934		14,248	
Able to refuse sex	Urban	0.0834***	(0.0141)	0.00649	(0.0106)
	Muslim	−0.0333**	(0.0134)	−0.0547***	(0.0117)
	Educated	0.0427***	(0.0139)	0.0491***	(0.0125)
	Married	−0.00185	(0.00206)	0.00302	(0.00220)
	Working	−0.0419***	(0.0139)	0.0277**	(0.0130)
	Literate	0.0251*	(0.0143)	0.0591***	(0.0133)
	n	15,935		14,248	

Note: Difference in means of selected covariates on the matched sample (treatment minus control), means and *t*-test are estimated by linear regression. *, **, *** significant at 10%, 5%, and 1%.