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SAN DIEGO STATE UNIVERSITY

Understanding gender-based violence and health in post-conflict Sri Lanka

A dissertation submitted in partial satisfaction of the requirements for the degree of
Doctor of Philosophy

in

Public Health (Health Behavior)

by

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2021

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The dissertation of Ruvani Wasana Fonseka is approved, and it is acceptable in quality and form for publication on microfilm and electronically.

Chair

University of California San Diego

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2021

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LIST OF ABBREVIATIONS

UCSD: University of California San Diego

GEH: UCSD Center on Gender Equity and Health

SDSU: San Diego State University

JDP: joint doctoral program

IPV: intimate partner violence

DHS: Demographic and Health Survey

OR: odds ratio

aOR: adjusted odds ratio

CI: confidence interval

SMAM: singulate mean age of marriage

RRR: relative risk ratio

WHO: World Health Organization

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Chapter 1, in full, has been submitted for publication by Fonseka, Ruvani W.; McDougal, Lotus P.; Raj, Anita; Reed, Elizabeth; Lundgren, Rebecka; Urada, Lianne; and Silverman, Jay G. The dissertation author was the primary investigator and author of this paper.

Chapter 2, in full, has been submitted for publication by Fonseka, Ruvani W.; McDougal, Lotus P.; Raj, Anita; Reed, Elizabeth; Lundgren, Rebecka; Urada, Lianne; and Silverman, Jay G. The dissertation author was the primary investigator and author of this paper.

Chapter 3, in full, is currently being prepared for submission for publication by Fonseka, Ruvani W.; McDougal, Lotus P.; Raj, Anita; Reed, Elizabeth; Lundgren, Rebecka; Urada,

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ABSTRACT OF THE DISSERTATION

Understanding gender-based violence and health in post-conflict Sri Lanka

by

Ruvani Wasana Fonseka

Doctor of Philosophy in Public Health (Health Behavior)

University of California San Diego, 2021
San Diego State University, 2021

Professor Jay G. Silverman, Chair

Sri Lanka is experiencing the prolonged impacts of a nearly 30-year civil war which ended in 2009. Living in a post-conflict area has been found in multiple settings to be associated with increased likelihood of intimate partner violence and girl child marriage, as well as poor health outcomes such as reduced access to reproductive health care and child malnutrition. Using data from the 2016 Sri Lankan Demographic and Health Survey, this dissertation aims to

understand associations between proximity to conflict, girl child marriage, intimate partner violence (IPV), and reproductive and child health outcomes. First, this dissertation examines the potential role of girl child marriage as a mediating factor in the associations between proximity to conflict and intimate partner violence in Sri Lanka; finding that residing in districts central to conflict (compared to districts distal to conflict) is associated with increased odds of girl child marriage and all forms of intimate partner violence, and that child marriage is a partial mediator of the association between centrality to conflict and all forms of intimate partner violence. Second, this dissertation examines how girl child marriage and intimate partner violence are associated with women's contraceptive method type, and how proximity to conflict moderates those relationships; finding that girl child marriage, physical IPV, and proximity to conflict are associated with differences in contraceptive method type, and that proximity to conflict moderates the associations of girl child marriage and physical IPV with contraceptive method type. Third, this dissertation explores whether maternal child marriage and intimate partner violence in Sri Lanka are associated with stunting (low height for age) among children ages 0-5 in Sri Lanka, and whether proximity to conflict moderates those relationships; finding that children in districts proximal and central to conflict experience reduced stunting compared to children in districts distal to conflict, and that proximity to conflict moderates associations of maternal sexual IPV and maternal emotional IPV with stunting. The findings of this dissertation advance the study of gender-based violence (GBV) and health in post-conflict Sri Lanka and add to the global literature on the health and social impacts of armed conflict.

Introduction

Girl child marriage has been identified by the United Nations as harmful to gender equality and the wellbeing of women and girls across the world.¹ Having married as a child has been shown in multiple settings to be associated with increased likelihood of IPV both in adolescence² and over a woman's lifetime.³ A majority of births among girls aged 15-19 occur in the context of marriage, linking girl child marriage to early childbearing.⁴ Girl child marriage also has implications for household decision-making: girls and adolescents who are married to much older men may be less able to assert themselves and exercise power in the household.⁵ In addition to associated demographic factors such as rural residence, lower education, and poverty, social norms such as expectations for female obedience and sexual purity at marriage also contribute to girl child marriage being acceptable or encouraged by families and communities.⁶

Intimate partner violence (IPV) is also a major issue across the globe⁷. In South Asia, IPV is relatively common, with a regional rate of 41%⁸ and country-level rates ranging from over 30% in India⁹ to 75% in Bangladesh.¹⁰ In Sri Lanka, reports of IPV prevalence have never been collected at the country level, instead only capturing rates of around 30-40% in various single-setting studies.^{11,12} The recent 2016 Demographic and Health Survey (DHS) in Sri Lanka is the first survey to ask a nationally-representative sample of Sri Lankan women about their experiences of IPV in the last 12 months.¹³ In the 2016 DHS, women across Sri Lanka reported experiencing IPV in the past year at a prevalence of 17%. However, the prevalence varied greatly by region, with certain districts in the north and east of the country reporting recent IPV in numbers as high as 50%, while districts in other regions reported rates as low as 7%.¹³ Additionally, only 1 in 3 partnered women in Sri Lanka reported working and earning income,

creating an additional financial dependence on partners that could incentivize remaining in a marriage with repeated IPV.¹³ Lifetime abuse experience and current IPV experience are correlated.¹⁴ This link may be especially strong in cultural contexts like South Asia where divorce is not a socially acceptable option for exiting an abusive marriage. The disaggregated data from the 2016 Sri Lankan DHS marks a novel opportunity to understand IPV across Sri Lanka.

Two families of health outcomes that have been shown to be linked to girl child marriage and IPV for women are reproductive health and child health. In studies across countries as diverse as the USA and Bangladesh, girl child marriage and IPV have been found to be associated with negative reproductive health outcomes including miscarriage, unintended pregnancy, and poor birth spacing.^{10,15,16} Girl child marriage and IPV not only affect the health of the women who experience them, but also the health of their children; they have been linked to poor child health outcomes such as diarrhea, fever, and respiratory illness in children under the age of 5, as well as suboptimal nutritional practices.¹⁷⁻¹⁹ Although links between girl child marriage, IPV and reproductive and child health have been identified in a number of countries, these relationships have never been studied in Sri Lanka, where a strong public health system focused on maternal and child health exists. Public health practitioners could benefit from knowing the links between IPV and health in the communities they serve, in order to provide effective health and social services that are informed by the recipients' lived realities.

Across the world, armed conflict threatens the wellbeing of millions of individuals, with 70,000 deaths occurring as a direct result of conflict each year.²⁰ Conflict causes morbidity and

mortality well beyond the deaths experienced during combat, and studies have established increases in crude death rates, maternal mortality, and infant mortality associated with conflict.^{21,22} Prolonged post-conflict instability can negatively impact development and household wellbeing.^{23,24} A large body of literature from research conducted outside of Sri Lanka links exposure to conflict and/or living in a post-conflict setting with experiencing IPV, and with negative reproductive and child health outcomes. The everyday normalization of military violence can result in the acceptance of violence as a problem-solving measure within the home as well, resulting in increased likelihood of IPV and child abuse.^{25,26} Specific wartime experiences such as physical and sexual war-related torture have been shown to be a risk factor for experiencing IPV,²⁷ which has also been associated with living in post-conflict settings.²⁸ Exposure to conflict has been linked to several negative reproductive health outcomes, including increased early marriage and underage pregnancies.^{29,30} Children's health has also been shown to be negatively affected by living in conflict-affected regions, experiencing health and social challenges such as nutritional deficiencies, PTSD, school absences, and acute illness.³¹⁻³⁴

In 2009, the 26-year Civil War in Sri Lanka ended with a surge of military force killing the leaders of the Liberation Tigers of Tamil Eelam (LTTE) organization, which had claimed the Northern and Eastern Provinces of the country as a separate Tamil state in the majority Sinhala country.³⁵ Over the 30 years and in the final stages, the residents of these provinces were exposed to tremendous amounts of military violence by both LTTE and government forces.^{31,36} Districts bordering the conflict zones also reported negative health impacts over the course of the war.³⁷ During the war, families in the conflict zones of the North and East practiced child marriage in order to remove their children from eligibility to be recruited by the LTTE or other

militant factions which were compelling youth to fight.³⁸ Researchers have established that girl child marriage is a risk factor for IPV and other reproductive health outcomes including early childbearing, lack of birth spacing and sterilization.³⁹ Additionally, multi-country analyses of the relationship between child marriage and IPV suggest that the driving force behind girl child marriage may influence its likelihood to be linked to IPV.³ Unlike other countries in South Asia where child marriage is highly prevalent, in Sri Lanka the rate of child marriage is below 20 percent nationally¹³. Studying the relationship between child marriage, IPV and reproductive health in the unique Sri Lankan context could provide additional information to the global community on how conflict-associated child marriage can impact women and girls' health, as compared to child marriage driven by religion or gender inequity in non-conflict-affected countries.

In 2016, 7 years after the end of the war, Sri Lanka's Department of Census and Statistics conducted the first nationally-representative Demographic and Health Survey (DHS) – all previous versions had been unable to representatively survey Sri Lankans in the Northern and Eastern provinces because of the ongoing conflict.¹³ This first country-level DHS revealed important regional distinctions in intimate partner violence prevalence. Across the country, 17 percent of women who had ever been married reporting having experienced intimate partner violence (IPV). However, in the 8 districts that make up the Northern and Eastern Provinces, the prevalence of IPV ranged from 20-25% in the two least severe districts to 50% in the two most affected.¹³ These descriptive data suggest that living in conflict-affected regions of Sri Lanka is linked to greatly increased likelihood of IPV, which supports research from around the world establishing associations between conflict and IPV. The large DHS dataset, with its numerous

health indicators, provides an opportunity to explore the relationship between the differing IPV prevalence across the country and the potential health sequelae of IPV for women and their children. The Sri Lankan DHS also provides an opportunity to study the impact of conflict on girl child marriage, IPV, and related health outcomes as compared to other South Asian countries without recent protracted conflict. There is a pressing need to better understand the differential prevalence of IPV across Sri Lanka and to understand its risk factors and health sequelae in order to inform policymakers and public health practitioners to develop targeted interventions for vulnerable individuals, families, and communities.

At the time of this study, there have been no peer-reviewed published studies on the possible relationships between child marriage, IPV, and reproductive and 0-5 child health outcomes in post-conflict Sri Lanka. The 2016 DHS data gives researchers the ability to understand child marriage, IPV and its related reproductive and child health outcomes across Sri Lanka, including conflict-affected areas. Using disaggregated data from 2016 Sri Lankan Demographic and Health Survey, this study aims to understand the risk factors of IPV in the post-conflict Sri Lankan context, particularly examining the role of child marriage as a mediating variable between conflict and IPV; and to identify any associations between child marriage and recent IPV with reproductive health and child nutritional outcomes, including how these relationships are moderated by proximity to conflict. This analysis will be conducted using binary and multinomial logistic regression analyses to test the proposed relationships.

This study will contribute to the South Asian regional literature on violence, reproductive health, and child health, as well as add to the global literature on post-conflict girl child marriage

and IPV and their health consequences. It will be the first study to use nationally representative data to understand the relationships between girl child marriage, IPV and health in post-conflict Sri Lanka and will establish a foundation of knowledge that can be built on by future girl child marriage, IPV and health researchers interested in Sri Lanka and other post-conflict settings.

Chapter 1. A mediation analysis of the role of girl child marriage in the relationship between proximity to conflict and past-year intimate partner violence in post-conflict Sri Lanka

Abstract

Background: Studies from many contexts indicate that proximity to conflict is associated with higher likelihood of intimate partner violence (IPV), and girl child marriage is associated with both proximity to conflict and increased IPV. In this study, we consider whether girl child marriage acts as a mediator of the association between the proximity to conflict and IPV in the context of Sri Lanka, which sustained long term conflict until 2009.

Methods: We analyzed responses of currently partnered women between ages 18 and 49 in the 2016 Sri Lankan Demographic and Health Survey (N=13,691). Using logistic regression analyses, we measured associations between proximity to conflict (residing in districts which were central, proximal, or distal to the regions where the war occurred) and our outcomes of IPV and girl child marriage, and secondarily assessed girl child marriage as a possible mediator of the association between proximity to conflict and past year IPV.

Results: Women residing in districts central to conflict, as compared to districts distal to conflict, had increased odds of past year sexual, physical, and emotional IPV, with the odds of sexual IPV increasing the most (adjusted odds ratio/aOR: 4.19, 95% confidence interval/CI: 2.08-8.41). Residing in proximal districts compared to districts distal to conflict was associated with lower odds of past year physical and emotional IPV, with the greatest decrease in emotional IPV (aOR: 0.31, CI: 0.18-0.54). Girl child marriage was more likely in districts central to conflict as opposed to those distal to conflict (aOR: 1.89, CI:1.22-2.93), and partially mediated the relationship between centrality to conflict and IPV.

Conclusions: Our findings demonstrate that residing in districts central to conflict compared to districts distal to conflict is associated with greater odds of IPV and girl child marriage in post-conflict Sri Lanka, with girl child marriage partially mediating the association between centrality to conflict and IPV. Residence in districts proximal to conflict appears protective against IPV. Future research should investigate what factors are responsible for decreased IPV in districts proximal to violence, and whether these factors can be reproduced to mitigate the increased prevalence of IPV in districts central to conflict.

Background

Intimate partner violence (IPV) is a pressing public health issue across the world.⁷ Across South Asia, the prevalence of IPV is estimated to be 41%.⁸ Compared to other countries within the South Asian region, the risk factors and prevalence of IPV have been studied less in Sri Lanka due to the nearly 30-year civil war which ended in 2009.³⁵ Multiple province- and district-level surveys have estimated the prevalence of IPV in post-conflict Sri Lanka to range from 30-40%, similar to the regional average.^{11,12,40}

One potential driver of IPV in post-conflict Sri Lanka that is distinct from many other South Asian countries is proximity to areas where recent armed conflict occurred. In post-conflict settings in Africa, residing in conflict-affected areas has been shown to be associated with increased risk of IPV,²⁸ and researchers have studied the impact of community violence and the resultant structural upheaval on IPV and mental health.^{41,42} Over the course of Sri Lanka's civil war, portions of the Northern and Eastern provinces were claimed as a separate state by the Liberation Tigers of Tamil Eelam (LTTE) organization.³⁵ Residents of the Northern and Eastern

provinces were exposed to tremendous amounts of military violence and collective trauma by both separatist and government forces.³⁶ The 2016 Sri Lankan Demographic and Health Survey (DHS), administered seven years after the end of the war, highlighted past year IPV prevalence rates of over 50% in multiple districts central to the conflict areas, providing evidence of a possible association between conflict exposure and IPV¹³; this idea has been further supported by unpublished analyses of DHS data which considered conflict exposure as a binary variable.⁴³

Girl child marriage has been shown in multiple settings to be associated with increased likelihood of IPV over a woman's lifetime,^{2,3} and to be more likely in communities that have experienced armed conflict.^{39,44-46} The region of South Asia has the second-highest prevalence of girl child marriage in the world (29%),⁴⁷ and girl child marriage has been found to be associated with increased likelihood of IPV in both India and Bangladesh.^{48,49} In Sri Lanka, the singulate mean age of marriage (SMAM) for women has risen and dipped over time, rather than mirroring the steady increase seen in neighboring countries and among Sri Lankan men, suggesting that the age of marriage for Sri Lankan women and girls is responsive to cultural shocks.⁵⁰ Girl child marriage was reported to be widely practiced among communities in areas central to the conflict, with nearly one in three women (31%) in one study reporting having been married by age 18,³⁸ compared to a national prevalence in the 2016 DHS of fewer than one in 9 women (11.6%).¹³ Qualitative research conducted during and after the war's end found that early marriage was considered to be a protective strategy used by families to prevent their children from being recruited as combatants or experiencing sexual violence related to the conflict and displacement.^{38,51} Although these practices were reported to have started during the war, they have continued in war-affected communities after the conflict's end, with new norms, such as

increased practice of underage customary marriages, permitting girls to continue to be married extralegally (the legal minimum age of marriage in Sri Lanka for most remains 18).^{51,52} In combination with the established knowledge that girl child marriage is associated with later IPV,³ this evidence that girl child marriage increased in Sri Lanka as a direct result of the conflict suggests that, in Sri Lanka, girl child marriage could serve as an intermediary, or mediating, factor between exposure to conflict and the experience of recent IPV.

This study aimed to understand the relationship between proximity to conflict and recent IPV experience in post-conflict Sri Lanka, and to test whether girl child marriage mediates this relationship. Analyzing the 2016 Demographic and Health Survey (DHS) data from Sri Lanka, we tested four hypotheses: 1) women in districts central to conflict will have increased odds of past year sexual, physical, and emotional IPV compared to women in districts distal to conflict; 2) women in districts central to conflict will have increased odds of having married as a child compared to women in districts distal to conflict; 3) women who married as children will have increased odds of past year sexual, physical, and emotional IPV compared to women married as adults; and 4) having married as a child will mediate the associations between proximity to conflict and past year IPV experience. The results of this study will build understanding of the relationships between conflict, girl child marriage, and IPV in Sri Lanka, and could impact policymakers' development of post-conflict interventions to prevent future violence.

Methods

Data Source

This study used data from the 2016 Sri Lankan Demographic and Survey (DHS), which collected individual-level data on child and maternal health outcomes, domestic violence experience, reproductive health, and information on economic engagement and agency of women in Sri Lanka (N = 27,210 households, 18,510 women age 15-49). The 2016 survey was the first DHS to be conducted on a nationally representative sample of households in Sri Lanka – all previous DHS data collection occurred during the nearly 30-year civil war and excluded portions of the Northern and Eastern provinces, which had been claimed as a separate state by the LTTE.³⁵

In addition to a general health survey administered to every eligible woman in each household, a domestic violence module was administered to one randomly selected woman in each household (n=16,629). The 2016 DHS was the first to ask questions on experience of past year intimate partner violence (IPV) in Sri Lanka. Although multiple peer-reviewed studies have investigated child health,^{53,54} postnatal care,⁵⁵ and household decision-making⁵⁶ using data from the 2016 DHS; to date, no peer-reviewed studies have been published using the IPV data gathered in the domestic violence module. Following the World Health Organization's guidelines for the ethical collection of information on domestic violence,⁵⁷ each module respondent was read an additional consent statement at the start of the module, informing her that the questions could be personal and reassuring her of the confidentiality of her responses. The module was not implemented if privacy could not be obtained. In the 2016 DHS, women taking part in the domestic violence module were asked nine questions about their experiences of intimate partner violence in the previous 12 months.¹³ This study was restricted to women who were currently living with an intimate partner and who answered the domestic violence module

of the DHS. This study was also restricted to women age 18 and above, following a convention in girl child marriage research of censoring girls still within the window of risk for girl child marriage.⁵⁸ The complete sample of women included in this study comprised of 13,691 participants. Ethical approval for this secondary analysis of de-identified data was obtained from the University of California, San Diego Institutional Review Board (Project number #191418XX).

Variables of interest

Dependent Variables: Past year intimate partner violence (IPV) – sexual, physical, or emotional

We examined three different IPV variables as dependent variables of interest. The three binary IPV variables are listed below:

1. Past year sexual IPV: having been forced to have sex by a partner in the last 12 months; yes or no.
2. Past year physical IPV: having experienced at least one of six types of physical intimate partner violence in the last 12 months: 1) slapping or beating with a hand, 2) pushing or shoving, 3) strangulation, 4) dragging or pulling, 5) beating with an object, or 6) burned; yes, or no.
3. Past year emotional IPV: having experienced at least one of two types of emotional intimate partner violence in the last 12 months: 1) being belittled/offended or 2) prevented from leaving home by a partner; yes or no.

In our analyses, we considered sexual, physical, and emotional IPV as separate outcomes, based on Spearman's rho correlation estimates across all three IPV variables remaining below 0.5.

Independent Variable: Proximity to Conflict

We included proximity to conflict as an independent variable in our analyses. This variable was defined as having three ordinal levels: distal, proximal, and central. Participants assigned to the distal category resided in one of the seven Sri Lankan districts that were neither in nor bordering the Northern and Eastern provinces of the country, where most of the armed conflict occurred during the civil war. Distal districts were Colombo, Galle, Gampaha, Kalutara, Kandy, Kegalle, Kurunegala, Matara, Nuwara Eliya, and Ratnapura. Participants assigned to the proximal category resided in one of the seven districts of Sri Lanka external to but sharing a border with at least one district within the Northern and Eastern provinces. Proximal districts were Anuradhapura, Badulla, Hambantota, Matale, Monaragala, Polonnaruwa, and Puttalam. Finally, participants assigned to the central category resided in a district located within either the Northern or Eastern province of Sri Lanka. Central districts were Ampara, Batticaloa, Jaffna, Kilinochchi, Mannar, Mullaitivu, Trincomalee, and Vavuniya. A map of Sri Lanka showing the geographic distribution of the proximity to conflict variable is included as Figure 1.

Potential mediator: Girl child marriage

Informed by prior research conducted in Sri Lanka and other countries on conflict, IPV, and girl child marriage, we considered girl child marriage to be a potential mediator of the

relationships between proximity to conflict and past year IPV. Girl child marriage was measured by having married or cohabited with a male partner before age 18; yes or no.

Covariates

We considered as covariates in the relationship between proximity to conflict, and past year IPV variables known or hypothesized to be associated with IPV. These variables included each respondent's age (years), education (primary or less, secondary, or higher than secondary), household wealth quintile, parity (0-1, 2, or 3 or more), the age difference between a respondent and her partner (years), religion (Buddhism, Hinduism, Islam, or other), and ethnicity (Sinhala, Sri Lankan Tamil, or other). Beyond individual-level characteristics, we also considered as covariates whether the respondent lived in an urban setting or not, and which district in Sri Lanka she lived in, to control for unmeasured variation at the community level.

Analysis

We first assessed the distributions of all three forms of past year IPV, proximity to conflict, girl child marriage, and all considered covariates in the sample. Next, we tested if the pairwise distributions of all the variables across past year IPV types were significantly different. We used chi-squared tests for all comparisons across past year IPV type after reducing all variables to categories (ordinal or nominal). In preparation for our multivariable model, we assessed all variables for multicollinearity by calculating their variance inflation factor (VIF); variables with VIF values above 5 were examined for overlap in distribution with other variables in the model. We kept in the analysis all covariates which could be retained with variance inflation factor (VIF) values less than 5, eliminating only ethnicity.

After examining bivariable associations, we conducted a mediation analysis with a series of adjusted logistic regressions, following the four steps suggested by Baron and Kenny.⁵⁹ Mediation analysis is a statistical technique that allows researchers to identify possible intermediary pathways between an independent and dependent variable. In our case, based on the literature summarized in the introduction, we considered whether girl child marriage could be the intermediary mechanism linking proximity to conflict to experiencing IPV. The different paths we analyzed are labeled in Figure 2.

First, we analyzed the relationships between proximity to conflict (the independent variable) and each form of past year IPV (the dependent variables) excluding girl child marriage (the proposed mediator), modeling the C path in Figure 2. Next, we analyzed the relationship between proximity to conflict and girl child marriage, excluding the past year IPV variable being considered as the dependent variable, modeling the A path in Figure 2. Finally, we ran full adjusted logistic regression models with proximity to conflict and girl child marriage as predictors of each past year IPV variable (calculating the B and C' paths in Figure 2). For a full mediating effect, the adjusted odds ratio (aOR) of proximity to conflict on past year (C) should lose statistical significance (C' p-value greater than 0.05) after the mediator is included in the model. A partial mediating effect exists when the impact of proximity to conflict on past year IPV is reduced when girl child marriage is included in the model (the aOR for C' is closer to 1 than C). All statistical analyses were conducted using R software version 3.6.3,⁶⁰ and estimates were weighted using the "survey" package⁶¹ in order to calculate population-representative measures that took into account the complex sampling design of the DHS.

Results

Descriptive statistics

Demographic characteristics of the sample and the distribution of past year IPV by characteristic are displayed in Table 1. The type of past-year IPV most prevalent among respondents was emotional IPV (13%), while past year sexual IPV had the lowest prevalence (2%). Over half of the participants lived in districts that were distal to conflict (64%) and had not been married as children (86%). Most women had obtained some secondary education (66%), practiced Buddhism (73%), were part of the Sinhala ethnic group (78%) and did not live in an urban setting (85%).

Bivariate analyses between IPV and other variables

Cross-tabulations of all forms of past year IPV and other variables are presented in Table 1. All forms of past year IPV were most prevalent among women in districts central to conflict and least prevalent in districts distal to conflict, as well as among women who were married as children. Almost all demographic characteristics were significantly associated ($p < 0.05$) with each form of IPV. All IPV variables were more prevalent among households with lower wealth, and among women with less education, higher parity, and who practiced Hinduism. Cross-tabulations of past year IPV with all districts in Sri Lanka can be found in Table 2.

Regression analyses between proximity to conflict and IPV

In our regression models, we controlled for age, education, household wealth quintile, parity, age difference between woman and partner, religion, urban setting, and district. All

regression estimates can be found in Table 3. Not controlling for girl child marriage, women in districts central to conflict were significantly more likely to experience all three forms of past year IPV than women in distal districts, with the greatest increase in odds occurring for past year sexual IPV (aOR: 4.19, 95% CI: 2.08-8.41). Conversely, we found that, compared to women in districts distal to conflict, women in proximal districts were significantly less likely to experience past year physical and emotional IPV, with the greatest reduction in odds occurring for past year emotional IPV (aOR: 0.31, 95% CI: 0.18-0.54). There was not a significant difference in the odds of sexual IPV between women in districts proximal to conflict and women in distal districts (aOR: 0.34, 95% CI: 0.09-1.23).

Mediation analyses of the role of girl child marriage

We found that the A path in all cases (the association between proximity to conflict and girl child marriage) was only significant at $p < 0.05$ when comparing districts that were central to conflict to districts that were distal to conflict (aOR: 1.89, CI: 1.22, 2.93, Table 3). Therefore, we only investigated the role of girl child marriage as a mediator of proximity to conflict and IPV among women in districts central to conflict compared to women in areas distal to conflict (the C' and B paths). All mediation path estimates for past year sexual, physical, and emotional IPV are shown in Figure 3. We found that the association between girl child marriage and each form of past year IPV (the B path) was significant. The adjusted odds ratio of women experiencing each form of past year IPV in districts central to conflict compared to women in distal districts decreased with the addition of girl child marriage (comparing the C and C' paths) by less than 5 percent (sexual IPV: 4%, physical IPV: 4%, emotional IPV: 3%), suggesting partial mediation.

Discussion

Our study provided evidence in support of our hypotheses about relationships between proximity to conflict, IPV, and girl child marriage in post-conflict Sri Lanka. Women in districts central to conflict had increased odds of all forms of past year IPV and girl child marriage compared to women in districts distal to conflict. Women who married as children had increased odds of past year sexual, physical, and emotional IPV compared to women who married as adults, and girl child marriage partially mediated the associations between proximity to conflict and past year IPV experience. Women in districts proximal to conflict had decreased odds of physical and emotional IPV, and no difference in likelihood of child marriage compared to women in districts distal to conflict. These findings support and add to the established research on associations between proximity to conflict, IPV and girl child marriage in different settings.

Our study provides evidence from South Asia to add to the growing literature that links centrality to conflict with increased IPV experience in other post-conflict settings, mainly in Sub-Saharan Africa. We found that women in areas central to conflict in Sri Lanka had greater adjusted odds of recent IPV experience than women in areas distal to conflict. Qualitative research in post-conflict Uganda has also revealed relationships between armed conflict and physical and sexual IPV,⁶² while researchers using DHS data collected five years after the end of armed conflict in Liberia found that women living in conflict-affected areas were more likely to experience any past year IPV compared to women in parts of the country not affected by conflict.²⁸ Our study adds to this literature to further support the idea that women living in conflict-affected areas of a post-conflict country are at increased risk of IPV compared to women living farther from the sites of armed conflict.

Our study quantitatively confirms a positive association between centrality to conflict and girl child marriage and provides evidence that girl child marriage partially mediates the positive association between all forms of IPV and centrality to conflict in Sri Lanka. These findings support qualitative research done in Sri Lanka on the links between conflict and girl child marriage as well as similar quantitative studies of girl child marriage and IPV in other conflict-affected settings. A previous study of women's and girls' wellbeing in post-conflict Sri Lanka established an elevated prevalence (31%) of girl child marriage in conflict areas, as well as qualitative data explaining the rate of girl child marriage as driven by conflict-related factors such as fear of children's recruitment into militant factions.³⁸ This conflict-related strategy of caregivers to "protect" girl children by marrying them has been found in other conflict-affected settings as well, including among Syrian and Sudanese refugee families exposed to conflict.^{45,46} Our findings that suggest girl child marriage partially mediates the increased likelihood of IPV experience among women exposed to conflict is supported by studies from post-conflict Uganda and the Democratic Republic of Congo, where girl child marriage was associated with greater risk of IPV.^{2,63} While there are other factors responsible for most of the increased odds of IPV among women living in areas central to conflict, girl child marriage appears to partially mediate and explain this relationship in Sri Lanka, supporting qualitative claims of its differential practice in conflict areas in Sri Lanka and other research on its association with IPV.

Although our study confirmed that living in areas central to conflict in Sri Lanka is associated with increased IPV and girl child marriage, we found different relationships in the proximal districts which bordered the conflict zone. Women living in proximal districts had

significantly lower odds of physical and emotional, and marginally significant ($p=0.1$) lower odds of sexual IPV compared to women in areas distal from conflict. Additionally, there was no significant difference in the odds of girl child marriage in proximal districts compared to distal districts. Other studies on the Sri Lankan conflict suggest some potential explanations for the apparent “protective” effect against IPV of residing in districts bordering the conflict. One study found increased health utilization in districts bordering the conflict, and suggested that people who were able to leave the conflict areas might have crossed over to use services.³⁷ This idea of differential mobility, that in wartime some are able to leave and others are not, was reiterated in a 2020 report on repeated collective violence in Sri Lanka⁶⁴. Although the author’s focus when discussing differential mobility was on individuals and families able to emigrate from Sri Lanka during wartime, the idea can also be applied to individuals within the country who were able to move outside of the war zone but chose to remain nearby, in the proximal districts. These individuals might have been less at risk for IPV based on the structural factors that also allowed them to escape the conflict zones. Additionally, it is possible that these areas closest to the conflict areas have developed greater services and resources than in distal areas based on the need to support those fleeing conflict. Researchers in other post-conflict settings have highlighted the role that structural factors can play in sustaining IPV beyond the period of armed violence.^{28,41} It is possible that existing factors in the proximal areas where IPV is less likely could be expanded into both conflict-affected and distal areas in order to reduce IPV experience in those areas.

This study had multiple limitations. All responses were collected at the same time, so the relationships we are assessing are only cross-sectional associations, and we cannot infer causality

from the findings. A small proportion of women reported being married as children overall, which may have underpowered our analyses to identify significant differences in girl child marriage between women in areas proximal to conflict and those in areas distal to conflict. It is possible that women responding to the survey may have underreported IPV or girl child marriage due to social desirability bias, or that women from districts with differing proximity to conflict recalled IPV experiences differently due to their varied contexts. The DHS questionnaire has been developed and tested in many contexts, including other post-conflict settings, and the survey questions have been developed to reduce bias in responses.⁶⁵ The survey did not collect complete information on women's location over time, only collecting information on the most recent location that women had moved from. Therefore, we cannot make conclusions about the direct impact of the conflict on survey participants, as it may have varied greatly based on their location over time. For this reason, our "proximity to conflict" variable must be interpreted in a post-conflict and cross-sectional context, seven years after the end of the Sri Lankan civil war; it is a geographic, rather than experiential, variable. Finally, in our partial mediation models, the 95% confidence intervals between the two adjusted odds ratios measuring centrality to conflict's association with IPV (the C and C' paths in Figure 2) overlap, which suggests that the observed partial mediation effect could possibly be due to chance. This concern is mitigated by the observation of repeated decreased odds ratios and partial mediation across all types of IPV that were studied.

Conclusions

In this study, we found that women in areas central to conflict in Sri Lanka had increased odds of experiencing sexual, physical, and emotional IPV compared to women in areas that were distal to conflict. We also found that centrality to conflict was associated with increased odds of girl child marriage, and that girl child marriage partially mediated the association between centrality to conflict and increased odds of IPV. Additionally, we found that women in areas proximal to conflict were less likely to experience IPV and not significantly more likely to experience girl child marriage compared to women in areas distal to conflict. These findings highlight the long-lasting impact of the Sri Lankan conflict on women's and girls' wellbeing and suggest as a possible solution that protective factors and programs which are successfully preventing IPV and girl child marriage in areas proximal to conflict should be expanded into areas central to conflict to support women and girls living there.

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Chapter 2. Associations between girl child marriage, intimate partner violence, proximity to conflict, and primary contraceptive method type in post-conflict Sri Lanka

Abstract

Outside of South Asia, armed conflict has been shown to be associated with women's contraceptive use, and to exacerbate girl child marriage and IPV, both of which are associated with contraceptive use in many contexts. We created multinomial regression models of the 2016 Demographic and Health Survey data from post-conflict Sri Lanka to study associations between primary contraceptive method type (modern spacing methods, sterilization, and traditional methods compared to no method) and the following: girl child marriage; past year sexual, physical, and emotional IPV; and proximity to conflict (distal, proximal, or central). We also investigated whether proximity to conflict moderated associations between child marriage, IPV, and method type. Girl child marriage was associated with increased relative risk (RR) of modern spacing methods (RR ratio/RRR: 1.92) and sterilization (RRR: 1.30); past year physical IPV was associated with decreased RR of traditional methods relative to no method (RRR: 0.72). Compared to women in districts distal to conflict, women in proximal districts had increased RR of modern spacing methods (RRR: 1.42) and sterilization (RRR: 1.52) and women in central districts had decreased RR of all method types (RRR range: 0.24-0.52) compared to no method. We found that proximity to conflict moderated the relationships between girl child marriage, past year physical IPV, and method type. Notably, past year physical IPV was only significantly associated with decreased RR of sterilization (RRR: 0.71) and traditional methods (RRR: 0.58) in distal districts, while it was not associated with any method type in proximal or central districts.

Introduction

Girl child marriage has been defined by the United Nations as harmful to gender equality and the wellbeing of women and girls across the world,¹ and has been found to be associated with intimate partner violence (IPV) as well as reproductive health outcomes including lack of birth spacing and sterilization.³⁹ Globally, girl child marriage and early childbearing are linked, with a majority of births among girls aged 15-19 occurring in the context of marriage.⁴ Girls and adolescents who are married young to much older men may be less able to assert themselves and exercise power in the household.⁵ Key factors associated with girl child marriage include rural residence, lower education, and poverty.³⁹ Social norms such as expectations for female obedience and sexual purity at marriage also contribute to girl child marriage being acceptable or encouraged by families and communities.⁶ The region of South Asia has the world's second greatest prevalence of girl child marriage, following sub-Saharan Africa.⁴⁷ In a study of India, Bangladesh, Nepal, and Pakistan, girl child marriage was significantly associated with rapid repeat childbirth, current modern contraceptive use, female sterilization (versus not being sterilized), not using contraception before first childbirth, pregnancy termination, unintended pregnancy, and inadequate use of maternal health services.⁶⁶ In India, girl child marriage has been found to be associated with high fertility, unwanted pregnancies, no contraceptive use before first childbirth, and female sterilization, even when controlling for duration of marriage.⁶⁷ Across South Asia, sterilization is often the preferred contraceptive option.⁶⁸ One potential reason for the association between child marriage and sterilization is a corresponding association between sterilization and high fertility. Couples who rely on sterilization as their only contraceptive option cannot space or delay births, so widespread use of sterilization over other options can drive early childbearing with lack of healthy birth spacing.⁶⁹ In combination with girl

child marriage, a preference for sterilization after reaching desired family size may lead to early pregnancies with unsafe outcomes.

Intimate partner violence (IPV) is a major issue across the globe.⁷ In South Asia, IPV is common,⁷⁰ with a regional prevalence of 41%⁸ and country-level prevalence estimates ranging from over 30% in India⁹ to 75% in Bangladesh.¹⁰ Multiple studies have established associations between IPV and women's contraceptive method choices. In South Asia, associations between IPV and contraception method type appear to vary across countries. Studies in Bangladesh and Nepal have found positive associations between physical IPV and contraceptive use.^{71,72} In contrast, a 2015 multi-country study of Nepal, Bangladesh and India which was proportionately skewed towards India did not find any associations between physical IPV and contraceptive methods, and instead found a positive association between sexual IPV and modern spacing methods and a negative association between sexual IPV and sterilization.⁷³ These different findings suggest that more research is needed in a wide range of South Asian countries to understand the varied roles that IPV may play in restricting or increasing women's use of contraceptives across the region.

Another societal factor that has been shown in many studies outside of South Asia to impact women's wellbeing and reproductive health is conflict. In the Democratic Republic of the Congo, post-conflict poverty was found to increase demand for contraception and desire for smaller family sizes compared to before the war.⁷⁴ A systematic review on relationships between armed conflict and adolescent marriage, sexual debut, and childbearing found that increased underage pregnancies may result from increased girl child marriage during prolonged conflict.²⁹

Conflict and post-conflict settings often suffer from underdevelopment of health systems, which can lead to lowered health access and negative outcomes for residents.²³ A large body of research conducted in conflict and post-conflict settings outside of Sri Lanka has established a relationship between exposure to conflict and/or living in a post-conflict setting with experiencing IPV and with negative reproductive health outcomes. The everyday normalization of military violence in communities exposed to armed conflict can result in the acceptance of violence as a problem-solving measure within the home, resulting in increased rates of IPV and child abuse.^{25,26} Specific wartime experiences such as physical and sexual war-related torture have been shown to be a risk factor for experiencing IPV,²⁷ which has also been associated with living in post-conflict settings.²⁸ Exposure to conflict has been linked to several negative reproductive health outcomes, including increased girl child marriage and underage pregnancies.^{29,30,39} Because of conflict's impact on child marriage, IPV, and reproductive health, it is possible that exposure to conflict could moderate any associations between these variables. Studies on the impact of conflict on women's sexual and reproductive health have largely been conducted in Sub-Saharan Africa and have not explored potential differences in how conflict affects women and girls in South Asia.

Within South Asia, Sri Lanka presents a unique context in which to study contraceptive use and its associations with girl child marriage, IPV, and conflict, due to its 26-year civil war, which ended in 2009. Over the war, residents of the Northern and Eastern provinces where the majority of armed conflict occurred were exposed to tremendous amounts of military violence, by both separatist and government forces.^{31,36} Initial research on the conflict's impact on health outcomes has uncovered marked differences in healthcare utilization and outcomes between

areas that were central, proximal, and those distal to the armed conflict.³⁷ Sri Lanka has a well-developed public health system with free access to contraception including sterilization.⁷⁵ Sterilization is the most commonly-used form of contraception in Sri Lanka, used by 14 percent of women ages 15-49,¹³ although researchers have identified variation in its use among groups, with Tamils living in the tea plantation or "estate" sector using sterilization as their primary method in larger numbers.⁷⁶⁻⁷⁸ Researchers have identified local lifetime IPV prevalence rates of around 30 to 40 percent in various single-setting studies across the country.^{11,12,40,79} During the war, families in the conflict zones of the North and East practiced girl child marriage in order to remove their children from eligibility to be recruited by militant factions which were compelling youth to fight,³⁸ and this practice may have persisted in the post-conflict era. Additionally, the legal age of marriage varies for different ethnic groups in Sri Lanka, with some groups being permitted to marry under age 18.⁸⁰ In post-conflict Sri Lanka, the lasting impact of the conflict on IPV, girl child marriage, and contraception remains poorly understood.

In 2016, 7 years after the end of the war, Sri Lanka's Department of Census and Statistics conducted the first-ever country-wide Demographic and Health Survey (DHS), which was also the first DHS in Sri Lanka to collect data on IPV.¹³ All previous DHS efforts had been unable to representatively survey Sri Lankans in the Northern and Eastern provinces because of the ongoing conflict.¹³ The large DHS dataset, with its numerous health indicators, provides a novel opportunity to explore the relationships between girl child marriage, IPV and contraception across areas differently impacted by conflict. Using disaggregated data from 2016 Sri Lankan Demographic and Health Survey, this study aims to conduct the first nationally representative analysis of the relationships between girl child marriage, past year IPV, and primary

contraceptive method type (comparing modern spacing methods, sterilization, and traditional methods to no method) in post-conflict Sri Lanka. Secondly, we will investigate associations between proximity to conflict and primary contraceptive method type. Furthermore, we aim to test whether proximity to conflict moderates any national associations between child marriage, IPV, and primary contraceptive method type, a question that has not previously been considered in South Asia.

Methods

Data Source

This study used data from the 2016 Sri Lankan Demographic and Survey (DHS), which collected individual-level data on child and maternal health outcomes, domestic violence experience, reproductive health, and information on economic engagement and agency of women in Sri Lanka (N = 27,210 households, 18,510 women age 15-49). The 2016 survey was the first DHS to be conducted on a nationally representative sample of households in Sri Lanka – all previous DHS data collection occurred during the nearly 30-year civil war and excluded portions of the Northern and Eastern provinces, which had been claimed as a separate state by the Liberation Tigers of Tamil Eelam (LTTE) organization.³⁵

In addition to a general health survey administered to every eligible woman in each household, a Domestic Violence Module was administered to one woman in each household (n=16,629). The 2016 DHS was the first to ask questions on experience of past year intimate partner violence (IPV) in Sri Lanka and to date, no peer-reviewed studies have been published using this IPV data. Following the World Health Organization's guidelines for the ethical

collection of information on domestic violence, one eligible woman per household was randomly selected for this module, which was not implemented if privacy could not be obtained⁵⁷.

Domestic violence module respondents were read an additional consent statement at the start of the module, informing her that the questions could be personal and reassuring her of the confidentiality of her responses. In the 2016 DHS, women taking part in the domestic violence module were asked nine questions about their experiences of intimate partner violence in the previous 12 months.¹³ This study was restricted to women who were currently living with an intimate partner, answered the domestic violence module of the DHS, and were not pregnant nor trying to become pregnant. This study was also restricted to women age 18 and above, following a convention in girl child marriage research to censor participants under age 18 who might marry after the survey's completion.⁵⁸ The complete sample of women included in this study comprised of 11,426 participants. Ethical approval for this research was obtained from the University of California, San Diego Institutional Review Board (Project number #191418XX).

Variables of interest

Dependent Variable: Primary contraceptive method type

As the dependent variable, we examined women's primary contraceptive method type, and divided their responses into four categories, listed below:

1. No method (this was used as the reference category in multinomial analyses).
2. Modern spacing methods: pill, IUD, implant, condom, injection, female condom, or emergency contraception.

3. Sterilization: male or female sterilization. Over 99 percent of this category comprised of female sterilization, but the respondents who listed male sterilization were included in order to retain a population-representative sample.
4. Traditional methods: lactational amenorrhea, rhythm method, or withdrawal (the same grouping referred to as traditional methods by the Sri Lankan Department of Census and Statistics in their descriptive report of DHS data).¹³

Independent Variables: Child Marriage and Intimate Partner Violence

We examined four variables as independent variables of interest, to account for the separate and overlapping effects of different experiences. The four binary independent variables we considered are listed below:

1. Child marriage: having married or cohabited with a male partner before age 18; yes or no.
2. Past year sexual IPV: having been forced to have sex by a partner in the last 12 months; yes or no.
3. Past year physical IPV: having experienced at least one of six types of physical intimate partner violence, including being beaten by a partner, in the last 12 months; yes, or no.
4. Past year emotional IPV: having experienced at least one of two incidents, either being belittled/offended or prevented from leaving home by a partner, in the last 12 months; yes or no.

We considered past year physical, sexual, and emotional IPV as separate independent variables to allow estimation of the independent effects of each form of IPV. We calculated Spearman's rho correlation estimates across all three IPV variables. All IPV correlation estimates were below 0.5, justifying retaining them as independent variables.

Moderating Variable: Proximity to Conflict

We considered proximity to conflict as a potential moderator of the associations between child marriage, past year IPV, and primary contraceptive method type. This variable was defined as having three ordinal levels: central, proximal, and distal. Participants assigned to the “central” category resided in either the Northern or Eastern provinces of Sri Lanka, where the majority of the armed conflict occurred during the civil war. Central districts were Ampara, Batticaloa, Jaffna, Kilinochchi, Mannar, Mullaitivu, Trincomalee, and Vavuniya. Participants assigned to the “proximal” category resided in one of the seven districts of Sri Lanka outside of the Northern and Eastern province that shared a border with one of both of these provinces. Proximal districts were Anuradhapura, Badulla, Hambantota, Matale, Monaragala, Polonnaruwa, and Puttalam. Finally, participants assigned to the “distal” category resided in districts that were neither in nor bordering the Northern and Eastern provinces of the country. Distal districts were Colombo, Gampaha, Galle, Kalutara, Kandy, Kegalle, Kurunegala, Matara, Nuwara Eliya, and Ratnapura. A map of Sri Lanka showing the geographic distribution of proximity to conflict is included as Figure 1.

Covariates

We included as covariates variables known or hypothesized to be associated with girl child marriage, IPV, and contraception. These variables included each respondent's age, education, household wealth quintile, parity, the age difference between her and her partner, her participation in decisions about her health care, years married, household size, religion, and ethnicity. Beyond individual-level characteristics, we also included as covariates whether the

respondent lived in an urban setting or not and which district in Sri Lanka she lived in to control for unmeasured variation at the community level.

Statistical Analysis

All statistical analyses were conducted using R software version 3.6.3,⁶⁰ and estimates were adjusted for complex survey design and participant-level weights using the "survey" package⁶¹ in order to calculate population-representative measures. We first assessed the distributions of all considered covariates, girl child marriage, all three forms of past year IPV, proximity to conflict, and primary contraceptive method type in the sample. We used chi-squared tests for all comparisons across primary contraceptive method type after reducing all variables to categories (ordinal or nominal). In preparation for our multivariable model, we assessed all variables for multicollinearity by calculating their variance inflation factor (VIF), and variables with VIF values above 5 were examined for overlap in distribution with other variables in the model. One of each pair of similarly distributed variables were excluded from the following multivariable models, resulting in a set of covariates in which all VIF values were less than 4.

After calculating the bivariate associations between our dependent and independent variables, we created a multivariable multinomial regression model of the adjusted change in relative risk of using modern spacing contraceptive methods, sterilization, or traditional methods (each compared to no method). We included in this multinomial model the variables of interest as well as all of the considered covariates that were significantly associated ($p < 0.05$) with primary contraceptive method type. Based on a VIF cutoff of 5, the following variables were excluded from multivariable models due to multicollinearity: age, ethnicity, and urban setting.

We next conducted a moderation analysis to assess the potential role of proximity to conflict in changing the associations between primary contraceptive method type and any independent variable which was significantly associated with primary contraceptive method type in the full adjusted model. Both girl child marriage and past year physical IPV were associated with primary contraceptive method type in the main model. Following methods described by Baron and Kenny, we introduced interaction terms combining proximity to conflict with each binary independent variable which had been found to be associated with primary contraceptive method type in our initial multivariable regression.⁵⁹ We assessed the significance of these interaction terms in a multinomial logistic regression of primary contraceptive method type that also contained the associated binary independent variables, proximity to conflict, and all previously included covariates. After identifying significant interaction effects, we examined relationships between all independent variables with significant interaction effects and primary contraceptive method type in multinomial models stratified by proximity to conflict. Finally, a sensitivity analysis was performed on the dataset to assess if removing respondents using male sterilization resulted in changes in the direction or significance of any of the measured associations.

Results

Descriptive characteristics of the sample and their distributions across primary contraceptive method types are summarized by unweighted frequencies and weighted percent values in Table 4. Almost half (49%) of women reported using modern spacing methods of

contraception. Nearly one in six (15%) of women had married before the age of 18. Women's experiences of IPV in the past year varied, with 2% reporting having experienced past year sexual IPV and 14% having experienced past year emotional IPV. The majority of women (64%) lived in districts which were distal to conflict. Most women were older than 29, had attended secondary education, and had given birth two or more times. Over one third of women (34%) had partners who were 6 or more years older than them. Eighty-six percent of women reported that they made decisions about their health care individually or as an equal with their partner. Most women had been married 10 or more years and lived in households with 4 or more people. Finally, most women lived outside of urban settings, with Buddhism as the most-practiced religion and Sinhala as the largest ethnic group represented.

Women's primary contraceptive method type varied significantly by their demographic characteristics (chi-squared test of distribution, p-value less than 0.05). These distributions are shown in the seven rightmost columns in Table 4. Women who were married as children were more likely to use sterilization (25%) and less likely to use traditional methods (8%) than women married as adults. Women who experienced each form of IPV similarly were more likely to use sterilization (20-23%) and less likely to use traditional methods (8-10%) than women who did not experience each IPV form, and they were also more likely to not use any method (24-26%). Over two in five (42%) women living in districts central to conflict were not using any method of contraception, which was much higher than the percentages in the distal (17%) and proximal (15%) districts. A majority of women under 40 were using modern spacing methods, while women ages 40-49 were most likely to be using no method of contraception (26%) or sterilization (28%). One in three women who had not attended secondary school reported using

sterilization, while about half of women who had attended secondary school or higher were using modern spacing methods. Over one in five women (22%) from the lowest wealth quintile were using sterilization, which was a larger proportion than in wealthier groups. Women who had given birth three or more times were much more likely to use sterilization (41%) than women who had given birth two or fewer times (less than 10%). Over one in four women (26%) who did not participate in their own health care decisions were not using any form of contraception, compared to fewer than one in five women (18%) who participated in decisions about their health care. Women who had been married for 20 years or longer were most likely to use no method (26%) or sterilization (33%) than women married shorter amounts of time, while a majority of women married for fewer than 20 years were using modern spacing methods.

Relative risk ratios for each of the primary contraceptive method types (modern spacing methods, sterilization, or traditional methods) compared to no method and each variable of interest are listed in Table 5. The multivariate multinomial model used to calculate the adjusted relative risk ratios included the variables of interest and all covariates excluding ethnicity, age, and urban setting based on VIF values above 5. Girl child marriage was significantly associated with increased relative risk of modern spacing (adjusted RRR/aRRR: 1.92, CI: 1.62-2.27) and sterilization (aRRR: 1.30, CI: 1.07-1.58) as compared to no methods. No past year IPV variable was significantly associated with an increase or decrease in relative risk of sterilization or modern spacing methods in the adjusted analyses. Women who experienced past year physical IPV had decreased relative risk of using traditional methods of family planning compared to using no family planning (aRRR: 0.72, CI: 0.53-0.98). Women in districts which were proximal to conflict had increased relative risk of using modern spacing (aRRR: 1.42, CI: 1.18-1.71) and

sterilization (aRRR: 1.52, CI: 1.19-1.95) compared to those in districts that were distal to conflict; women living in districts that were central to conflict had decreased relative risk of modern spacing methods (aRRR: 0.52, CI: 0.41-0.67), sterilization (aRRR: 0.49, CI: 0.36-0.68), and traditional methods (aRRR: 0.24, CI: 0.07-0.78) over no methods, compared to women in districts distal to conflict.

Next, we examined the role of proximity to conflict as a potential moderator of the relationship between girl child marriage, past year physical IPV and primary contraceptive method type by creating two separate interaction terms that combined proximity to conflict with either girl child marriage or past year physical IPV. We added these two interaction terms to a multinomial logistic regression model of primary contraceptive method type with girl child marriage, past year physical IPV, proximity to conflict, and all covariates included in the previous full regression model. Past year emotional and sexual IPV were excluded from this model because they were not significantly associated with contraceptive method type in the previous full adjusted multinomial model. Results from this interaction analysis are shown in Table 6. In the interaction model, there were statistically significant interaction effects between centrality to conflict and both child marriage and physical IPV, suggesting that proximity to conflict moderates the relationships between girl child marriage, physical IPV, and primary contraceptive method type.

To understand how proximity to conflict moderates the relationships between girl child marriage, past year physical IPV and primary contraceptive method type, we conducted a stratified analysis using three separate multinomial regression models for primary contraceptive

method type in women divided among districts that were distal (n=6,373), proximal (n=2,654), and central (n=2,399) to conflict. Results of this analysis are shown in Table 7. Overall, we found that girl child marriage remained significantly associated with increased relative risk of modern spacing methods in all three settings, while past year physical IPV was only significantly associated with decreased relative risk of sterilization and traditional methods in districts distal to conflict and had no association with any contraceptive method type in districts which were proximal or central to conflict.

In districts distal to conflict, girl child marriage was significantly associated with increased relative risk of using modern spacing methods (aRRR: 1.81, CI: 1.43-2.30) and marginally associated ($p < 0.1$) with increased relative risk of sterilization (aRRR: 1.31, CI: 0.99-1.72) compared to no methods. In distal districts, past year physical IPV was significantly associated with decreased relative risk of both sterilization (aRRR: 0.71, CI: 0.52-0.98) and traditional methods (aRRR: 0.58, CI: 0.41-0.80) compared to no methods. In districts which were proximal to conflict, girl child marriage was significantly associated with increased relative risk of modern spacing methods (aRRR: 2.05, CI: 1.44-2.92) and marginally associated with increased relative risk of sterilization (aRRR: 1.42, CI: 0.96-2.11), while past year physical IPV was not associated with any type of contraceptive method. In districts which were central to conflict, girl child marriage was significantly associated with increased relative risk of modern spacing methods (aRRR: 2.30, CI: 1.61-3.30) and was marginally associated with decreased relative risk of traditional methods (aRRR: 0.33, CI: 0.10, 1.06), while past year physical IPV was not associated with any type of contraceptive method. Finally, a sensitivity analysis on a dataset excluding all respondents who chose male sterilization as their primary method (n=8) did

not find any changes in the direction or significance of any of the measured associations calculated throughout our analyses.

Discussion

Our research adds depth to the research literature on contraceptive use in South Asia. We found that girl child marriage and past year physical IPV were associated with changes in the relative risk of using specific primary contraceptive method types compared to no method in post-conflict Sri Lanka. Girl child marriage was associated with increased relative risk of modern spacing methods and sterilization, while past year physical IPV was associated with decreased relative risk of traditional methods compared to no methods. Compared to women in districts which were distal to conflict, women living in districts which were central to conflict had decreased relative risk of all types of contraceptive methods, while women living in districts proximal to conflict had increased relative risk of using modern spacing methods and sterilization.

In addition to the aforementioned associations, we found that proximity to conflict interacted with both girl child marriage and physical IPV, moderating their associations with primary contraceptive method type. Through analyses stratified by proximity to conflict, we were able to uncover differences in the relationships between both girl child marriage and physical IPV with primary contraceptive method. Past year physical IPV was only significantly associated with primary contraceptive method type in districts distal to conflict, with decreased relative risk of sterilization and traditional methods; whereas it had no associations with primary

contraceptive method type in districts which were proximal or central to conflict. As in the country-level analysis, girl child marriage was significantly associated with increased relative risk of modern spacing methods in all districts. Unlike the country-level analysis, girl child marriage was only marginally associated with increased relative risk of sterilization in districts which were distal or proximal to conflict and was marginally associated with decreased risk of traditional methods in districts central to conflict.

The associations that we found between girl child marriage and primary contraceptive method type mainly support the findings of other studies on girl child marriage and contraceptive use in South Asia, with a notable difference in districts central to conflict. Multiple studies in other South Asian countries have identified positive associations between girl child marriage and modern spacing methods,⁶⁶ and between girl child marriage and female sterilization.^{39,66,67} Our results also found significant positive associations between girl child marriage and modern spacing methods in Sri Lanka in both the national and stratified analyses. Associations between girl child marriage and sterilization in Sri Lanka were less uniform – although girl child marriage was significantly associated with increased relative risk of sterilization in the nationwide analysis, the positive association was only marginally significant in stratified analyses within areas distal and proximal to conflict, while no relationship between girl child marriage and sterilization existed in districts central to conflict. This discrepancy in associations between girl child marriage and two different types of modern contraceptive methods by proximity to conflict highlights the importance of future research in post-conflict settings examining between-group variation in primary contraceptive method type across geographic regions which may have experienced the impact of conflict in differing ways.

Our study's findings on associations between intimate partner violence and primary contraceptive method type add complexity to the literature provided on this topic from other countries across South Asia. In the country-wide analysis, we found that past year physical IPV was with associated decreased relative risk of traditional methods, while neither past year sexual nor emotional IPV were associated with any change in primary contraceptive method type. In the stratified analyses, past year physical IPV was only associated with primary contraceptive method type in districts which were distal to conflict, where it was associated with decreased relative risk of both sterilization and traditional methods. Studies in Bangladesh and Nepal have also found associations between physical IPV and contraceptive methods, however in these countries physical IPV has been associated with increased use of contraceptive methods,^{71,72} while in this study in Sri Lanka we found physical IPV to be associated with decreased use of contraceptive methods. In contrast to the aforementioned studies, a 2015 multi-country study of Nepal, Bangladesh and India which was proportionately skewed towards India did not find any associations between physical IPV and contraceptive methods, instead finding sexual IPV to be associated with increased use of modern spacing methods and decreased use of sterilization.⁷³ The variation in associations between IPV and contraceptive method type across different South Asian nations warrants further research to understand the unique aspects of each country's reproductive health programs and how physical and sexual IPV can either inhibit or prompt women's use of specific contraceptive methods.

Our paper provides a novel contribution to the literature on contraceptive use and its associations with IPV and girl child marriage in post-conflict settings, a subject rarely studied in

South Asia. In our national analysis, we found multiple associations between proximity to conflict and primary contraceptive method type in Sri Lanka. Women in districts that were central to conflict had half the relative risk of using modern methods (sterilization or modern spacing) and one quarter the relative risk of using traditional methods compared to women in districts that were distal to conflict. In contrast, women in districts that were proximal to conflict had increased relative risk of using both modern spacing methods and sterilization compared to those more distal to conflict. A 2017 study by Johnson found pronounced health impacts during the war in Sri Lankan districts which were proximal to conflict, and suggested that the findings might be the result of people with health issues from under-resourced conflict areas traveling to neighboring areas to access health services outside of the conflict zone.³⁷ Our results showing women's decreased use of all contraceptive method types in districts central to the conflict could be a result of women's limited mobility to access services not present in their communities. Further research on reproductive health care access across post-conflict Sri Lanka is needed.

Proximity to conflict was also found to modify the associations between primary contraceptive method type and both girl child marriage and past year physical IPV. In particular, past year physical IPV was not associated with any contraceptive method type in districts which were proximal or central to conflict, despite being significantly associated with decreases in sterilization and traditional methods in districts distal to conflict. It is possible that prolonged exposure to armed conflict in districts that were central and proximal to conflict has in some way altered the perpetration and impact of physical IPV in these communities. Guruge et al.'s qualitative research on IPV in the war-affected Eastern Province of Sri Lanka found that IPV survivors and service providers attributed men's use of IPV to a desire to reclaim power after

experiencing a reversal or challenge to gender roles in the war and post-war context.⁸¹ This same concept arose in qualitative research on post-conflict IPV in the Democratic Republic of the Congo, where men who experienced conflict-related sexual violence reported using IPV to regain their sense of masculinity in the post-war setting.⁷⁴ More research needs to be conducted on the relationship between IPV and contraception in post-conflict settings, as compared to non-conflict areas, and how war-related trauma might impact these relationships.

This study had multiple limitations. One limitation was the use of cross-sectional data for all variables. All responses were collected at the same time, so the relationships we are assessing are only associations, and we cannot infer causality from the findings. It is possible that women responding to the survey may have underreported IPV or girl child marriage due to social desirability bias, or that women from districts with differing proximity to conflict recalled IPV experiences differently due to their varied contexts. The DHS questionnaire has been developed and tested in many contexts, including post-conflict settings, and the survey questions have been developed to reduce bias in responses. The survey did not collect complete information on women's location over time, only collecting information on the most recent location that women had moved from, therefore, we did not have the data to analyze women's lived experience of the conflict and cannot make conclusions about the direct impact of the conflict on survey participants. For this reason, our "proximity to conflict" variable must be interpreted in a post-conflict and cross-sectional context, seven years after the end of the Sri Lankan civil war. Because the DHS was designed to be nationally representative, minority groups in the country with known higher rates of IPV were not counted in large enough numbers for statistically meaningful analysis. One example of this is the low representation of the group labeled "Indian

Tamils" in the 2016 DHS and defined as Tamils living in the up-country region of Sri Lanka and often working on tea "estates" (plantations).¹³ Although multiple studies focused on this population have highlighted high rates of IPV and sterilization compared to national averages,^{40,76–78,82,83} the proportions in this study sample were too small to separate up-country Tamils from other minority ethnic groups or to separate women living in estate areas from other non-urban participants. More research should be conducted on the experiences of minority groups in Sri Lanka, particularly in the estate sector, to better understand the high rates of IPV and sterilization that exist there. Finally, we were limited in our analyses by the lack of certain individual-level data, including access to reproductive healthcare, distance from nearest health center, location over one's lifetime, and lifetime experience of IPV (rather than past year IPV). We suggest that future DHS implementations in Sri Lanka collect anonymized geolocation data and ask all participants about their locations over time, access to reproductive healthcare and their lifetime experiences of IPV so that the impact of these variables can be examined in future analyses of contraceptive use. Additionally, we suggest increased inclusion of Sri Lanka in multi-country studies of sexual and reproductive health in South Asia, to increase understanding of post-conflict sexual and reproductive health in the region.

The current findings may inform future research and practice, particularly in the fields of reproductive health and intimate partner violence prevention in Sri Lanka. Sri Lanka's government-funded IPV survivor support systems are mainly linked to reproductive and perinatal health provision.^{83,84} Sri Lankan women living in districts central to conflict have much lower likelihood of using modern contraception than women living in districts distal to conflict and might therefore utilize reproductive health services less frequently than women in other

areas of Sri Lanka. Efforts should be made to understand this difference, and possibly increase access to reproductive health care in districts that were central to conflict if these services are lacking. Additionally, IPV intervention and prevention services should be expanded beyond reproductive health care settings in districts that were central to conflict in order to reach more women at risk of violence, regardless of their use of contraceptive methods.

Conclusion

In this study, we found that girl child marriage and past year physical IPV were associated with significant changes in the relative risk of using certain contraceptive method types in post-conflict Sri Lanka. Women in districts central to conflict had lower relative risk of using all types of contraceptive methods compared to women in districts distal to conflict. We also found that proximity to conflict moderated the associations between girl child marriage, past year physical IPV and contraceptive method type found in the national analysis, with no associations between past year physical IPV and contraceptive method type in areas that were proximal or central to conflict. Our findings suggest that an expansion of governmental IPV prevention and response services in Sri Lanka beyond reproductive health care settings may be a promising practice to reach women most at risk of violence in the country's post-conflict context.

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Chapter 3. Measuring the impacts of maternal child marriage and maternal intimate partner violence and the moderating effects of proximity to conflict on stunting among children under 5 in post-conflict Sri Lanka

Abstract

This study aimed to understand whether maternal child marriage and past year intimate partner violence (IPV) impact stunting among Sri Lankan children under 5 years old, and, secondarily, whether proximity to conflict is associated with stunting. Additionally, we assessed whether proximity to conflict moderates the relationships between maternal child marriage, past year IPV (sexual, physical, and emotional) and stunting. We tested these questions using logistic regression analyses of the 2016 Sri Lankan Demographic and Health Survey (n=4,941 mother-child dyads). In country-wide adjusted analyses, we did not find associations between maternal child marriage or IPV and stunting ($p>0.5$). Children in districts proximal and central to conflict were significantly less likely to be stunted compared to children in districts distal to conflict (proximal adjusted odds ratio/aOR: 0.43, 95% confidence interval/CI: 0.22-0.82, central aOR: 0.53, CI: 0.29-0.98). We found significant interaction effects between proximity to conflict and both sexual and emotional IPV, which we further explored in stratified analyses. In districts distal to conflict, maternal sexual IPV was associated with increased odds of stunting (aOR: 2.71, CI: 1.16-6.35); and in districts central to conflict, maternal emotional IPV was significantly associated with increased odds of stunting (aOR: 1.80, CI: 1.13-2.89). Maternal emotional IPV was significantly associated with decreased odds of stunting in districts proximal to conflict (aOR: 0.42, CI: 0.18-0.96). Maternal child marriage and physical IPV were not associated with stunting in Sri Lanka. Variations in associations between maternal IPV and stunting across Sri

Lanka may reflect the lasting and differential impact of conflict and the humanitarian responses which may have improved child nutrition practices and resources in districts central and proximal to conflict. Policies and programs addressing stunting in Sri Lanka should consider the role of maternal IPV as well as community-level variations based on proximity to conflict.

Introduction

Stunting, or low height for age, is the most prevalent form of child malnutrition in the world, and is experienced by 161 million children aged 0-5 years.⁸⁵ Stunting has been shown to be associated with increased childhood morbidity and mortality, reduced cognitive function, and elevated risk of chronic disease in adulthood; addressing stunting has been identified by the World Health Organization as a major global health priority.^{85,86} Many socioeconomic risk factors for stunting have been identified in the research literature, such as wealth, feeding practices, household food insecurity, and lower levels of parental education.^{87,88} In addition to socioeconomic factors, some studies have identified associations between maternal characteristics such as height and ethnicity that suggest possible genetic drivers of stunting in children, particularly in communities with low average heights.^{85,88} The causes of stunting are numerous, context-specific, and have yet to be fully understood.

Two maternal gender inequities that appear to be associated with stunting in different settings are child marriage and intimate partner violence (IPV). Maternal child marriage has been found in multiple contexts to be associated with increased child malnutrition and infant mortality,^{89,90} and has been specifically linked to increased odds of stunting across multiple

countries in Sub-Saharan Africa,¹⁹ potentially through the mechanisms of early childbearing and variation in nutritional practices. Maternal experience of IPV has also been found to be associated with increased likelihood of stunting in settings in Africa and South Asia,^{32,91} possibly as a result of increased household stress and variation in nutritional practices. South Asia has high rates of child marriage and a 41 percent prevalence of IPV,^{8,58} further incentivizing study in the region on these factors' influence on child stunting.

Proximity to conflict is another factor that may impact stunting and could plausibly moderate the relationships between maternal child marriage, maternal IPV, and stunting. Studies in multiple conflict-affected countries in Sub-Saharan Africa have found armed conflict and conflict exposure to be associated with negative child health outcomes, increased child mortality, and increased likelihood of stunting.^{21,30,33} Researchers have found that, by increasing social and economic vulnerabilities, conflict can increase the likelihood of child marriage in war-affected communities.^{39,45,46} Living in a post-conflict setting has also been shown to increase the likelihood of recent IPV experience in multiple countries.^{28,43} Long-term exposure to armed conflict can create changes in interpersonal interactions, social practices, and access to resources, which may explain the associations between proximity to conflict and the negative outcomes of child marriage, IPV, and stunting. It is also plausible that proximity to conflict may alter the mechanisms by which maternal child marriage and IPV influence child stunting, thereby moderating any relationships between maternal child marriage and IPV and stunting in post-conflict settings.

In Sri Lanka, which emerged from a prolonged conflict in 2009, post-conflict associations between maternal child marriage, IPV, proximity to conflict, and stunting remain poorly understood. The Sri Lankan conflict adversely affected health infrastructure in the North and East of the country, and created socioeconomic barriers to thriving that have persisted for many years post-conflict.^{92,93} Researchers in Sri Lanka have identified low household wealth, short maternal height, and low birthweight as associated with stunting in children under 5 years old.⁸⁸ While the post-conflict prevalence of stunting ranges from 26% to 44% in areas proximal and central to the conflict in Sri Lanka,^{94,95} no national studies have assessed the impact of proximity to conflict on childhood experience of stunting. Studies of child marriage conducted during and after the conflict have identified increased practice of child marriage in areas central and proximal to conflict compared to those distal from the conflict.^{38,51} A recent study found that IPV in Sri Lanka was most likely to occur in areas central to conflict and in the context of socioeconomic disadvantage.⁴³ The co-occurrence of socioeconomic hardship and conflict creates a need for multivariable analyses that assess the independent contributions of maternal child marriage and IPV to stunting while controlling for other associated factors. Additionally, it is possible that the prolonged conflict has altered relationships between child marriage, IPV and stunting by changing the environment in which they occur – assessing for moderation can help uncover whether these relationships differ by proximity to conflict.

This study aims to understand whether maternal child marriage and maternal IPV are associated with stunting in Sri Lankan children under 5 years old, adjusting for proximity to conflict. We will secondarily look at effects of proximity to conflict on stunting. The study also seeks to identify if proximity to conflict acts as a moderator for observed associations of

maternal child marriage and IPV with stunting. The findings from this study will expand our understanding of linkages between women's lived experiences and the health of their children, as well as additional vulnerabilities or challenges that may be faced by families in post-conflict settings.

Materials and Methods

Data Source: 2016 Sri Lankan Demographic and Health Survey

This study used data from the 2016 Sri Lankan Demographic and Survey (DHS), which collected data on child and maternal health outcomes, domestic violence experience, reproductive health, and the economic engagement and agency of women in Sri Lanka (N = 27,210 households, 18,510 women age 15-49 and 8,146 children aged 0-59 months). The 2016 survey was the first DHS to be conducted on a nationally representative sample of households in Sri Lanka; all previous DHS data collection occurred during the civil war and excluded portions of the Northern and Eastern provinces, which had been claimed as a separate state by the Liberation Tigers of Tamil Eelam (LTTE) organization.³⁵

In addition to a general health survey administered to every eligible woman in each household, a Domestic Violence Module was administered to one woman in each household (n=16,629). The 2016 DHS was the first to ask questions on experiences of intimate partner violence (IPV) in Sri Lanka and, to date, no peer-reviewed studies have been published using this IPV data. Following the World Health Organization's guidelines for the ethical collection of information on domestic violence, one eligible woman per household was randomly selected for

this module, which was not implemented if privacy could not be obtained.⁵⁷ Each domestic violence module respondent was read an additional consent statement at the start of the module, informing her that the questions could be personal and reassuring her of the confidentiality of her responses. In the 2016 DHS, women taking part in the domestic violence module were asked nine questions about their experiences of intimate partner violence in the previous 12 months.¹³ In addition to asking women about their own health, the enumerators collected health and anthropometric data for all children under the age of five in each household (n=8,146). In addition, enumerators surveyed mothers on the children's nutrition practices and recent illnesses. These children's data can be linked to that of their mothers, thus allowing for dyadic analyses studying the relationship between maternal characteristics and child health.

This study combines data on household-level characteristics, women's child marriage and IPV experiences, and under-5 child health. This study was restricted to children under the age of five whose mothers were currently living with an intimate partner and had answered the domestic violence module of the DHS. It was restricted to only singleton birth children, following a convention in child nutrition research of censoring children born in multiple births due to them having increased likelihood of lower gestational ages and birthweights than their singleton peers.⁹⁶ This study was also restricted to mothers age 18 and above, following a convention in girl child marriage research to censor participants under age 18 who might marry as children after the survey's completion.⁵⁸ The complete sample included in this study comprised of 4,941 child-mother dyads. Ethical approval for this research was obtained from the University of California, San Diego Institutional Review Board (Project number 191418XX).

Variables of interest

Dependent Variable: Stunting

As the dependent variable, we examined stunting of children ages 0-59 months (under five years). Following World Health Organization (WHO) guidelines, we defined children as experiencing stunting if their height-for-age measurement was more than two standard deviations below the median height-for-age of the WHO Child Growth Standards in their age and sex category.⁸⁶

Independent Variables: Maternal Child Marriage and Intimate Partner Violence

We examined four variables as independent variables of interest, to account for the separate and overlapping effects of different experiences. The four binary independent variables we considered are listed below:

1. Maternal child marriage: the mother married or cohabited with a male partner before age 18; yes or no.
2. Maternal past year sexual IPV: the mother had been forced to have sex by a partner in the last 12 months; yes or no.
3. Maternal past year physical IPV: the mother had experienced at least one of six types of physical intimate partner violence in the last 12 months: 1) slapping or beating with a hand, 2) pushing or shoving, 3) strangulation, 4) dragging or pulling, 5) beating with an object, or 6) burned; yes, or no.
4. Maternal past year emotional IPV: the mother had experienced at least one of two incidents in the last 12 months, either being belittled/offended or prevented from leaving home by a partner; yes or no.

We considered maternal past year physical, sexual, and emotional IPV as separate independent variables to allow estimation of the independent effects of each form of IPV. We calculated Spearman's rho correlation estimates across all three IPV variables. All IPV correlation estimates were below 0.5, justifying retaining them as independent variables.

Moderating Variable: Proximity to Conflict

We considered proximity to conflict areas as a potential moderator on the relationships between maternal child marriage, past year IPV, and stunting. This variable was defined as having three levels: central, proximal, and distal. Dyads assigned to the “central” category reported residing in either the Northern or Eastern provinces of Sri Lanka, where the majority of the armed conflict occurred during the civil war. Participants assigned to the “proximal” category reported residing in one of the seven districts of Sri Lanka outside of the Northern and Eastern provinces that shared a border with one of both of these regions. Proximal districts were Anuradhapura, Badulla, Hambantota, Matale, Monaragala, Polonnaruwa, and Puttalam. Finally, participants assigned to the “distal” category resided in districts that were neither in nor shared a border with the Northern and Eastern provinces of the country. The “distal” districts were defined as Colombo, Galle, Gampaha, Kalutara, Kandy, Kegalle, Kurunegala, Nuwara Eliya, Matara, and Ratnapura. A map of Sri Lanka showing the geographic distribution of proximity to conflict is included as Figure 1.

Covariates

We included as covariates variables known or hypothesized to influence the relationship between the independent variables of interest and stunting. We considered the child's sex (male

or female), age in months (0-59), and birth order (1, 2, or 3 or above). The maternal variables we considered were height (short: ≤ 145 cm, average: > 145 cm and ≤ 155 cm, or tall: > 155 cm),⁵³ age (18-49 years), and age difference between mother and her partner (in years). At the household level, we considered household wealth quintile, religion (Buddhism, Hinduism, Islam, or other religion), and ethnicity (Sinhala, Sri Lankan Tamil, or Other). Beyond individual- and household-level variables, we also included covariates at the geographic level to control for unmeasured variation between different settings, considering whether the mother and child lived in an urban setting (yes or no), and their district of residence (one of 25 administrative divisions across Sri Lanka).

Statistical Analysis

All statistical analyses were conducted using R software version 3.6.3.⁶⁰ Estimates were adjusted for complex survey design and participant-level weights using the "survey" package in order to calculate population-representative measures.⁶¹ We first assessed the distributions of girl child marriage, all three forms of past year IPV, proximity to conflict, stunting, and all considered covariates in the sample. Next, we tested if the pairwise associations between each of the variables of interest and stunting were statistically significant. We used chi-squared tests for all pairwise distributions after reducing all variables to categories (ordinal or nominal). In preparation for our multivariable model, we assessed all variables for multicollinearity by calculating their variance inflation factor (VIF) and variables with VIF values above 5 were examined for overlap in distribution with other variables in the model. We kept in the analysis all covariates which could be retained with variance inflation factor (VIF) values less than 5, eliminating only religion.

We calculated the unadjusted change in odds of stunting (compared to no stunting) for each of our variables of interest. We then created a multivariable logistic regression model inclusive of all variables of interest as well as covariates to test the adjusted effects of each of our variables of interest on stunting. We included in this model all of the considered covariates that were associated at $p < 0.2$ with stunting in pairwise distributions. Next, we examined the role of proximity to conflict as a potential moderator of the relationships between maternal child marriage, maternal past year IPV, and stunting by creating four separate interaction terms that combined proximity to conflict with maternal child marriage and with each form of maternal past year IPV⁵⁹. We assessed the significance of these interaction terms in a combined logistic regression model for stunting that also contained maternal child marriage, the maternal past year IPV variables, proximity to conflict, and all covariates included in the previous full regression model. Finally, to understand how relationships between the independent variables and stunting were impacted by differing proximity to conflict, we examined relationships between independent variables with significant ($p < 0.05$) or marginally significant ($p < 0.1$) interaction effects and stunting in adjusted regression models stratified by proximity to conflict.

Results

Descriptive characteristics of the sample and their distributions by stunting are summarized in Table 8. Over one in ten (13%) children were stunted. Nearly one in six (15%) mothers had married before the age of 18. Maternal experiences of IPV in the past year varied, with 2% reporting having experienced past year sexual IPV and 13% having experienced past

year emotional IPV. The majority of households (64%) were in districts which were distal to conflict. One in four children (26%) had two or more older siblings and most were normal birthweight (86%) and exclusively breastfed through 6 months of age (88%). Mothers were mainly between 145 and 155 centimeters tall, older than 29, had attended secondary education, and were younger than their male partner. Over half (56%) of households used an appropriate method of water treatment. A majority of households were also Buddhist (72%), Sinhala (77%), and did not live in an urban setting (85%).

Children's stunting varied significantly in pairwise unadjusted associations with many characteristics (measured by a chi-squared test of distribution, p value less than 0.05). Maternal child marriage was not significantly associated with stunting ($p>0.1$), while all three forms of maternal past year IPV showed marginal positive associations with stunting ($p<0.1$). Children in districts proximal to conflict appeared marginally more likely to experience stunting ($p=0.08$) compared to children in areas distal or central to conflict. Covariates significantly associated with stunting ($p<0.05$) in chi-squared pairwise analyses were child's age, maternal height, maternal education, household wealth, religion, ethnicity, and residence in specific districts.

Odds ratios for each variable of interest and stunting are listed in Table 10. Neither maternal child marriage nor any form of past year IPV were associated with changes in the odds of stunting in the national adjusted regression model. In contrast, associations between proximity to conflict and stunting were present in the adjusted model, with significantly lower odds of stunting among children in districts that were proximal (adjusted odds ratio/aOR: 0.43, 95%

confidence interval/CI: 0.22-0.82) and central (aOR: 0.53, CI: 0.29-0.98) compared to children in areas distal to conflict.

Results from the interaction analysis assessing moderation by proximity to conflict are shown in Table 11. In the interaction model, there was a significant interaction between maternal past year sexual IPV and centrality to conflict (aOR: 0.15, CI: 0.04-0.53), suggesting that proximity to conflict moderates the relationship between maternal past year sexual IPV and stunting. Additionally, the emotional IPV interaction model had a marginal ($p < 0.1$) interaction with proximity to conflict in both the proximal (aOR: 0.41, CI: 0.15, 1.11) and central to conflict (aOR: 1.78, CI: 0.91, 3.47) categories.

To further understand how relationships between maternal past year sexual and emotional IPV and stunting differed by proximity to conflict, we conducted a stratified analysis using three separate logistic regression models for stunting in children divided among districts that were distal ($n=2,690$), proximal ($n=1,121$), and central ($n=1,130$) to conflict. Results of this analysis are shown in Table 12. Maternal past year sexual IPV was significantly associated with increased odds of stunting in areas distal to conflict (aOR: 2.71, CI: 1.16-6.35). Maternal past year emotional IPV was significantly associated with decreased odds of stunting in districts proximal to conflict (aOR: 0.42, CI: 0.18-0.96), and increased odds of stunting in districts central to conflict (aOR: 1.80, CI: 1.13-2.89).

Discussion

Our study looked at the impacts of maternal child marriage and IPV on stunting in Sri Lanka, and the potential role of proximity to conflict as a moderator of these relationships. In adjusted models across the country, neither maternal girl child marriage nor any form of maternal past year IPV appeared to be associated with stunting. In those same models, children living in districts proximal and central to conflict were less likely to be stunted than in children distal to conflict. Proximity to conflict significantly moderated relationships between maternal sexual and emotional IPV and stunting, with a further stratified analysis revealing that sexual IPV was associated with increased stunting only in districts distal to conflict, while emotional IPV was associated with increased stunting in areas central to conflict but decreased stunting in areas proximal to conflict. We did not find associations between maternal child marriage or past year physical IPV and stunting. Our findings suggest that Sri Lankan children born to mothers contending with IPV may face a heightened vulnerability to stunting that varies by their proximity to conflict.

We did not find country-wide associations between maternal child marriage or any form of maternal IPV and stunting. However, this lack of association at the country level did not preclude the possibility of moderated associations between the independent variables and stunting that differed by proximity to conflict. This investigation was further supported by our finding that proximity to conflict was associated with stunting, and other research which found conflict to be associated with child marriage and IPV.^{28,39,43,45,46} In our full adjusted regression model, children living in districts proximal and central to conflict had decreased odds of stunting compared to those living distal to conflict. These decreases might be explained by the impact of humanitarian and post-conflict aid programs focused on childhood nutrition, which are more

likely to be implemented in areas central and proximal to conflict zones within a country. Evidence on the effectiveness of humanitarian interventions to improve health is inconclusive,⁹⁷ and our finding of reduced stunting in post-conflict settings in Sri Lanka contributes to this literature.

We found that proximity to conflict moderated the associations linking maternal past year sexual and emotional IPV with stunting. Maternal past year sexual IPV was only associated with stunting in areas distal to conflict, suggesting that the relationship between maternal IPV and child nutrition practices vary with increased proximity to conflict. Positive associations between sexual IPV and stunting have been found in other countries,^{32,91} again suggesting that relationships between IPV and stunting in districts proximal and central to conflict in Sri Lanka may be impacted by enduring effects of the conflict. Maternal past year emotional IPV was associated with increased stunting in districts central to conflict, and decreased stunting in districts proximal to conflict, with no association in districts distal to conflict. These findings highlight the differences between children and families residing in districts which are proximal to rather than central to conflict – perhaps protective factors such as increased child welfare services exist in the proximal districts which prevent maternal emotional IPV from having the negative consequences to child health that it is associated with in districts central to conflict. One study of Sri Lankan health infrastructure found differential health services utilization between proximal and central districts,³⁷ further supporting the idea that children in proximal districts may have access to resources to prevent maternal IPV from resulting in poor nutrition.

The lack of association between stunting and child marriage in our study sample contradicts research from other settings linking child marriage to stunting and child malnutrition. For example, one study of nearly 40,000 mother-child pairs across Sub-Saharan Africa found that the odds of stunting were 29% higher for children born to women who married before 18 compared to those whose mothers married later,¹⁹ and a study in India found that malnutrition was higher in children born to mothers married as minors.⁸⁹ One possible explanation for this discrepancy is the relatively high age of mothers in this study's sample – most of the Sri Lankan mothers included in this study were older than 29 years old. The associations found in other countries between maternal child marriage and child malnutrition may be facilitated by early childbearing, as explained in research that shows associations between infant mortality and young maternal age.⁹⁰ In the case of this sample, although many mothers were married before age 18, they may have given birth to the child included in this study many years into adulthood.

This study had multiple limitations. The survey did not collect complete information on women's location over time, only collecting information on the most recent location that women had moved from; therefore, we cannot make conclusions about the direct impact of the conflict over time on survey participants. For this reason, our "proximity to conflict" variable must be interpreted in a post-conflict and cross-sectional context, seven years after the end of the Sri Lankan civil war. We suggest that future DHS implementations in Sri Lanka collect anonymized geolocation data and ask all participants about their migration histories so that the impact of these experiences can be examined in future analyses. Additionally, although the international community has elevated stunting as a major concern that must be alleviated through nutritional interventions, researchers have highlighted overall shorter heights in Sri Lanka, and the

possibility that genetic factors may drive Sri Lankan child heights to appear more stunted when judged against a global set of standards.⁸⁸ In the context of a shorter population, greater stunting across the population may not be a sign of malnutrition. However, the consistent associations between stunting and low household wealth in Sri Lanka suggest that stunting remains an indicator of child malnutrition that may be intervened upon through socioeconomic intervention.

Conclusions

In this study, we did not find country-level associations between maternal child marriage or maternal past year IPV and stunting. Children in districts proximal and central to conflict were less likely to be stunted compared to children distal to conflict, suggesting the existence of additional (possibly humanitarian) nutritional resources for children in areas impacted heavily by conflict. Proximity to conflict moderated the impacts of maternal past year sexual and emotional IPV on stunting, with maternal sexual IPV increasing the odds of stunting in districts distal to conflict and emotional IPV in districts increasing odds of stunting in districts central to conflict. Conversely, maternal past year emotional IPV was associated with decreased odds of stunting in proximal districts, suggesting additional resources for women experiencing IPV or children at risk of malnutrition in those areas. Conducted among children born after the end of the Sri Lankan civil war in 2009, this study shows the lasting impacts of conflict on health. Programs to address stunting in Sri Lanka should also consider the role of maternal IPV and take into account the varying contexts of regions of the country differentially exposed to conflict. With targeted interventions, disparities in child nutrition can be addressed and the impacts of conflict can be prevented from harming future generations.

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Chapter 3, in full, is currently being prepared for submission for publication by Fonseca, Ruvani W.; McDougal, Lotus P.; Raj, Anita; Reed, Elizabeth; Lundgren, Rebecka; Urada, Lianne; and Silverman, Jay G. The dissertation author was the primary investigator and author of this paper.

Conclusion

Sri Lanka's 26-year civil war has had lasting impacts on the wellbeing of its inhabitants. Although the country's child marriage and IPV prevalence are low compared to many of its neighbors in the South Asian region, there are significant differences in these risk factors across geographic areas differently impacted by the conflict. Using a three-level proximity to conflict variable that took into account the unique characteristics of districts bordering the conflict zone, this dissertation aimed to understand the relationships between girl child marriage, IPV, and reproductive and child health outcomes using the 2016 Sri Lankan Demographic and Health Survey (DHS), collected seven years after the end of the war.

Chapter one examined the relationship between proximity to conflict and past year IPV and examined whether girl child marriage acted as a mediating factor in the pathway from conflict proximity to IPV. Our findings highlighted that women in districts central to conflict had greater odds of all forms of IPV compared to women in districts distal to conflict. Additionally, we found that residence in districts proximal to conflict was associated with decreased odds of past year physical and emotional IPV. Living in a district central to conflict also increased women's odds of having married as a child, and girl child marriage was found to partially mediate the positive associations between centrality to conflict and all forms of past year IPV. These findings suggest that reducing girl child marriage in post-conflict Sri Lanka, particularly in districts central to the conflict, may contribute to decreased IPV. Additionally, women and girls in districts central to conflict are at elevated risk for both girl child marriage and IPV, and programs and policies targeting gender equity in districts central to conflict could contribute to reducing violence and decreasing the lasting effects of the conflict.

Chapter two investigated associations between girl child marriage, past year IPV, and primary contraceptive method type and considered whether proximity to conflict moderated these associations. We found that girl child marriage was associated with an increased relative risk of modern spacing methods and sterilization, while past year physical IPV was associated with decreased relative risk of traditional contraceptive methods, relative to no method. Compared to women in districts distal to conflict, women in districts proximal to conflict had increased relative risk of modern spacing contraceptive methods and sterilization, while women in districts central to conflict had decreased relative risk of all contraceptive method types compared to no method. Proximity to conflict moderated the associations between girl child marriage, past year physical IPV, and primary contraceptive method type, with physical IPV only being associated with changes in the relative risk of specific contraceptive method types in districts distal to conflict. These findings suggest that the relationships between girl child marriage, past year IPV, and primary contraceptive method type differ by proximity to conflict, and that programs seeking to improve contraceptive access and use in Sri Lanka should not only consider the roles of IPV and girl child marriage in women's decisions around and access to contraception but also how proximity to conflict might influence those roles.

Finally, chapter three explored associations between maternal child marriage, maternal past year IPV, and stunting in children under 5 years old in Sri Lanka and secondarily assessed the impact of proximity to conflict on stunting and on the chapter's main relationships of interest. The results showed that maternal child marriage and past year IPV had no measured impact on stunting in nationwide analyses, while children in districts that were proximal or central to conflict experienced lower odds of stunting than children in districts that were distal to the conflict. We found evidence of interaction between proximity to conflict and both sexual and

emotional IPV, which we explored further in stratified analyses. Our findings of differential associations between IPV and stunting by proximity to conflict suggest that policymakers seeking to address stunting in Sri Lanka need to consider not only the potential impact of IPV on stunting, but also the varying risk and protective factors that may differ by proximity to conflict.

Taken together, these three papers show the intertwined nature of child marriage, intimate partner violence, and health in post-conflict Sri Lanka, and the overarching impact of the Sri Lankan civil war on pathways to health, even in generations born after the war's end. This research was limited by the use of cross-sectional data, capturing only women's current residence and recent experiences of IPV. Future research that examines Sri Lankan women's experiences of IPV and exposure to conflict throughout their lifetimes could greatly add to our understanding of how conflict, gender-based violence and health are related in Sri Lanka. Programs in Sri Lanka that seek to address gender inequities such as girl child marriage and IPV, as well as their downstream health consequences like contraceptive use and stunting, need to consider the impact that proximity to conflict plays in individuals' risk factors, health behaviors, and access to services. By fully considering and addressing the ongoing and intergenerational impacts of conflict, policymakers in conflict-affected settings like Sri Lanka will be able to ensure a healthy future for generations to come.

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Figures

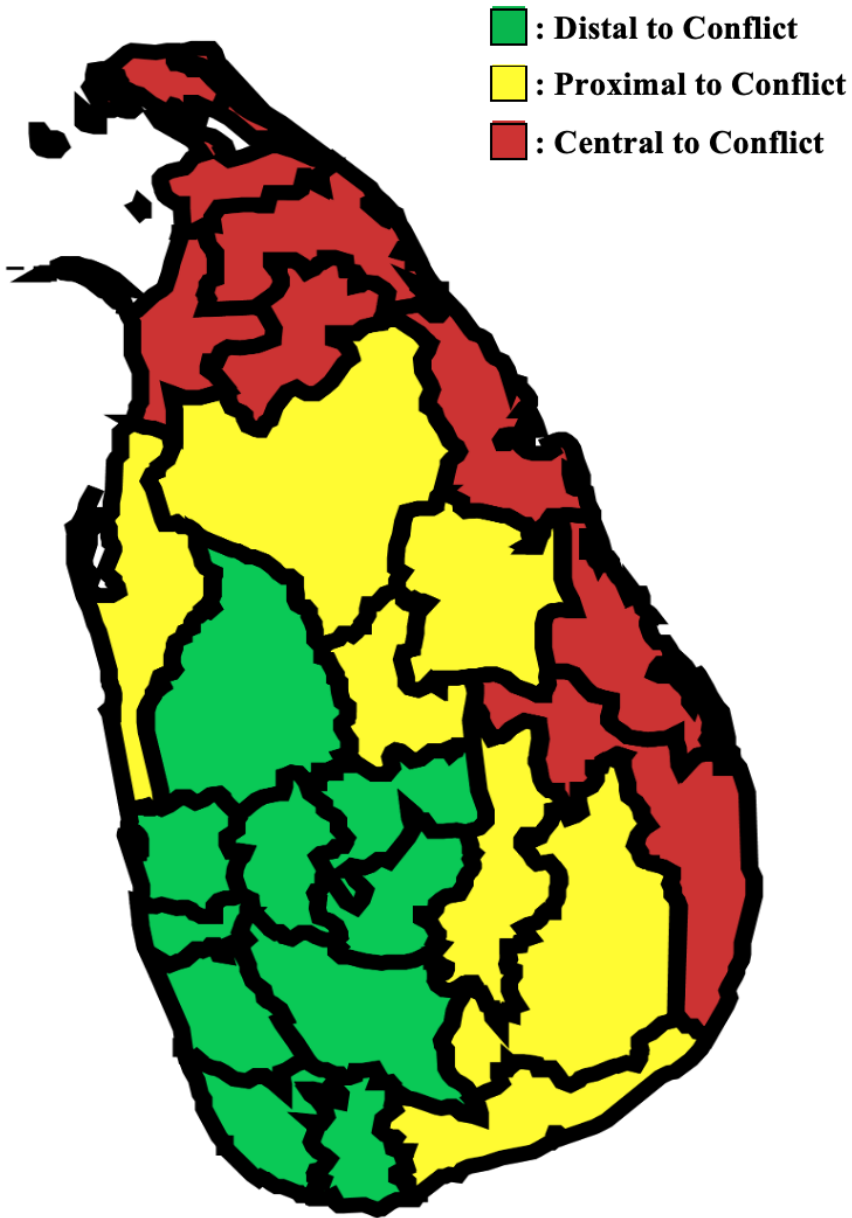
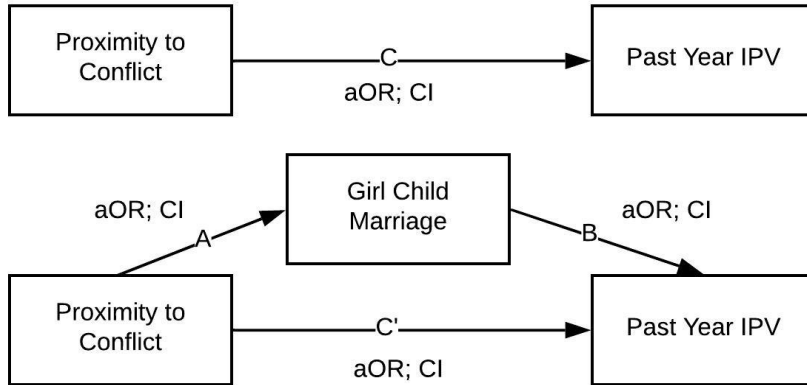
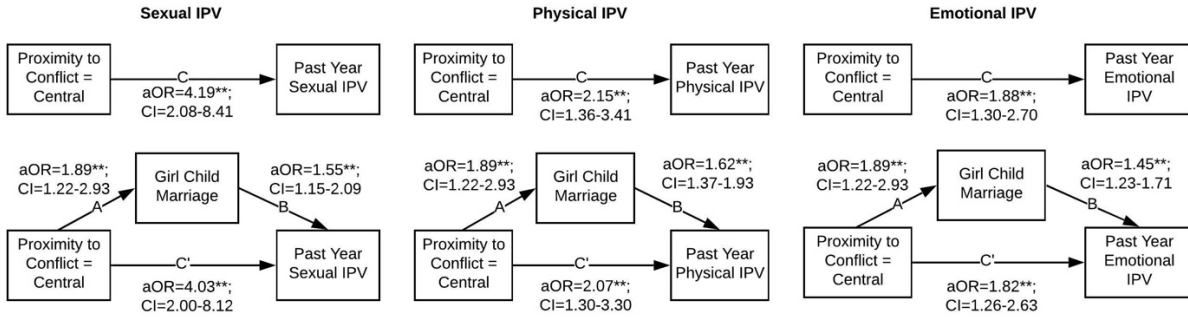


Figure 1. Map of Sri Lankan Districts



Legend: aOR: adjusted odds ratio; CI: 95% confidence interval

Figure 2. Measuring whether girl child marriage mediates the relationship between proximity to conflict and past-year intimate partner violence (IPV) in post-conflict Sri Lanka



Legend: aOR: adjusted odds ratio; CI: 95% confidence interval; * $p < 0.05$; odds ratios use proximity to conflict=distal as reference group

Figure 3. Measuring whether girl child marriage mediates the relationship between proximity to conflict (comparing central to distal) and past year sexual, physical, and emotional intimate partner violence (IPV) in post-conflict Sri Lanka

Tables

Table 1. Demographic details of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module and distribution of past year sexual, physical, and emotional intimate partner violence (IPV) (N=13,691) (Continued)

Characteristic	Total		Past year sexual IPV			Past year physical IPV			Past year emotional IPV		
	n	% [^]	n	%	Chi-squared p-value	n	%	Chi-squared p-value	n	%	Chi-squared p-value
Total	13691	100%	363	2%	-	1290	9%	-	1949	13%	-
Proximity to Conflict											
Distal	7603	64%	110	1%	<0.01*	529	7%	<0.01*	867	11%	<0.01*
Proximal	3131	23%	60	2%		247	8%		261	9%	
Central	2957	13%	193	8%		514	19%		821	29%	
Girl Child Marriage											
No	11707	86%	265	2%	<0.01*	967	8%	<0.01*	1539	12%	<0.01*
Yes	1984	14%	98	5%		323	16%		410	19%	
Age^{^^}											
18-29	3031	22%	69	2%	0.03*	276	8%	0.04*	394	12%	<0.01*
30-39	5852	43%	147	2%		543	8%		804	13%	
40-49	4808	35%	147	3%		471	10%		751	15%	
Education											
Primary (01-05) or less	1189	8%	76	6%	<0.01*	234	20%	<0.01*	288	24%	<0.01*
Secondary (6-12)	9119	66%	252	2%		919	10%		1303	13%	
Higher than Secondary	3383	26%	35	1%		137	4%		358	10%	
Household wealth quintile											
Lowest	3090	18%	169	5%	<0.01*	575	19%	<0.01*	734	22%	<0.01*
Second	2787	20%	89	3%		276	10%		399	14%	
Middle	2683	21%	42	2%		200	7%		305	11%	
Fourth	2660	21%	33	1%		146	6%		270	10%	
Highest	2471	20%	30	1%		93	4%		241	10%	
Parity											
0-1	4267	32%	62	1%	<0.01*	276	6%	<0.01*	475	10%	<0.01*
2	5154	39%	123	2%		470	9%		687	12%	
3+	4270	29%	178	4%		544	12%		787	17%	
Age difference between woman and partner^{^^}											
same or older	2468	18%	77	3%	0.12	283	11%	<0.01*	397	15%	0.05*
1-5 years	6712	49%	176	2%		628	9%		911	12%	
6-10 years	3598	27%	77	2%		285	7%		494	13%	

Table 1. Demographic details of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module and distribution of past year sexual, physical, and emotional intimate partner violence (IPV) (N=13,691) (Continued)

Characteristic	Total		Past year sexual IPV			Past year physical IPV			Past year emotional IPV		
	n	% [^]	n	%	Chi-squared p-value	n	%	Chi-squared p-value	n	%	Chi-squared p-value
over 10 years	913	6%	33	3%		94	9%		147	14%	
Religion											
Buddhism	8855	73%	135	2%	<0.01*	585	7%	<0.01*	922	11%	<0.01*
Hinduism	2327	11%	127	6%		417	19%		624	27%	
Islam	1267	9%	59	4%		132	10%		195	15%	
Other	1242	8%	42	3%		156	12%		208	15%	
Urban Setting											
No	11510	85%	312	2%	0.85	1097	9%	0.56	1604	13%	<0.01*
Yes	2181	15%	51	2%		193	9%		345	16%	
District^{^^^}					<0.01*			<0.01*			<0.01*

n values are unweighted, while percent values are weighted

Chi-squared p-values are weighted according to the survey's complex sampling design

[^]Total percent values are calculated within the same column, while all other percent values are calculated within the same row

^{^^}Age and age difference between woman and partner are presented in cross-tabulations as categorical but were included in regression models as continuous variables

^{^^^}A full list of districts is omitted due to length (see Table 2)

**p*<0.05

Table 2. District of residence of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module and distribution of past year sexual, physical, and emotional intimate partner violence (IPV) (N=13,691)

District	Total		Past year sexual IPV			Past year physical IPV			Past year emotional IPV		
	n	% [^]	n	%	Chi-squared p-value	n	%	Chi-squared p-value	n	%	Chi-squared p-value
<i>Distal to conflict</i>											
Colombo	1069	10%	16	1%	<0.01*	76	7%	<0.01*	124	11%	<0.01*
Galle	640	5%	10	2%		45	7%		119	19%	
Gampaha	1101	10%	14	1%		103	10%		66	6%	
Kalutara	603	6%	12	2%		31	5%		34	5%	
Kandy	808	7%	17	2%		54	6%		188	24%	
Kegalle	492	4%	2	0%		18	4%		34	7%	
Kurunegala	1034	9%	23	2%		75	7%		69	7%	
Matara	550	4%	0	0%		14	3%		88	15%	
Nuwara Eliya	480	3%	8	2%		52	11%		53	12%	
Ratnapura	826	6%	8	1%		61	8%		92	12%	
<i>Proximal to conflict</i>											
Anuradhapura	590	5%	10	2%		27	6%		34	6%	
Badulla	506	4%	6	1%		40	8%		43	8%	
Hambantota	442	3%	4	1%		22	5%		13	3%	
Matale	304	2%	21	5%		49	16%		76	26%	
Monaragala	411	3%	3	1%		22	6%		17	4%	
Polonnaruwa	343	2%	3	1%		20	6%		23	7%	
Puttalam	535	4%	13	2%		67	12%		55	10%	
<i>Central to conflict</i>											
Ampara	578	4%	41	7%		56	10%		128	22%	
Batticaloa	416	3%	37	9%		122	29%		177	43%	
Jaffna	374	3%	26	7%		80	22%		129	36%	
Kilinochchi	283	1%	16	6%		66	23%		134	45%	
Mannar	343	0%	20	6%		54	17%		50	15%	
Mullaitivu	271	0%	8	3%		36	14%		78	30%	
Trincomalee	343	2%	37	11%		78	24%		73	22%	
Vavuniya	349	1%	8	2%		22	7%		52	16%	

n values are unweighted, while percent values are weighted

Chi-squared p-values are weighted according to the survey's complex sampling design

^ Total percent values are calculated within the same column, while all other percent values are calculated within the same row

**p<0.05*

Table 3. Logistic regression analyses of the relationship between proximity to conflict, girl child marriage, and past year sexual, physical, and emotional intimate partner violence (IPV) among currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module (N=13,691)

<i>Relationships between proximity to conflict, girl child marriage, and past year sexual IPV (SIPV)</i>									
Variable of interest	C path (outcome: SIPV=yes)			A path (outcome: Child Marriage=yes)			C' and B path (outcome: SIPV=yes)		
	aOR	CI	p-value	aOR	CI	p-value	aOR	CI	p-value
Proximity to Conflict									
Distal	ref	ref	ref	ref	ref	ref	ref	ref	ref
Proximal	0.34	0.09, 1.23	0.10	1.28	0.83, 1.97	0.30	-	-	-
Central	4.19	2.08, 8.41	<0.01*	1.89	1.22, 2.93	<0.01*	4.03	2.00, 8.12	<0.01*
Girl Child Marriage									
No	-	-	-	-	-	-	ref	ref	ref
Yes	-	-	-	-	-	-	1.55	1.15, 2.09	<0.01*
<i>Relationships between proximity to conflict, girl child marriage, and past year physical IPV (PIPV)</i>									
Variable of interest	C path (outcome: PIPV=yes)			A path (outcome: Child Marriage=yes)			C' and B path (outcome: PIPV=yes)		
	aOR	CI	p-value	aOR	CI	p-value	aOR	CI	p-value
Proximity to Conflict									
Distal	ref	ref	ref	ref	ref	ref	ref	ref	ref
Proximal	0.51	0.29, 0.91	0.02*	1.28	0.83, 1.97	0.30	-	-	-
Central	2.15	1.36, 3.41	<0.01*	1.89	1.22, 2.93	<0.01*	2.07	1.30, 3.30	<0.01*
Girl Child Marriage									
No	-	-	-	-	-	-	ref	ref	ref
Yes	-	-	-	-	-	-	1.62	1.37, 1.93	<0.01*
<i>Relationships between proximity to conflict, girl child marriage, and past year emotional IPV (EIPV)</i>									
Variable of interest	C path (outcome: EIPV=yes)			A path (outcome: Child Marriage=yes)			C' and B path (outcome: EIPV=yes)		
	aOR	CI	p-value	aOR	CI	p-value	aOR	CI	p-value
Proximity to Conflict									
Distal	ref	ref	ref	ref	ref	ref	ref	ref	ref
Proximal	0.31	0.18, 0.54	<0.01*	1.28	0.83, 1.97	0.30	-	-	-
Central	1.88	1.30, 2.70	<0.01*	1.89	1.22, 2.93	<0.01*	1.82	1.26, 2.63	<0.01*
Girl Child Marriage									
No	-	-	-	-	-	-	ref	ref	ref
Yes	-	-	-	-	-	-	1.45	1.23, 1.71	<0.01*

Regression models included as covariates age, education, household wealth quintile, parity, age difference between woman and partner, religion, urban setting, and district.

Confidence intervals and p-values are weighted according to the survey's complex sampling design

aOR = adjusted odds ratio; CI = 95% confidence interval

*p<0.05

Table 4. Demographic Details of currently partnered women age 18-49 who are not pregnant or trying to become pregnant and participated in the 2016 Sri Lanka DHS Domestic Violence module, by type of contraceptive method (N=11,426) (Continued)

Characteristic	Total		Primary Contraceptive Method Type								Chi-squared p-value
			None		Modern Spacing Methods		Sterilization		Traditional Methods		
	n	%	n	%^	n	%^	n	%^	n	%^	
Total	11426	100	2551	19	5383	49	2026	17	1466	14	--
Child Marriage											
No	9622	85	2199	20	4499	49	1577	16	1347	15	<0.01*
Yes	1804	15	352	17	884	50	449	25	119	8	
Past Year Sexual IPV											
No	11104	98	2455	19	5254	49	1956	17	1439	14	<0.01*
Yes	322	2	96	26	129	41	70	23	27	10	
Past Year Physical IPV											
No	10288	91	2250	19	4870	49	1780	17	1388	15	<0.01*
Yes	1138	9	301	24	513	47	246	21	78	8	
Past Year Emotional IPV											
No	9735	87	2098	19	4633	50	1682	17	1322	15	<0.01*
Yes	1691	13	453	24	750	46	344	20	144	10	
Proximity to Conflict											
Distal	6373	64	1078	17	3120	50	1100	17	1075	17	<0.01*
Proximal	2654	23	408	15	1402	54	557	21	287	11	
Central	2399	13	1065	42	861	38	369	15	104	5	
Age^^											
18-29	2111	18	374	16	1500	72	32	1	205	11	<0.01*
30-39	4834	42	858	15	2648	57	745	15	583	13	
40-49	4481	39	1319	26	1235	30	1249	28	678	17	
Education											
Primary (01-05) or less	1111	8	334	26	318	30	378	35	81	9	<0.01*
Secondary (6-12)	7682	67	1651	18	3799	51	1366	18	866	13	
Higher than Secondary	2633	24	566	19	1266	49	282	11	519	21	
Household wealth quintile											
Lowest	2642	18	746	22	1156	48	593	22	147	7	<0.01*
Second	2349	20	514	19	1130	50	423	18	282	13	
Middle	2217	21	431	18	1154	53	346	15	286	14	
Fourth	2180	21	438	18	1054	50	344	16	344	16	
Highest	2038	20	422	20	889	44	320	15	407	21	
Parity											
0-1	2390	22	590	22	1316	56	29	1	455	21	<0.01*
2	4832	44	1036	19	2764	58	321	7	711	16	
3+	4204	34	925	18	1303	33	1676	41	300	8	

Table 4. Demographic Details of currently partnered women age 18-49 who are not pregnant or trying to become pregnant and participated in the 2016 Sri Lanka DHS Domestic Violence module, by type of contraceptive method (N=11,426) (Continued)

Characteristic	Total		Primary Contraceptive Method Type								Chi-squared p-value
			None		Modern Spacing Methods		Sterilization		Traditional Methods		
	n	%	n	%^	n	%^	n	%^	n	%^	
Age difference between woman and partner^^											
same or older	1996	17	481	21	941	50	317	15	257	14	<0.01*
1-5 years	5550	49	1218	19	2657	50	940	16	735	15	
6-10 years	3075	27	643	18	1449	49	602	20	381	14	
over 10 years	805	7	209	23	336	43	167	20	93	13	
Person that makes decisions about health care											
Woman or woman and partner	9725	86	2075	18	4643	50	1716	17	1291	15	<0.01*
Partner or someone else	1701	14	476	26	740	45	310	17	175	12	
Years married^^											
0-9	3197	28	618	17	2086	67	76	2	417	14	<0.01*
10-19	5033	44	1010	17	2459	51	902	17	662	15	
20 or more	3196	28	923	26	838	28	1048	33	387	14	
Household size											
1-3	1713	15	434	23	778	47	226	13	275	18	<0.01*
4	3748	33	799	19	1977	54	384	10	588	17	
5	3129	27	643	17	1404	47	738	24	344	12	
6+	2836	24	675	20	1224	46	678	23	259	10	
Religion											
Buddhism	7480	73	1113	15	3925	52	1281	17	1161	16	<0.01*
Hinduism	1917	11	735	38	664	34	432	23	86	5	
Islam	992	8	379	34	406	44	119	13	88	9	
All other religions	1037	8	324	22	388	43	194	19	131	16	
Ethnicity											
Sinhala	7996	79	1205	15	4158	52	1371	17	1262	16	<0.01*
Sri Lankan Tamil	2210	12	927	39	744	35	443	21	96	5	
Other ethnicities^^^	1220	10	419	31	481	42	212	17	108	9	
Urban Setting											
No	9634	85	2035	18	4626	50	1765	18	1208	14	<0.01*
Yes	1792	15	516	26	757	44	261	14	258	15	

Table 4. Demographic Details of currently partnered women age 18-49 who are not pregnant or trying to become pregnant and participated in the 2016 Sri Lanka DHS Domestic Violence module, by type of contraceptive method (N=11,426) (Continued)

Characteristic	Total		Primary Contraceptive Method Type								Chi-squared p-value
			None		Modern Spacing Methods		Sterilization		Traditional Methods		
District	n	%	n	% [^]	n	% [^]	n	% [^]	n	% [^]	
<i>Distal to Conflict</i>											
Colombo	881	10	193	22	426	48	116	13	146	17	<0.01*
Galle	541	5	78	15	254	47	96	18	113	20	
Gampaha	916	10	146	15	442	49	145	16	183	20	
Kalutara	511	6	60	12	251	49	81	16	119	23	
Kandy	645	6	130	20	316	50	128	18	71	12	
Kegalle	412	4	77	19	227	55	66	16	42	10	
Kurunegala	881	9	124	14	478	54	127	15	152	17	
Matara	465	4	88	19	242	53	61	12	74	16	
Nuwara Eliya	422	3	103	22	144	37	156	37	19	4	
Ratnapura	699	7	79	11	340	49	124	17	156	23	
<i>Proximal to Conflict</i>											
Anuradhapura	494	5	68	13	303	63	92	18	31	6	
Badulla	431	4	73	15	199	48	124	29	35	9	
Hambantota	375	3	79	22	176	47	67	18	53	14	
Matale	257	2	28	10	144	56	55	21	30	13	
Monaragala	350	3	45	12	186	54	79	22	40	12	
Polonnaruwa	294	2	40	14	178	61	57	19	19	7	
Puttalam	453	4	75	16	216	49	83	17	79	17	
<i>Central to Conflict</i>											
Ampara	450	4	160	34	197	45	58	13	35	8	
Batticaloa	337	3	181	55	104	30	34	10	18	5	
Jaffna	297	2	120	39	88	30	73	25	16	5	
Kilinochchi	236	1	64	27	105	45	61	25	6	3	
Mannar	285	0	219	76	34	13	32	11	0	0	
Mullaitivu	232	0	49	20	129	58	42	18	12	4	
Trincomalee	274	2	102	36	132	49	29	11	11	4	
Vavuniya	288	1	170	58	72	25	40	14	6	3	

n values are unweighted, while percent values are weighted

Chi-squared *p*-values are weighted according to the survey's complex sampling design

[^]cross-tabulated weighted percent values are calculated within the same row

^{^^}Age, age difference between woman and partner, and years married are presented in Table 1 and 2 as categorical but were included in regression models as continuous variables

^{^^^}other ethnicities include Muslim, Malay, Indian Tamil, Burgher, and other

**p*<0.05

Table 5. Multinomial logistic regression comparing different contraceptive method types to no contraception among currently partnered women age 18-49 who are not pregnant or trying to become pregnant in the 2016 Sri Lanka DHS Domestic Violence module (N=11,426)

		Primary Contraceptive Method Type (Compared to No Method) [^]								
		Modern Spacing Methods			Sterilization			Traditional Methods		
Variable of interest		aRRR	CI	p-value	aRRR	CI	p-value	aRRR	CI	p-value
<i>Independent Variables</i>										
	Girl Child Marriage									
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	1.92	1.62, 2.27	<0.01*	1.30	1.07, 1.58	0.01*	0.89	0.70, 1.13	0.30
	Past Year Sexual IPV									
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	1.04	0.73, 1.49	0.80	1.09	0.72, 1.66	0.70	1.44	0.86, 2.41	0.20
	Past Year Physical IPV									
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	0.97	0.79, 1.20	0.80	0.96	0.74, 1.25	0.80	0.72	0.53, 0.98	0.04*
	Past Year Emotional IPV									
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	1.06	0.89, 1.27	0.50	1.03	0.82, 1.29	0.80	0.82	0.64, 1.05	0.11
<i>Potential Moderator</i>										
	Proximity to Conflict									
	Distal	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Proximal	1.42	1.18, 1.71	<0.01*	1.52	1.19, 1.95	<0.01*	1.02	0.81, 1.29	0.90
	Central	0.52	0.41, 0.67	<0.01*	0.49	0.36, 0.68	<0.01*	0.24	0.07, 0.78	0.02*

aRRR=Adjusted relative risk ratio, CI = 95% confidence interval

[^]Model included as covariates education, household wealth quintile, parity, age difference between woman and partner, person that makes decisions about healthcare, years married, household size, religion, and district.

*p<0.05

Table 6. Interaction effects between proximity to conflict and girl child marriage and physical IPV among currently partnered women age 18-49 who are not pregnant or trying to become pregnant in the 2016 Sri Lanka DHS Domestic Violence module (N=11,426) (N=11,426)

		Primary contraceptive method type (compared to no methods) with interaction terms between child marriage and conflict and physical IPV and conflict added to model [^]								
		Modern Spacing			Sterilization			Traditional		
Interaction term		aRRR	CI	p-value	aRRR	CI	p-value	aRRR	CI	p-value
Proximity to Conflict*Child Marriage Interaction										
	Proximal*Child Marriage	1.12	0.75, 1.66	0.60	1.22	0.78, 1.91	0.40	0.63	0.35, 1.13	0.12
	Central*Child Marriage	1.25	0.85, 1.84	0.30	0.89	0.55, 1.43	0.60	0.25	0.08, 0.78	0.02*
Proximity to Conflict*Physical IPV Interaction										
	Proximal*Physical IPV	1.44	0.86, 2.40	0.20	1.66	0.90, 3.04	0.10	1.09	0.50, 2.34	0.80
	Central*Physical IPV	1.64	1.08, 2.48	0.02*	1.82	1.08, 3.05	0.02*	1.73	0.77, 3.89	0.20

aRRR = Adjusted relative risk ratio, CI = 95% confidence interval

[^]Interaction model included child marriage, physical IPV, conflict, and was adjusted for education, household wealth quintile, parity, age difference between woman and partner, person that makes decisions about healthcare, years married, household size, religion, and district. Sexual and emotional IPV were not included due to not being significantly associated with contraceptive use in the adjusted multinomial model across proximity to conflict levels.

*p<0.05

Table 7. Stratified multinomial logistic regressions across proximity to conflict comparing relative risk of different contraceptive method types to no contraception among currently partnered women age 18-49 who are not pregnant or trying to become pregnant and participated in the 2016 Sri Lanka DHS Domestic Violence module (N=11,426)

<i>Proximity to Conflict</i>		Primary Contraceptive Method Type (Compared to No Method) [^]								
Variable		Modern Spacing Methods			Sterilization			Traditional Methods		
<i>Distal (n=6373)</i>		aRRR	CI	p-value	aRRR	CI	p-value	aRRR	CI	p-value
Girl Child Marriage										
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	1.81	1.43, 2.30	<0.01*	1.31	0.99, 1.72	0.06 [^]	1.00	0.75, 1.35	>0.9
Past Year Physical IPV										
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	0.81	0.63, 1.04	0.10	0.71	0.52, 0.98	0.04*	0.58	0.41, 0.80	<0.01*
<i>Proximal (n=2654)</i>		RRR	CI	p-value	RRR	CI	p-value	RRR	CI	p-value
Girl Child Marriage										
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	2.05	1.44, 2.92	<0.01*	1.42	0.96, 2.11	0.08 [^]	0.69	0.40, 1.19	0.20
Past Year Physical IPV										
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	1.15	0.72, 1.84	0.50	1.35	0.79, 2.29	0.30	0.65	0.32, 1.31	0.20
<i>Central (n=2399)</i>		RRR	CI	p-value	RRR	CI	p-value	RRR	CI	p-value
Girl Child Marriage										
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	2.30	1.61, 3.30	<0.01*	1.10	0.70, 1.72	0.70	0.33	0.10, 1.06	0.06 [^]
Past Year Physical IPV										
	No	ref	ref	ref	ref	ref	ref	ref	ref	ref
	Yes	1.29	0.91, 1.84	0.20	1.36	0.88, 2.11	0.20	1.16	0.53, 2.53	0.70

aRRR = adjusted relative risk ratio, CI = 95% confidence interval

[^]Multivariate models included as covariates education, household wealth quintile, parity, age difference between woman and partner, person that makes decisions about healthcare, years married, household size, religion, and district.

*p<0.05

[^]p<0.1

Table 8. Demographic details of youngest singleton-birth children under 5 years old of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module by stunting (N=4,941) (Continued)

Characteristic	Total		No		Stunting		Chi-squared p-value
	n	%	n	% [^]	n	% [^]	
<i>Total</i>	4941	100%	4263	87%	678	13%	-
<i>Independent Variables</i>							
Maternal Child Marriage							
No	4249	85%	3680	87%	569	13%	0.11
Yes	692	15%	583	85%	109	15%	
Maternal Past Year Sexual IPV							
No	4826	98%	4172	87%	654	13%	0.08
Yes	115	2%	91	81%	24	19%	
Maternal Past Year Physical IPV							
No	4489	91%	3891	87%	598	13%	0.09
Yes	452	9%	372	84%	80	16%	
Maternal Past Year Emotional IPV							
No	4289	87%	3727	87%	562	13%	0.07
Yes	652	13%	536	85%	116	15%	
<i>Potential Moderator</i>							
Proximity to Conflict							
Distal	2690	64%	2314	86%	376	14%	0.08
Proximal	1121	23%	988	89%	133	11%	
Central	1130	13%	961	86%	169	14%	
<i>Demographic Characteristics</i>							
Sex							
Male	2571	52%	2208	87%	363	13%	0.59
Female	2370	48%	2055	87%	315	13%	
Age in months^{^^}							
0-11	967	20%	859	90%	108	10%	<0.01*
12-35	2174	44%	1815	84%	359	16%	
36-59	1800	36%	1589	88%	211	12%	
Birth order							
1	1649	35%	1446	88%	203	12%	0.16
2	1929	39%	1667	86%	262	14%	
3 or above	1363	26%	1150	86%	213	14%	
Maternal Height							
≤145 cm	362	8%	240	68%	122	32%	<0.01*
>145 cm and ≤155 cm	2758	57%	2329	85%	429	15%	
>155 cm	1821	35%	1694	93%	127	7%	
Maternal Age^{^^}							
18-29	1843	23%	1572	86%	271	14%	0.14
30-39	2690	42%	2337	88%	353	12%	
40-49	408	35%	354	86%	54	14%	

Table 8. Demographic details of youngest singleton-birth children under 5 years old of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module by stunting (N=4,941) (Continued)

Characteristic	Total		No		Stunting		Chi-squared p-value
	n	%	n	% [^]	n	% [^]	
Maternal Education							
Primary (01-05) or less	259	8%	198	77%	61	23%	<0.01*
Secondary (6-12)	3295	67%	2803	86%	492	14%	
Higher than Secondary	1387	26%	1262	91%	125	9%	
Age difference between mother and partner^{^^}							
same or older	952	17%	818	87%	134	13%	0.49
1-5 years	2492	49%	2158	87%	334	13%	
6-10 years	1238	27%	1071	86%	167	14%	
over 10 years	259	6%	216	84%	43	16%	
Household wealth quintile							
Lowest	1212	18%	966	80%	246	20%	<0.01*
Second	1030	20%	867	84%	163	16%	
Middle	956	21%	850	89%	106	11%	
Fourth	936	21%	836	89%	100	11%	
Highest	807	20%	744	92%	63	8%	
Religion							
Buddhism	3121	72%	2742	88%	379	12%	<0.01*
Hinduism	842	11%	686	82%	156	18%	
Islam	517	9%	440	86%	77	14%	
All other religions	461	8%	395	87%	66	13%	
Ethnicity							
Sinhala	3337	77%	2938	88%	399	12%	<0.01*
Sri Lankan Tamil	994	12%	820	83%	174	17%	
Other ethnicities ^{^^^}	610	11%	505	84%	105	16%	
Urban Setting							
No	4161	85%	3582	87%	579	13%	0.38
Yes	780	15%	681	88%	99	12%	
District^{^^^^}							
							<0.01*

Frequency (n) values are unweighted, while percent values and p-values are weighted according to the survey's complex sampling design

*p<0.05

[^]Cross-tabulated weighted percent values are calculated within rows

^{^^}Age in months, maternal age, and age difference between mother and partner are presented in Table 1 and 2 as categorical to facilitate cross-tabulations, but were included in regression models as continuous variables

^{^^^}Other ethnicities include Muslim, Malay, Indian Tamil, Burgher, and other

^{^^^^}A full list of districts is omitted due to length (see Appendix Table 1)

Table 9. District of residence of youngest singleton-birth children under 5 years old of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module by stunting

Characteristic	Stunting						Chi-squared p-value
	Total		No		Yes		
	n	%	n	% [^]	n	% [^]	
District							
<i>Distal to Conflict</i>							
Colombo	366	10%	313	86%	53	14%	<0.01*
Galle	226	5%	204	90%	22	10%	
Gampaha	367	11%	336	89%	31	11%	
Kalutara	226	6%	201	89%	25	11%	
Kandy	299	7%	235	79%	64	21%	
Kegalle	165	4%	139	83%	26	17%	
Kurunegala	386	8%	331	86%	55	14%	
Matara	208	4%	185	89%	23	11%	
Nuwara Eliya	169	3%	121	72%	48	28%	
Ratnapura	278	6%	249	90%	29	10%	
<i>Proximal to Conflict</i>							
Badulla	216	5%	189	88%	27	12%	
Anuradhapura	160	4%	127	80%	33	20%	
Hambantota	142	3%	129	91%	13	9%	
Matale	109	2%	94	89%	15	11%	
Monaragala	164	3%	148	89%	16	11%	
Polonnaruwa	143	2%	130	92%	13	8%	
Puttalam	187	4%	171	91%	16	9%	
<i>Central to Conflict</i>							
Jaffna	227	4%	190	83%	37	17%	
Ampara	158	3%	139	87%	19	13%	
Batticaloa	126	2%	115	92%	11	8%	
Kilinochchi	116	0%	93	80%	23	20%	
Mannar	138	0%	113	81%	25	19%	
Mullaitivu	99	0%	86	87%	13	13%	
Trincomalee	145	2%	124	86%	21	14%	
Vavuniya	121	1%	101	86%	20	14%	

Frequency (n) values are unweighted, while percent values and p-values are weighted according to the survey's complex sampling design

* $p < 0.05$

[^]cross-tabulated weighted percent values are calculated within rows.

Table 10. Logistic regression comparing stunting to no stunting among youngest singleton-birth children under 5 years old of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module (N=4,941)

Variables of interest	Stunting (compared to no stunting)					
	Unadjusted OR			Adjusted OR [^]		
	OR	95% CI	p-value	aOR	95% CI	p-value
Independent Variables						
Maternal Child Marriage						
No	ref	ref	ref	ref	ref	ref
Yes	1.21	0.96, 1.52	0.11	0.95	0.70, 1.28	0.73
Maternal Past Year Sexual IPV						
No	ref	ref	ref	ref	ref	ref
Yes	1.63	0.94, 2.81	0.08	1.17	0.64, 2.14	0.60
Maternal Past Year Physical IPV						
No	ref	ref	ref	ref	ref	ref
Yes	1.29	0.96, 1.72	0.09	0.95	0.67, 1.34	0.76
Maternal Past Year Emotional IPV						
No	ref	ref	ref	ref	ref	ref
Yes	1.26	0.98, 1.61	0.07	1.04	0.76, 1.42	0.80
Potential Moderator						
Proximity to Conflict						
Distal	ref	ref	ref	ref	ref	ref
Proximal	0.81	0.66, 1.00	0.05	0.43	0.22, 0.82	0.01*
Central	1.04	0.84, 1.29	0.71	0.53	0.29, 0.98	0.04*

OR=Odds ratio, aOR=adjusted Odds ratio, CI = Confidence Interval

* $p < 0.05$

[^]Multivariate model included as covariates age in months, birth order, maternal height, maternal age, maternal education, household wealth quintile, ethnicity, and district.

Table 11. Interaction effects of proximity to conflict on associations between maternal child marriage, past year IPV and stunting among youngest singleton-birth children under 5 years old of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module (N=4,941)

Interaction term	Stunting (compared to no stunting)		
	aOR	95% CI	p-value
Proximity to Conflict*Child Marriage Interaction			
Proximal*Child Marriage	0.96	0.51, 1.81	0.90
Central*Child Marriage	1.20	0.63, 2.29	0.58
Proximity to Conflict*Sexual IPV Interaction			
Proximal*Past Year Sexual IPV	0.56	0.09, 3.39	0.58
Central*Past Year Sexual IPV	0.15	0.04, 0.53	<0.01*
Proximity to Conflict*Physical IPV Interaction			
Proximal*Past Year Physical IPV	1.14	0.43, 3.02	0.78
Central*Past Year Physical IPV	1.32	0.61, 2.84	0.48
Proximity to Conflict*Emotional IPV Interaction			
Proximal*Past Year Emotional IPV	0.41	0.15, 1.11	0.08
Central*Past Year Emotional IPV	1.78	0.91, 3.47	0.09

aOR=adjusted odds ratio, CI = confidence interval

**p<0.05*

^Multivariate model included maternal child marriage, maternal past year sexual, emotional, and physical IPV, and proximity to conflict, as well the following covariates: age in months, birth order, maternal height, maternal age, maternal education, household wealth quintile, ethnicity, and district.

Table 12. Stratified logistic regressions across proximity to conflict comparing odds of stunting to no stunting among youngest singleton-birth children under 5 years old of currently partnered women age 18-49 who participated in the 2016 Sri Lanka DHS Domestic Violence module (N=4,941)

Proximity to Conflict	Stunting (compared to no stunting)								
	Distal (n=2,690)			Proximal (n=1,121)			Central (n=1,130)		
Variable	aOR	95% CI	P-value	aOR	95% CI	P-value	aOR	95% CI	P-value
Maternal Past Year Sexual IPV									
No	ref	ref	ref	ref	ref	ref	ref	ref	ref
Yes	2.71	1.16, 6.35	0.02*	1.42	0.30, 6.73	0.66	0.48	0.19, 1.23	0.13
Maternal Past Year Emotional IPV									
No	ref	ref	ref	ref	ref	ref	ref	ref	ref
Yes	0.90	0.59, 1.36	0.61	0.42	0.18, 0.96	0.04*	1.80	1.13, 2.89	0.01*

aOR = adjusted odds ratio, CI = confidence interval

*: $p < 0.05$

Multivariate models included as covariates age in months, birth order, maternal height, maternal age, maternal education, household wealth quintile, ethnicity, and district. Models did not include maternal child marriage or maternal past year physical IPV, due to lack of interaction with proximity to conflict.