

Mediating effects of inequitable gender norms on intimate partner violence and contraceptive use in a cluster randomized control trial in Niger

Sabrina C. Boyce^{*,1} (b), Alexandra M. Minnis² (b), Julianna Deardorff¹ (b), Sandra I. McCoy³ (b), Dana E. Goin⁴ (b), Sneha Challa⁵ (b),

Nicole E. Johns⁶ (b), Sani Aliou⁷ (b), Mohamad I. Brooks⁸ (b), Abdoul-Moumouni Nouhou⁹ (b), Holly Baker⁶ (b), Jay G. Silverman⁶ (b)

¹Maternal, Child, and Adolescent Health Program, Division of Community Health Sciences, School of Public Health, University of California, Berkeley, Berkeley, CA 94720, United States

²Women's Global Health Imperative, RTI International, San Francisco, CA 94105, United States

³Division of Epidemiology, School of Public Health, University of California, Berkeley, Berkeley, CA 94720, United States

⁴Division of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY 10032, United States

⁵School of Nursing, University of California, San Francisco, San Francisco CA 94143, United States

⁶Center on Gender Equity and Health, University of California, San Diego, School of Medicine, La Jolla, CA 92093, United States

⁷Niger Country Office, Pathfinder International, Niamey, Niger

⁸Pathfinder International, Watertown, MA 02472, United States

⁹GRADE Africa, Niamey, Niger

*Corresponding author: Sabrina C. Boyce, Community Health Sciences Division, School of Public Health, University of California, Berkeley, 2121 Berkeley Way, Room 6163, Berkeley, CA 94720-7360 (boyce.sabrina@berkeley.edu)

Abstract

Previous research has demonstrated that the Reaching Married Adolescents intervention (RMA) was associated with changes in inequitable gender norms, intimate partner violence (IPV), and modern contraceptive use. This study seeks to understand if changes in inequitable gender norms mediate the RMA intervention's effects on contraceptive use and intimate partner violence (IPV). A 4-arm cluster randomized control trial was conducted to evaluate effects of the RMA intervention (household visits, small groups, combination, control) on married adolescent girls and their husbands in Dosso, Niger (baseline: 1042 dyads; 24 months follow-up: 737 dyads; 2016-2019). Mediation was assessed using inverse odds ratio weighting. In the small group intervention, of the total effect on IPV prevalence (8% reduction), indirect effects via inequitable gender norms are associated with a 2% decrease (95% CI, -0.07 to 0.12) and direct effects with a 6% decrease (95% CI, -0.20 to -0.02). For household visits, of the total effect on contraceptive use (20% increase), the indirect effect accounts for an 11% decrease (95% CI, -0.18 to -0.01) and direct effect, a 32% increase (95% CI, 0.13-0.44); this is similar to findings for the combination arm. This experimental evidence informs the value of changing underlying social norms to reduce IPV and increase contraception use.

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Key words: mediation analysis; Sub-Saharan Africa; gender norms; intimate partner violence; contraceptive use; married adolescents.

Introduction

Gender norms, a subset of social norms that constitute the unwritten rules that govern gender-related roles and behavior and that are understood through social norms theory, the theory of gender and power, and feminist theory, are upstream, culturally bound determinants of many health behaviors, including those related to intimate partner violence (IPV), HIV, and reproductive health.¹⁻⁶ Various conceptual frameworks position gender norms as central to improving IPV and reproductive health.^{4,7,8} The World Health Organization, building on the work of Gupta et al.⁹ has endorsed the efficacy of improving gender equality and health via "gender transformative" interventions, programs that view gender role expectations as a set of social norms that are modifiable and can facilitate improvements in IPV and reproductive

health.^{10,11} The development of such public health interventions addressing gender norms are gaining momentum in low- and middle-income countries (LMICs), but there remain critical gaps in the evidence about the importance of and how to change these norms to improve health.⁷ These gaps leave in question whether investing in expensive, long-term interventions aimed at uprooting inequitable gender norms should be prioritized for reducing IPV and improving reproductive health.

Randomized evaluations have the potential to produce causal evidence to clarify whether gender transformative interventions successfully change gender norms and whether changes in these norms are a mechanism through which health outcomes are achieved. Very few evaluations of gender norms-focused interventions, however, provide evidence of the direct link between

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programming and normative change as a determinant of health behavior change.^{1,12,13} Measurement of effects on gender norms is nascent and is measured as perceptions of what peers do (descriptive norms) and what peers think is acceptable (injunctive norms).¹ Correlational evidence suggests associations of gender norms with IPV and reproductive health14-16 and experimental evidence has demonstrated positive effects on either gender norms or health outcomes in LMIC,¹⁷⁻²³ but few studies have assessed if changes in gender norms as a result of an intervention improved these health outcomes. Moreover, no identified randomized evaluations of gender norm-focused interventions in LMIC have assessed for mechanistic effects to show health improvements occurring via change in the targeted gender norms. If, however, such evidence existed, this could affirm theoretical assumptions and justify prioritizing investment in such interventions, particularly in resource-limited contexts.^{5,24}

This study provides an opportunity to understand whether change in gender norms is a mechanism through which the Reaching Married Adolescents in Niger (RMA) intervention improved health among married adolescents and their husbands. The RMA intervention had two main components, household visits and small group discussions, intervention strategies commonly used in LMIC to address IPV and reproductive health.²⁵ The RMA intervention was evaluated using a 4-arm factorial cluster randomized control trial in Niger. Previous work has demonstrated evidence of an effect of the RMA household visit intervention on inequitable gender norms and modern contraceptive use and of the RMA small group intervention on inequitable gender norms and IPV.^{26,27} This study aims to examine changes in inequitable gender norms as a pathway through which household visits increased modern contraceptive use and small group discussions reduced IPV.

Methods Setting

The study was conducted in a rural region of Niger called Dosso which is composed of 3 districts: Dosso, Doutchi, and Loga. Niger is a high-need setting, ranked 154th of 162 nations on the United Nations (UN) Gender Inequality Index and with some of the highest rates of maternal mortality (509 per 100 000 live births), fertility (6.9 births per woman), and girl child marriage (76% of girls) in the world.²⁸⁻³¹

Intervention

The RMA intervention is a gender-synchronized (ie, concurrently delivered to husbands and wives), community health worker (CHW) intervention developed by Pathfinder International and implemented from 2017-2019. Male and female CHWs were trained to facilitate individual-level household visits (delivered monthly to husbands and wives separately) and single-sex small group discussions (delivered twice per month for wives and monthly for husbands) that provided information about and access to a range of family planning methods and focused on the benefits of healthy birth spacing³² (Appendix S1).

Study design and sample Study design

A 4-arm cluster randomized control trial (cRCT) was conducted to evaluate the effects of the individual and combined intervention components. The 4 arms included individual household visits (Arm 1), small group discussions (Arm 2), both household visits and small group discussions (combination; Arm 3), and control (Arm 4), with all intervention arms also receiving community dialogues. Each district (Dosso, Doutchi, Loga) was randomly assigned one of 3 treatment conditions (stage 1 of randomization; 1:1:1). Within each district, 16 eligible villages were randomly selected for inclusion in the study; 12 were randomly assigned to receive the designated treatment condition for that district and 4 to control (stage 2 of randomization; 1:1:1:1). Within each village, 25 of the enumerated households were randomly selected for recruitment. Baseline data were collected May through July 2016 (T1), and the same households were revisited at 24 months (April through June 2018; T2) after 12 months of intervention implementation (April 2017-February 2018; Appendix S1).

Study protocols were approved by the ethics review boards of the University of California San Diego School of Medicine and the Niger Ministry of Health.

Sample

At T1, 1351 eligible husband-wife dyads were invited to participate in the research. Surveys were collected from 1072 adolescent wives (79.3% female participation), 968 of whom also provided data at T2 (90.3% female retention), and from 1080 husbands (79.9% male participation), of whom 773 provided data at T2 (71.6% male retention). We previously reported baseline imbalances across study arms²⁷ (Appendix S1). In the retained sample (n = 773), 70.9% of husbands in Arm 1, 64.4% in Arm 2, and 75.7% in Arm 3 participated in at least one program element.²⁷

Measurements

Outcomes

Outcomes were measured at T2. Current modern contraceptive use was reported by wives and measured as an affirmative response to currently using an intrauterine device, injectable, implant, contraceptive pill, male condom, female condom, emergency contraception, and/or lactational amenorrhea (LAM) to delay or limit their number of pregnancies. Intimate partner violence, physical and/or sexual violence from husbands, in the past 12 months was also reported by wives and measured using 8 items from the Demographic Health Survey (DHS).³³ An affirmative response by wives to one or more items was dichotomously categorized as having experienced past 12month IPV.

Mediator

Social norms regarding gender equity were measured with husbands at T2 using a novel adaptation of the Gender Equitable Men Scale (GEMS), a validated scale to assess individual attitudes about gender that has been used in over 20 countries.³⁴ This adaptation measures second order beliefs social norms by using the question stem, "People in your community think that . . . " before asking about 5 scenarios from the original GEM scale: (1) " . . . a woman's most important role is to take care of the home and cook for the family"; (2) " . . . a man should have the final word about decisions in the home"; (3) " . . . there are times when a woman deserves to be beaten"; (4) " . . . a woman should never question her husband's decisions even if she disagrees with them"; (5) "... it is natural and right that men have more power than women in the family." Response options were coded dichotomously as 1 if "agree" or "somewhat agree" and 0 if "disagree", and missing for "don't know"/"decline to answer". Response values were summed across all items to create a score (Cronbach's $\alpha = 0.62$, range: 0-5; 5 = some or full agreement with all items). Using a median split approach, we dichotomized scores as 5 (high inequitable gender norms) vs less than 5 (lower inequitable gender norms).

Social norms were measured contemporaneously with outcomes. Because no data were collected between T1 and T2, temporality was preserved between the exposure and the mediator but not between the mediator and outcomes.

Covariates

Covariates were included in all analytic models to control for factors hypothesized to be associated with both study arm assignment and the dependent variable, based on theory and content expertise. Among the factors considered for inclusion were sociodemographic factors found to be imbalanced across arms at baseline (assessed via univariate multinomial regression that accounted for clustering, P < .05). For the total effect and natural direct and indirect effects models, covariates hypothesized to be associated with study arm assignment and outcomes (modern contraceptive use, IPV) were included: district, wife age, husband and wife education (modern, Quranic, or no education), husband migration for 3 or more months in the previous year (yes, no), and total household assets (Figure 1). Total household assets were assessed as a count of 6 household items, a measure of wealth used by the Niger DHS.³³ In the model used to develop mediation weights, we included covariates hypothesized to be associated with study arm assignment and the mediator: husband and wife education, husband migration, and total household assets.²⁷ In the model used to develop inverse probability of censoring weights to account for loss-to-follow-up, sociodemographic variables associated with loss-to-follow-up for husband-wife dyadic pairs (assessed via t tests for continuous variables and Fisher's exact for categorical variables, P < .10) were included: husband current age, husband and wife ages at marriage, husband and wife parity, wife education, and husband migration.

Statistical analysis Main effects

Previously reported results provide evidence that receipt of the RMA household visits (Arm 1) and combination (Arm 3) were associated with an increase in current modern contraceptive use, and receipt of the RMA small group visit (Arm 2) was associated with a decrease in IPV.²⁶ Therefore, in this analysis, only results of the mediation analyses for Arm 1 and 3 will be reported for the contraceptive use outcome and those of Arm 2 for the IPV outcome. Total effects for each outcome were assessed using an intention-to-treat approach and a difference-in-differences (DID) estimator to further account for baseline imbalances across study arms. A mixed-effects linear probability model was utilized to estimate prevalence differences with clustering at the village level and to account for multiple observations on each couple. Inverse probability of censoring weights (IPCW) were included to reduce selection bias related to couple loss-to-follow-up, though this data-based method likely only partially accounts for this source of sampling bias.³⁵ For this analysis, we utilized linear models to estimate prevalence differences to accommodate the linear parallel trend assumption of the DID estimator, which is sensitive to functional form, $^{\rm 36,37}$ rather than the incidence rate ratios estimated in the original report.²⁶

Mediation

Previously, we reported that assignment to the RMA small group intervention was associated with a reduction in perceived inequitable gender norms (mediator), the household visits with a modest increase in perceived inequitable gender norms, and no effect for the combination arm.²⁷ For this analysis, we assessed the relationship between inequitable gender norms (mediator)

and each primary outcome, using a linear mixed effects model to estimate prevalence differences.

To estimate natural direct and indirect effects via these gender norms, we utilized inverse odds ratio weighting (IORW).^{38,39} First, we estimated the natural direct effect, which is the pathway between the RMA intervention and outcome that does not include the mediator. Using the IORW approach, which utilizes the invariance property of the odds ratio, we estimated the odds of being included in each study arm based on the mediator and potential confounders of the exposure-mediator relationship using a multinomial regression model that included inverse probability of censoring weights.⁴⁰ The inverse of the predicted probabilities from this model were used to create stabilized mediation weights, which were included in the total effects model to estimate the natural direct effect by blocking the indirect pathway between the RMA intervention and gender norms.

Natural indirect effects estimate the hypothesized pathway between the RMA intervention and outcome that travels through inequitable gender norms. The natural indirect effect is calculated by subtracting the natural direct effect estimate from that of the total effect. The nonparametric bootstrap accounting for village-level clustering was used to calculate 95% Wald-type confidence intervals for all effect estimates (n = 1000). The mediation proportion is calculated by dividing the natural indirect effect by the sum of the natural direct and indirect effect.⁴¹ All analyses were conducted using RStudio, version 2022.02.1 build 461.⁴²

Results

Sociodemographic characteristics of the husband-wife dyads are presented in Table 1. For this analysis, 1042 husband-wife dyads were included from T1 and 737 husband-wife dyads from T2. At baseline, husbands were 25.6 years and wives were 17.3 years on average. Husbands reported having 1.5 children, while adolescent wives reported 1.0 (difference related to polygamous marriages, 13% of husbands). Among husbands, 45.2% perceived high levels of gender inequitable social norms at T1 and 37.9% at T2. In the overall sample, 8.7% of married adolescent girls reported experiencing IPV from their husbands in the past 12 months at T1 and 9.7% at T2. Additionally, 11.8% reported currently using a form of modern contraceptive at T1 and 38.3% at T2.

See Appendix S2 for baseline imbalances of outcomes across study arms and baseline characteristics associated with couple retention at T2.

Main effects

For the IPV outcome, estimates of the total effect of the RMA intervention indicate that assignment to the small group intervention (Arm 2) is associated with an 8% reduction in IPV prevalence (aPD: -0.08, 95% CI, -0.18 to 0.01; Table 2), relative to the control arm (Arm 4). For modern contraceptive use, the total effect of the household visits (Arm 1) is a 20% increase in use (aPD 0.20, 95% CI, 0.03-0.36) and of the combination (Arm 3) an 19% increase in use (aPD 0.19, 95% CI, 0.07-0.34), relative to the control arm (Arm 4; Table 2).

Associations between inequitable gender norms and main outcomes

The effects of each intervention arm on inequitable gender norms, the first stage of the mediation pathway, have been previously reported; the small group intervention was associated with a reduction in inequitable gender norms, household visits with a Small Group (Arm 2) Intervention Model



Figure 1. Hypothesized mediation pathway between the reaching married adolescents in Niger (RMA) intervention, gender inequitable social norms, and two outcomes, intimate partner violence (IPV) and modern contraceptive use (Dosso, Niger; 2016-2019).

moderate increase in inequitable gender norms, and the combination arm was not associated with these norms,²⁷ relative to the control arm. The second stage of the mediation pathway is the relationship between inequitable gender norms and the main outcomes, contraceptive use and IPV. Among husbands who perceived high inequitable gender norms, the prevalence of IPV victimization among their wives is 5% higher (aPD: 0.05, 95% CI, -0.002 to 0.09), and the prevalence of modern contraceptive

Table 1. Baseline covariates and husband perceived social norms (T2) by past 12-month intimate partner violence and current modern contraceptive use (T2) among husbands of married adolescent girls in Niger (Dosso, Niger; 2016-2019).

	Overall	Intimate partner violence (Past 12 months; T2)ª		Current modern contraceptive use (T2) ^a	
	(n = 1042)	Yes (n = 92)	No (n = 825)	Yes (n = 301)	No (n = 496)
Study arm, %					
Household visits (Arm 1)	279 (26.8)	23 (25.0)	223 (27.0)	81 (26.9)	129 (26.0)
Small groups (Arm 2)	247 (23.7)	16 (17.4)	199 (24.1)	75 (24.9)	112 (22.6)
Combination (Arm 3)	256 (24.6)	26 (28.3)	201 (24.4)	85 (28.2)	118 (23.8)
Control	260 (25.0)	27 (29.3)	202 (24.5)	60 (19.9)	137 (27.6)
District, %					
Dosso	342 (32.8)	35 (38.0)	269 (32.6)	100 (33.2)	170 (34.3)
Doutchi	335 (32.1)	26 (28.3)	268 (32.5)	96 (31.9)	157 (31.7)
Loga	365 (35.0)	31 (33.7)	288 (34.9)	105 (34.9)	169 (34.1)
Baseline covariates	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Husband age	25.6 (5.4)	25.2 (5.0)	25.7 (5.4)	26.2 (5.6)	25.4 (5.2)
Husband age at marriage	22.5 (5.0)	22.5 (4.7)	22.4 (5.0)	22.8 (5.3)	22.3 (4.8)
Husband parity	1.5 (2.0)	1.4 (2.1)	1.5 (2.0)	1.7 (2.1)	1.3 (2.0)
Husband education, %					
Any modern	502 (48.5)	45 (48.9)	396 (48.4)	170 (57.0)	222 (45.0)
Quaranic only	215 (20.8)	20 (21.7)	174 (21.3)	49 (16.4)	111 (22.5)
No schooling	318 (30.7)	27 (29.3)	248 (30.3)	79 (26.5)	160 (32.5)
Husband migration for > 3 months, %	722 (69.8)	67 (73.6)	560 (68.4)	193 (64.8)	356 (72.2)
Wife age	17.3 (1.5)	17.4 (1.4)	17.3 (1.6)	17.4 (1.5)	17.2 (1.6)
Wife age at marriage	14.2 (1.9)	14.5 (1.9)	14.1 (1.9)	14.1 (1.8)	14.2 (1.9)
Wife parity	1.0 (1.0)	0.9 (0.9)	1.0 (1.0)	1.1 (1.0)	0.9 (1.0)
Wife education, %					
Any modern	364 (35.1)	46 (50.0)	275 (33.6)	137 (45.7)	150 (30.4)
Quaranic only	171 (16.5)	15 (16.3)	142 (17.3)	36 (12.0)	96 (19.5)
No schooling	501 (48.4)	31 (33.7)	402 (49.1)	127 (42.3)	247 (50.1)
Total household assets	2.1 (1.2)	2.0 (1.1)	2.1 (1.2)	2.0 (1.2)	2.1 (1.2)
Mediator	n, %	n, %	n, %	n, %	n, %
High perceived inequitable gender norms					
T1 (n = 1042)	460 (45.2)	48 (53.3)	359 (44.5)	127 (42.8)	229 (47.6)
T2 ($n = 737$)	275 (37.9)	36 (46.8)	231 (37.4)	81 (32.4)	151 (42.3)

Abbreviations: T1, baseline; T2, 24-month follow-up; SD, standard deviation.

^aIntimate partner violence and modern contraceptive use based on wife reports at T2.

use among their wives is 7% lower (aPD: -0.07; 95% CI, -0.14 to 0.01) than among husbands who perceived lower levels of inequitable norms.

Mediation effects

The mediation pathway through gender inequitable social norms appears to have contributed to the observed association between

Table 2. Estimated total, natural direct, and indirect effects^a of the reaching married adolescents in Niger intervention on past 12-months intimate partner violence and current modern contractive use via perceived inequitable gender norms among husbands of married adolescents (Dosso, Niger; 2016-2019).

	Total effect		Natural direct effect		Natural indirect effect	
	aPD ^b	95% CI ^c	aPD ^b	95% CI ^c	aPD ^b	95% CI ^c
Intimate partner violence (past 1	2-months; n = 73	37 couples)				
Arm 2: Small groups ^d	-0.08	-0.18 to 0.01	-0.06	-0.20 to -0.02	-0.02	-0.07 to 0.12
Current modern contractive use	(n = 646 couples)					
Arm 1: Household visits ^d Arm 3: Combined ^d	0.20 0.19	0.03-0.36 0.07-0.34	0.32 0.28	0.13-0.44 0.12-0.46	-0.11 -0.09	-0.18 to -0.01 -0.20 to 0.02

Abbreviations: aPD, adjusted prevalence difference; CI, confidence interval ^aNatural direct and indirect effects were estimated using inverse odds ratio weighting (Tchetgen, Tchetgen 2013). ^baPD estimated using a mixed effects difference-in-difference linear regression with inverse probability of censoring weights and adjusting for household assets, husband education, wife education, and husband migration with clustering based on village and multiple observations.

^cWald-type 95% CI estimated using nonparametric bootstrap with 1000 repetitions.

^dOnly arms for which significant effects on main outcomes were detected were included in this table and in mediation analyses. Reference group is couples in the control arm.

the small group RMA intervention and reductions in IPV prevalence (Table 2). Specifically, the estimated natural direct effect of the RMA intervention on IPV is a 6% reduction in IPV (95% CI, -0.20 to -0.02). The estimated natural indirect effect of the RMA intervention via inequitable gender norms is a 2% reduction (95% CI, -0.07 to 0.12) in IPV. This indirect effect suggests that 22.3% of the total effect between the RMA small group intervention and reduced prevalence of IPV is explained by a reduction in inequitable gender norms, though this proportion-mediated estimate is likely unstable due to small effect sizes.

In both household and combination arms of the study, the natural direct pathways appear to fully account for the total effects on contraceptive use. For the household visits, the estimated natural direct effect is a 32% increase (95% CI, 0.13-0.44) in current contraceptive use, 60% higher than the total effect. The estimated natural indirect effect via gender inequitable norms is an 11% decrease in contraceptive use (95% CI, -0.18 to -0.01), suggesting that this pathway may have reduced the total effects of this intervention on contraceptive use (Table 2). Similarly in the combination intervention, the estimated natural direct effect is a 28% increase (95% CI, 0.12-0.46), 47% higher than the total effect for this arm, and the estimated natural indirect effect via gender inequitable norms is a 9% decrease (95% CI, -0.20 to 0.02) in contraceptive use (Table 2).

Discussion

This study examined the mechanistic role of inequitable gender norms on the observed total effects of the RMA intervention components on reductions in IPV and increases in current modern contraceptive use using data from a cRCT in Niger. Silverman et al previously reported the estimated main effects of each RMA component on these outcomes, and Boyce et al on the estimated effects of RMA components on inequitable gender norms.^{26,27} This study extends this line of inquiry by providing evidence that reductions in perceived inequitable gender norms may account for a small portion of the 8% reductions in IPV prevalence associated with assignment to the small groups RMA intervention. While the total effect size is weak in these linear models (used in this analysis to align with assumptions of the DID models) but strong in the relative risk estimates previously published, the estimated indirect effects suggest that husbands' perceptions of inequitable gender norms may be an important part of the causal pathway between the small group intervention and IPV perpetration among husbands, but this estimate is imprecise. These results provide some evidence to support theoretical understanding of how social norms underly IPV behavior^{7,8} and suggest that small groups provided a social environment in which husbands could critically discuss gender role expectations with their peers, which may have shifted their perception of gender norms in a positive direction and influenced their decision to use violence toward their wife.

These findings also affirm the importance of husbands' perceived gender norms in shaping contraceptive use in this study; increases in inequitable gender norms may have decreased contraceptive use. Previous results suggest that the household intervention slightly increased perceived inequitable gender norms among husbands, the combined intervention was not associated with changes in gender norms, and both arms increased modern contraceptive use.^{26,27} In the current study, in both the household and combined arms, the estimated natural direct effects were stronger than the total effects on contraceptive use, suggesting gains in contraceptive use were attributable to other mechanisms. Moreover, for the household arm, increases in equitable gender norms appear to have diminished what would have otherwise been larger increases in contraceptive use. The household visit intervention provided little opportunity for husbands to observe change within their peers around issues of gender norms and likely affirmed husband participation in contraceptive decisionmaking, and as a result, may have reinforced gender inequitable norms and male-dominated contraceptive decision-making.

To our knowledge, this study is one of the first to provide rigorous evidence from a cRCT suggesting gender norms change was one of the mechanisms behind reductions in IPV. SASA!, a social norms-shifting intervention that reduced IPV and HIV in Uganda, is one of very few interventions with evidence from a cRCT of both improving gender norms (measured by aggregating individual attitudes at the community level, a proxy of social norms) and health outcomes.21,43 Similarly, Program H implemented in India demonstrated positive shifts in gender equity and IPV perpetration in a quasi-experimental trial.44 Neither of these studies, however, assessed for mediating effects of these social norms. In contrast, the Tostan model in Senegal both improved social norms and reduced female genital cutting (FGC), and while quasi-experimental evidence suggests messaging diffused through social networks, the final evaluation did not support the hypothesis that changes in social norms drove reductions in FGC.²⁰ The present study contributes experimental evidence that the small group RMA intervention may have reduced IPV partially via decreasing perceived inequitable gender norms.^{26,27} These results help open the "black box" around how the RMA small group intervention may influence behavior, informing its future use, and provide evidence to support related theoretical frameworks.^{2-4,7,8}

These findings also raise important questions about the other mechanisms through which the RMA intervention components decreased IPV and increased contraceptive use. Because changes in these norms did not contribute to the observed increase in contraceptive use and only partially explain decreases in IPV, other mechanisms likely contribute to the interventions' impact. The measurement of gender inequitable norms included in this study likely represents just one "slice" of the set of behavioral expectations that contextualize and inform IPV and contraceptive-related behavioral decision-making. Broader measurement of gender norms related to these behaviors might provide a more complete understanding of the mechanistic effects of gender norms, particularly for contraceptive use. It may also be that increases in contraceptive use are driven more by individual- and/or community-level acceptance of modern contraceptive use. Using data from this cRCT, Challa et al. found that assignment to the RMA intervention (all study arms were collapsed into one) was associated with increases in spousal communication about contraceptive use and that spousal communication may be a mechanism behind increases in contraceptive use.⁴⁵ Extensions of this line of inquiry by Challa et al. that explores mechanistic effects by intervention arm could further clarify spousal communication as a mechanism of contraceptive use increases.

These results should be considered in light of several limitations. First, measurement of gender norms is an emerging field. The scale used in this study is new, has no standard for dichotomization, shows modest reliability ($\alpha = 0.62$), and therefore may have introduced measurement bias. We hypothesize that our decision rule for dichotomizing the scale at 5 vs <5 could have led to a weaker association between the exposure and mediator

and a stronger association between the mediator and outcome than had we dichotomized at a lower value or had we left the scale as continuous. Yet, as one of few scales measuring gender norms, rather than simply aggregating individual attitudes, it contributes to this nascent area of scientific research.¹ Second, there is a lack of precision in the effect estimates and limited power to detect natural indirect effects, particularly for IPV. This is due in part to the use of a linear model with these binary outcomes to accommodate the DID estimator. Additionally, the IORW approach to mediation is known to provide less precise estimates than parametric approaches yet was chosen because of its model flexibility.40 Third, temporality cannot be established between mediator and outcomes in this analysis because they were assessed at the same time point. Finally, this mediation analyses assumes no uncontrolled confounding between (1) the exposure and outcome, (2) the exposure and mediator, and (3) the mediator and outcome. Verifying and upholding these assumptions is difficult in most mediation analysis, including this one. While the exposure assignment was randomized, baseline imbalances across study arms were detected. Sociodemographic imbalances at baseline were controlled for in models, and a DID estimator was used, but it is possible there remains uncontrolled confounding related to the exposure. Uncontrolled confounding between the mediator and outcome is of particular concern, given concurrent measurement, including any confounding factors that are affected by the exposure.⁴⁰

Conclusion

This study is among the first cluster RCTs implemented in a LMIC that provides evidence suggesting inequitable gender norms on the causal pathway to reductions in IPV. Furthermore, this study offers critical evidence to support theoretical hypotheses that reductions in inequitable gender norms are a potential mechanism behind interventions that reduce risk for IPV. In particular, these results provide a window into one way that the RMA intervention may have achieved reductions in IPV in the small group arm by reducing perceived inequitable gender norms among husbands of adolescent wives. Further mechanistic research is needed to understand other mechanisms that contributed to reductions in IPV in the small groups and how the household visits and combination arms increased modern contraceptive use among married adolescent girls and their husbands, despite negligible changes in inequitable gender norms. Continued research is needed to understand how men can be engaged in efforts to improve equity in gender norms in order to improve IPV and modern contraceptive use, as well as a wide range of other gender equity-related health outcomes.

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Supplementary material

Supplementary material is available at American Journal of Epidemiology online.

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Conflict of interest

The authors declare no conflicts of interest.

Data availability

Deidentified data will be made available upon reasonable request.

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