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ORIGINAL PAPER

The effect of intimate partner violence on women's mental distress: a prospective cohort study of 3010 rural Indian women

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Abstract

Purpose Intimate partner violence (IPV) encompasses physical, sexual, and psychological abuse, as well as controlling behavior. Most research focuses on physical and sexual abuse, and other aspects of IPV are rarely investigated. We estimated the effect of these neglected aspects of IPV on women's mental distress.

Methods We used data from 3010 women living in rural tribal communities in Rajasthan, India. Women completed baseline interviews and were re-interviewed approximately 1.5 years later. We measured IPV with questions adopted from the Demographic and Health Survey's Domestic Violence Module, which asked seven questions about physical abuse, three questions about psychological abuse, and five questions about partner controlling behavior. Mental distress was measured with the 12-item General Health Questionnaire (score range 0–12). We used Poisson regression models to estimate the relation between changes in IPV and mental distress, accounting for time-fixed characteristics of individuals using individual fixed effects.

Results Women reported an average of 2.1 distress symptoms during baseline interviews. In models that controlled for time-varying confounding (e.g., wealth, other types of abuse), experiencing psychological abuse was associated with an increase of 0.65 distress symptoms (95% CI 0.32, 0.98), and experiencing controlling behavior was associated with an increase of 0.31 distress symptoms (95% CI 0.18, 0.44). However, experiencing physical abuse was not associated with an increase in distress symptoms (mean difference = − 0.15, 95% CI − 0.45, 0.15).

Conclusions Psychological abuse and controlling behavior may be important drivers of the relation between IPV and women's mental health.

Keywords Intimate partner violence · Controlling behavior · Psychological abuse · Mental distress · India

Introduction

Intimate partner violence (IPV) is "any behavior within an intimate relationship that causes physical, psychological or sexual harm to those in the relationship" and encompasses various types of abuse (physical, sexual, psychological) and controlling behavior by an intimate partner [1]. IPV is a serious public health concern. Worldwide, approximately 30% of women over the age of 15 experience physical or sexual abuse by an intimate partner during their lifetime [2], and a population-based study of ever-partnered women from 10 countries found that—depending on country—between 20 and 70% of women had experienced psychological abuse and between 21 and 90% had experienced partner controlling behavior [3]. Physical and sexual abuse by an intimate partner, the most commonly investigated aspects of IPV [2], are consistently associated with worse mental health, including symptoms of depression, post-traumatic stress, anxiety, and attempted suicide [4–6].

The majority of IPV research has focused on physical abuse, either alone or in combination with other types of abuse, and other aspects of abuse are less commonly investigated [4, 7]. Psychological abuse (e.g., threatening to harm,

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insulting or belittling) and partner controlling behavior (e.g., restricting access to friends and family, monitoring movements) might be important, yet neglected aspects of IPV. Psychological abuse might erode women's self-esteem [8] and self-efficacy [9], and controlling behavior could reduce women's social support—an important buffer of various life stressors such as IPV [10, 11]—through reduced contact with neighbours, friends, and family members. Reductions in self-esteem, self-efficacy, and social support could contribute to poor mental health [9, 12].

Although psychological abuse and partner controlling behavior could have important implications for mental health, the effect of these forms of abuse is not well known. Research originating from primarily high-income settings reports cross-sectional associations between psychological abuse and adverse mental health outcomes, including post-traumatic stress disorder [13, 14], depressive symptoms [13–15], and suicidality [14]. Evidence from lower-income settings remains scarce [16], although cross-sectional evidence indicates psychological abuse is associated with mental distress [16], poor mental health [17], and suicide attempts [17], and a recent longitudinal study found an association between psychological abuse and depressive symptoms [18]. However, we are not aware of research investigating the independent effect of partner controlling behavior on women's mental health in either a high or lower-income setting. Within India, population-based surveys indicate that psychological abuse is common and about half of married Indian women experience partner controlling behavior [19]. Thus, these common forms of abuse could be important contributors to women's mental health in India, which is an unexplored area of research.

Our study helps address this knowledge gap. We estimated the longitudinal association between women's exposure to physical abuse, psychological abuse, and partner controlling behavior and changes in mental distress using data collected as part of a randomized controlled trial conducted in rural tribal communities in Rajasthan, India.

Methods

Study population

Our data come from a cluster-randomized controlled trial assessing the impact of access to an affordable daycare program on women and children's health and well-being. The trial was conducted in 160 village hamlets (i.e., clusters of houses that constitute separate communities around a village) in rural Rajasthan, India. We conducted a household census in the 160 hamlets to identify eligible households, namely those with a mother (either biological or guardian) of at least one child between 1 and 6 years old. One eligible woman from each eligible household was randomly selected to participate in the study, and women who agreed to participate underwent an informed consent process. Interviewers conducted structured interviews in women's homes. Interviewers completed training prior to each survey wave, including procedures to address confidentiality issues. Every attempt was made to respect respondents' privacy and administer survey questions soliciting sensitive information with only the interviewer and respondent present. In particular, enumerators were trained to remind respondents of the confidentiality of their responses and to ask anyone who may have been present to leave prior to the last survey section, which included sensitive questions about intimate partner violence. The survey team was roughly 50% female. We did not explicitly offer respondents the choice of their enumerator, but any requests for female interviewers were accommodated. Other survey procedures and quality control measures are available in the trial protocol [20].

A total of 3177 women completed interviews between January and May 2015 (participation rate = 89%). Approximately, 1.5 years later, between June and October 2016, 3042 women were re-interviewed (participation rate = 96%). We restricted our sample to women who were partnered or married at baseline and who completed both baseline and follow-up interviews, which resulted in a final analytic sample size of 3010 women.

The study received ethics approval from the Institutional Review Board of McGill University's Faculty of Medicine and the Human Subjects Committee of the Institute for Financial Management in Chennai, India. The trial protocol is publicly available [20].

Measures

The primary exposure of interest was IPV. Questions pertaining to IPV came from the Demographic and Health Survey's (DHS) Domestic Violence Module [21], which were adopted from the Conflict Tactics Scale (CTS) [22]. The CTS is a reliable and valid way to measure IPV [23]. The DHS Domestic Violence Module included seven questions about women's experiences of physical abuse (e.g., slapped by partner) and three questions about psychological abuse (e.g., partner threatened to hurt you) in the past year. There were five questions about women's experience of a partner's controlling behavior (e.g., partner limits contact with your family), which were not restricted to the past year. Response categories included "not at all", "sometimes", and "often". For each of these three types of abuse, we classified women as experiencing abuse if she answered "sometimes" or "often" to any question in that category. Although the DHS module includes questions about sexual abuse, these questions were not included in our survey because a local

advisory committee suggested that it was not culturally appropriate for interviewers to ask sex-related questions.

The primary outcome was reported symptoms of mental distress. Mental distress was measured with the General Health Questionnaire (GHQ-12) [24], translated into Hindi by Gautam et al. [25]. The GHQ-12 is commonly used to detect mental health problems in India [26–28]. The GHQ-12 includes 12 items about how women have been feeling recently. For example, women were asked, "have you recently been losing confidence in yourself?". Potential responses were "not at all", "no more than usual", "rather more than usual", and "much more than usual". We used a scoring system commonly employed in India [26–29] (i.e., the 0–0-1–1 scoring system) to dichotomize each symptom as occurring more than usual or not. Thus, distress scores could range from 0 to 12, with higher scores denoting greater reported distress.

Interviewers collected information on IPV, mental health, socio-demographic characteristics, and wealth indicators during baseline and follow-up interviews. Socio-demographic variables included age, religion, caste, education, age at marriage, and number of sons and daughters living in the household. Wealth variables included 23 asset-based indicators commonly used to measure wealth in India [19]. Indicators included housing characteristics (i.e., type of toilet facility, material of exterior wall, type of roofing, home electrification, source of drinking water), the number of durables owned (i.e., number of cell phones, watches/clocks, electric stoves, wood stoves, fans, televisions, bikes, motorcycles, wells, grain storage cans, pressure cookers, chairs/stools, beds, silver jewelry, gold jewelry, and wedding ornaments), home ownership, and whether the household had a savings account. We summarized wealth with a polychoric principle component analysis (PCA) [30], which is a common way to measure wealth in low- and middle-income countries (LMICs) [31]. We used a one component PCA that explained 27% of the variance in baseline surveys and 26% of the variance in follow-up interviews.

Analytic approach

Because this randomized trial was not specifically designed to investigate the impact of IPV, some important characteristics of women were not measured. For instance, a recent systematic review identified childhood sexual abuse, childhood trauma, and early life experiences as important confounders of the relation between IPV exposure and mental health [6]. Our goal was to estimate the effect of reporting one of three types of IPV (i.e., controlling behavior, psychological abuse, physical abuse) in the past year on changes in the number of mental distress symptoms. We used a fixed effects approach, which models changes in the exposure and outcome within the same individual, and thus individuals act as their own controls. Using this design, any measured or unmeasured fixed characteristics of individuals (e.g., caste), including past exposures (e.g., childhood sexual abuse), are accounted for [32]. A fixed effects approach can provide a less biased estimate than standard regression adjustment in the presence of unmeasured, time-fixed confounders. However, because a fixed effects approach models changes within individuals over time, this approach does not account for time-varying characteristics of individuals (e.g., wealth) or reverse causation [32].

Analysis

We modeled the relation between changes in IPV and mental distress using Poisson regression [33]. Poisson models assume that the mean and variance are equal, and in adjusted models we found no evidence that this assumption was violated. Unadjusted models controlled for other forms of abuse (e.g., physical, psychological) and adjusted models controlled for measured time-varying confounders, including household wealth, number of sons in the household, and number of daughters in the household. While changes in access to affordable daycare may confound the relation between IPV and mental distress, access to daycare was not a confounder in this study because exposure to daycare was balanced by IPV exposure (in expectation) due to randomization.

We also estimated the effect of being exposed to multiple forms of abuse by including product terms in the regression equation (e.g., physical abuse × controlling behavior). We did not account for losses to follow-up or missing data in our analyses because loss to follow-up was minimal (i.e., 4%) and missing data were rare (i.e., $<4\%$ for any variable). We also estimated these same effects by modeling counts of abuse items as our main exposure (e.g., controlling behaviors: range 0–4). All models were estimated using robust standard errors to account for potential clustering of responses among women within the same hamlet.

Our main effect estimate is the predicted mean difference in the number of mental distress symptoms due to exposure to different forms of abuse. We also estimated the effect of being jointly or triply exposed to multiple types of abuse concurrently (e.g., experiencing both physical and psychological abuse concurrently), and we estimated whether the effect of experiencing multiple types of abuse concurrently was greater than the estimated effect of experiencing these forms of abuse separately (i.e., if there were departures from additivity). We did this by estimating the joint effect (e.g., joint effect of experiencing physical and psychological abuse concurrently) and subtracting the estimated independent effects of experiencing each type of abuse (e.g., independent effect of physical abuse + independent effect of psychological abuse).

Sensitivity analysis

Exposure to the intervention, randomized access to a community-based daycare program, may result in some unmeasured changes that affect the relation between IPV and mental distress. Therefore, in a sensitivity analysis we restricted our sample to women living in village hamlets that were not randomized to the intervention (the control arm).

Results

The majority of women included in this study had no education (74%), were Hindu (96%), and were members of a Scheduled Tribe (94%). Table 1 shows baseline socio-demographic characteristics of women by reported exposure to abuse. There were no major differences between women's reported abuse and most demographic characteristics. However, women who reported no abuse married at a slightly older age and reported a smaller gap in age between them and their husbands. Women who reported no abuse reported fewer distress symptoms (1.6), compared to women reporting controlling behavior (2.4), physical abuse (2.6), or psychological abuse (2.9).

Abuse was common (Table 2). The majority of women reported controlling behavior (60%), and many women reported psychological abuse (33%) or physical abuse (37%). Women frequently experienced multiple forms of abuse concurrently, and the most common pattern of

Table 1 Baseline socio-demographic characteristics by reported abuse, $n=3010$ (Rajasthan, India, 2015)

	Any physical abuse ($n=1120$)	Any psychological abuse ($n=987$)	Any controlling behavior ($n=1764$)	No abuse ($n=896$)
Age (years)	30.2 (6.8)	30.1 (6.9)	29.7 (6.7)	30.2 (6.6)
Ever attended school				
Yes	24%	26%	26%	25%
No	76%	74%	74%	75%
Hindu religion				
Hindu	96%	97%	96%	96%
Muslim	0.3%	0%	0.3%	0.3%
Christian	3%	2%	3%	3%
Sikh	0%	0%	0%	0.1%
No religion	0.5%	0.6%	0.6%	0.3%
Caste				
Scheduled tribe	96%	96%	95%	92%
Scheduled caste	2%	2%	2%	3%
Other backwards caste	1%	0.5%	1%	1%
None of them	2%	2%	3%	4%
Number of boys in household	1.7 (1.2)	1.7 (1.2)	1.6 (1.2)	1.6 (1.2)
Number of girls in household	1.7 (1.3)	1.8 (1.3)	1.6 (1.2)	1.7 (1.3)
Wealth index score	− 0.3 (1.2)	− 0.3 (1.2)	− 0.1 (1.3)	− 0.1 (1.4)
Age at marriage				
15 or younger	7%	7%	7%	6%
15–18	46%	46%	45%	45%
18 or older	47%	47%	48%	50%
Age gap between respondent and husband				
Respondent older	7%	8%	8%	10%
Respondent less than 5 years younger	67%	68%	67%	72%
Respondent more than 5 years younger	25%	24%	26%	19%
Mother-in-law lives in home				
Yes	25%	24%	27%	24%
No	75%	76%	73%	76%
GHQ-12 score (0–12)	2.6 (2.7)	2.9 (2.8)	2.4 (2.5)	1.6 (2.1)

[a]Values are mean (standard deviation) or %

[b]Some women experienced multiple forms of abuse and are therefore represented in multiple abuse categories

Table 2 Baseline intimate partner violence experience, $n=3010$ (Rajasthan, India, 2015)

Variables	Percent (%)
Any controlling behavior	60
Does not trust you with any money	18
Tries to limit your contact with your family	20
Doesn't permit you to meet your female friends	25
Jealous or angry if you talk to other men	40
Insists on knowing where you are	42
Any psychological abuse, past year	33
Threaten to hurt or harm you	16
Insult you	22
Say or do something to humiliate you	28
Any physical abuse, past year	37
Try to choke you or burn you	4
Threaten to or attacked you with a knife, gun, or another weapon	2
Kick, drag, or beat you up	10
Punch you	12
Push, shake, or throw something at you	19
Twist your arm or pull your hair	21
Slap you	31

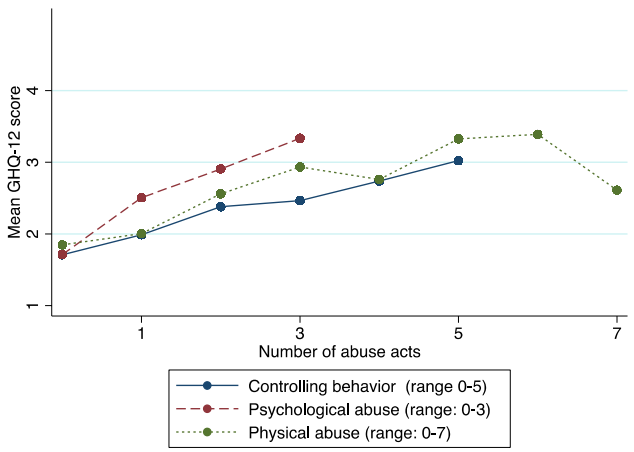

Fig. 1 GHQ-12 score (higher = greater distress) by type and number of abuse acts

multiple abuse was experiencing all three types of abuse concurrently (19%). There was a gradient between the number of abuse items women reported and mental distress score, with women reporting exposure to more abuse having higher mental distress scores (Fig. 1). This pattern was most consistent for psychological abuse and controlling behavior. Among women reporting physical abuse, there was an approximately linear relation between the number of abuse acts and distress for women who reported up to five abuse acts, although among women reporting six or seven abuse acts, the association plateaued.

Over the study period, 37% of women reported a change in physical abuse, 43% reported a change in controlling behavior, and 41% reported a change in psychological abuse. In both unadjusted and adjusted models, changes in experiencing abuse corresponded to a change in mental distress (Table 3). In models that adjusted for time-varying confounders (i.e., household wealth, number of boys in the household, number of girls in the household, other types of abuse), experiencing psychological abuse was associated with an increase of 0.65 distress symptoms (95% CI 0.32, 0.98), which corresponds to a 32% increase (95% CI 16, 49) in symptoms relative to the mean. Experiencing controlling behavior was associated with an increase of 0.31 distress symptoms (95% CI 0.18, 0.44), which corresponds to a 15% increase (95% CI 9, 22) in symptoms relative to the mean number of distress symptoms. However, experiencing physical abuse was not associated with an increase in distress symptoms (adjusted mean difference = − 0.15, 95% CI − 0.45, 0.15; percent decrease = 7%, 95% CI − 22, 7). We also estimated the association between changes in the number of abuse items and changes in mental distress (Appendix 1). This analysis supported similar inference.

The number of distress symptoms reported by women jointly exposed to psychological abuse and controlling behavior was smaller than expected if the exposures acted additively (excess difference due to joint exposure = − 0.46, 95% CI − 0.83, − 0.08). The effect of experiencing both controlling behavior and physical abuse concurrently was associated with a slightly larger than expected effect estimate if the independent effects were additive (excess difference due to concurrent exposure = 0.15, 95% CI − 0.18, 0.49). Exposure to psychological abuse and physical abuse concurrently, and all three types of abuse concurrently, showed no major departures from additivity. A sensitivity analysis restricted to women living in the control arm of the study (Appendix 2) showed similar estimates as those reported in the main analysis (Table 3).

Discussion

Violence against Indian women is exceedingly common. A nationally representative survey conducted in 2015/2016 of ever-married Indian women aged 15–49 estimates that 31% have experienced physical, sexual or psychological abuse by an intimate partner in their lifetime, and 48% have experienced at least one controlling behavior by their husband [19]. Our study found that among women with young children living in rural tribal communities, more than one-third experienced psychological abuse or physical abuse in the past year, and the majority of women reported controlling partner behavior. Many women in our study experienced multiple types of abuse concurrently, which mirrors research

Table 3 Association between changes in IPV experience and changes in mental distress, $n = 3010$ (Rajasthan, India, 2015–2016)

Controlling behavior	Psychological abuse	Physical abuse	Crude mean difference (95% CI)[a]	Adjusted mean difference (95% CI)[b]	Excess difference due to joint exposure
No	No	No	0 (Ref)	0 (Ref)	n/a
Yes	No	No	0.29 (0.16, 0.42)	0.31 (0.18, 0.44)	n/a
No	Yes	No	0.68 (0.34, 1.01)	0.65 (0.32, 0.98)	n/a
No	No	Yes	− 0.14 (− 0.44, 0.16)	− 0.15 (− 0.45, 0.15)	n/a
Yes	Yes	No	0.50 (0.32, 0.67)	0.50 (0.33, 0.67)	− 0.46 (− 0.83, − 0.08)
No	Yes	Yes	0.42 (0.09, 0.75)	0.45 (0.12, 0.77)	− 0.08 (− 0.63, 0.47)
Yes	No	Yes	0.31 (0.14, 0.49)	0.31 (0.14, 0.49)	0.15 (− 0.18, 0.49)
Yes	Yes	Yes	0.75 (0.60, 0.90)	0.74 (0.60, 0.89)	− 0.06 (− 0.55, 0.43)

[a]Adjusted for other forms of abuse (e.g., physical, psychological, controlling behavior)

[b]Adjusted for other forms of abuse (e.g., physical, psychological, controlling behavior), household wealth, number of boys in the household, number of girls in the household, and the following interaction terms: controlling behavior × psychological abuse, physical abuse × controlling behavior, physical abuse × psychological abuse, physical abuse × psychological abuse × controlling behavior

in other contexts that show specific types of abuse rarely occur in isolation [15, 34, 35].

We found evidence that psychological abuse and controlling behavior were more damaging to mental health than physical abuse. While unadjusted estimates found physical abuse associated with mental distress, this relationship disappeared upon control for other forms of abuse. Specifically, we found that women reporting physical abuse had higher levels of mental distress than women reporting no abuse (2.6 vs 1.6 symptoms), as well as evidence of a linear relationship between the number of physical abuse acts women experienced and mental distress for women experiencing up to five physical abuse acts. For women experiencing more than five abuse acts, the relation plateaued, and one potential explanation is that women experiencing many abuse acts may normalize abuse; thus, the addition of more abuse acts may not be as distressing to them as to women who experience fewer abuse acts. However, while unadjusted estimates found physical abuse associated with mental distress, the incidence of physical abuse was not associated with an increase in mental distress upon control for other types of abuse. Instead, our results indicate that psychological abuse and controlling behavior—which frequently occurs in conjunction with physical abuse—may be driving this association.

Our findings align with research indicating that women identify psychological abuse as more distressing than physical abuse [36], and cross-sectional studies that show that psychological abuse is a stronger predictor of post-traumatic stress disorder [13], depressive symptoms [13, 15], and mental distress [16] than physical abuse. We are not aware of other research studies investigating the independent effect of controlling behavior on women's mental health, and our study advances the current knowledge base by estimating the longitudinal association between these neglected aspects of IPV and women's mental health. We encourage future research investigating controlling behavior and psychological abuse, including potential pathways linking psychological abuse (e.g., self-esteem, self-efficacy) and controlling behavior (e.g., social ties) with women's mental health.

Controlling behavior is common in India [19], and some women in this context may not consider it abuse. There is also some debate in the literature regarding if controlling behavior should be considered a part of, or separate from, IPV [34, 37]. We classified controlling behavior as part of IPV, which is supported by research originating from a different Indian context (Pune). This study found wide agreement that controlling behavior was a salient dimension of IPV [38]. Regardless of whether or not controlling behavior is a component of IPV or is a closely related concept, our results indicate that controlling behavior may have negative implications for women's mental health.

While our study advances knowledge of the effect of neglected aspects of IPV on mental health, one limitation of our study is that we used a questionnaire that excluded some examples of psychological abuse and controlling behaviors specific to India. Recent measurement efforts in India suggest additional examples of psychological abuse (e.g., harassment about wedding-related gifts or dowry, intentional spreading of false rumors, being forced to become vegetarian or non-vegetarian) and controlling behavior (e.g., limiting contacts with natal family, limiting phone access, controlling choice of attire) [38, 39]. Our study, which did not measure these instances of abuse, may underestimate the prevalence of IPV.

Our study has additional limitations. First, we only investigated abuse by an intimate partner. In an Indian context, it is not uncommon for in-laws living in the household to be involved in abuse [40]. Our study was not designed to capture abuse from other family members, which could be investigated in future research studies. Second, there is some indication that the relation between IPV and mental health is

bi-directional [41]; because our measures include past-year abuse and current mental health, we could not investigate if poor mental health led to subsequent reporting of abuse. Third, while our study design accounted for unmeasured time-invariant factors, there are likely relevant additional time-varying factors that we did not control for. For example, pregnancy is associated with higher risk of IPV [42], and many women suffer from depression in the post-partum period [43]. Thus, pregnancy is one unmeasured factor that may have resulted in residual time-varying confounding. Fourth, we did not measure sexual abuse by an intimate partner, which is also likely an independent contributor to poor mental health. Investigating the effect of sexual abuse—in relation to other forms of IPV—could be one direction of future research.

Despite these limitations, our study addresses a number of knowledge gaps. First, the majority of IPV research is conducted in high-income settings [4, 6], and our study adds information about the effect of IPV on mental health in an LMIC. Second, our study investigated psychological abuse and controlling behavior, which are neglected aspects of IPV [6, 7]. Third, most research is cross sectional [5], and our study provides longitudinal evidence for the link between IPV and mental health. Longitudinal evidence is crucial for understanding the relationship between different forms of IPV and women's mental health because of the potential for reverse causation (e.g., women with mental health problems may be more likely to be victims of abuse [44]) and reporting bias (e.g., women who are depressed may retrospectively reinterpret acts as abuse). Although our fixed effects approach cannot completely rule out reverse causation, our prospective study design can help clarify this relationship by mitigating some sources of bias (e.g., reporting bias from retrospectively reinterpreting acts of abuse). Fourth, we were able to account for early life experiences through a fixed effects study design, and the majority of longitudinal studies have not controlled for these factors [6]. Taken together, our paper strengthens the evidence for a link between IPV and poor mental health.

In summary, our study contributes to a better understanding of the causes of poor mental health among Indian women. IPV is highly prevalent among Indian women, and recent reports document an array of interventions for addressing IPV in South Asia that are being delivered through the health sector, women's collectives, and local governance systems [45]. These interventions have the potential to reduce violence against women and improve their mental health. Our results indicate that certain aspects of IPV are particularly detrimental to mental health, which could help inform rigorous evaluations of such interventions.

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Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethics statement The study received ethics approval from the Institutional Review Board of McGill University's Faculty of Medicine and the Human Subjects Committee of the Institute for Financial Management in Chennai, India. The research was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Appendix 1: Association between changes in counts of abuse items and mental distress, *n* = 3010 (Rajasthan, India, 2015–2016)

	Crude mean difference (95% CI)[a]	Adjusted mean difference (95% CI)[b]
Controlling behavior	0.20 (0.15, 0.24)	0.19 (0.15, 0.24)
Psychological abuse	0.36 (0.25, 0.47)	0.35 (0.24, 0.46)
Physical abuse	0.04 (− 0.04, 0.11)	0.02 (− 0.06, 0.09)
Controlling behavior + psychological abuse	0.44 (0.34, 0.54)	0.44 (0.34, 0.53)
Controlling behavior + physical abuse	0.18 (0.11, 0.26)	0.19 (0.11, 0.26)
Psychological abuse + physical abuse	0.33 (0.22, 0.44)	0.33 (0.22, 0.44)
Controlling behavior + psychological abuse + physical abuse	0.41 (0.32, 0.51)	0.41 (0.32, 0.51)

[a]Adjusted for other forms of abuse (e.g., physical, psychological, controlling behavior)

[b]Adjusted for other forms of abuse (e.g., physical, psychological, controlling behavior), household wealth, number of boys in the household, number of girls in the household, and the following interaction terms: controlling behavior × psychological abuse, physical abuse × controlling behavior, physical abuse × psychological abuse, physical abuse × psychological abuse × controlling behavior

Appendix 2: Association between changes in IPV experience and changes in mental distress among women in control arm, *n* = 1259 (Rajasthan, India, 2015–2016)

Controlling behavior	Psychological abuse	Physical abuse	Crude mean difference (95% CI)[a]	Adjusted mean difference (95% CI)[b]
No	No	No	0 (Ref)	0 (Ref)
Yes	No	No	0.30 (0.12, 0.48)	0.32 (0.13, 0.50)
No	Yes	No	0.69 (0.31, 1.08)	0.68 (0.29, 1.06)
No	No	Yes	0.02 (− 0.39, 0.44)	0.02 (− 0.39, 0.44)
Yes	Yes	No	0.39 (0.17, 0.61)	0.40 (0.18, 0.62)
No	Yes	Yes	0.51 (0.06, 0.97)	0.51 (0.05, 0.96)
Yes	No	Yes	0.14 (− 0.12, 0.40)	0.14 (− 0.12, 0.40)
Yes	Yes	Yes	0.70 (0.49, 0.90)	0.70 (0.49, 0.90)

[a]Adjusted for other forms of abuse (e.g., physical, psychological, controlling behavior)

[b]Adjusted for other forms of abuse (e.g., physical, psychological, controlling behavior), household wealth, number of boys in the household, number of girls in the household, and the following interaction terms: controlling behavior × psychological abuse, physical abuse × controlling behavior, physical abuse × psychological abuse, physical abuse × psychological abuse × controlling behavior

References

1. Heise L, Garcia Moreno C (2002) Violence by intimate partners. In: Krug EG, et al. (eds) World report on violence and health. World Health Organization, Geneva, pp 87–121
2. Devries KM, Mak JYT, García-Moreno C, Petzold M, Child JC, Falder G, Lim S, Bacchus LJ, Engell RE, Rosenfeld L, Pallitto C, Vos T, Abrahams N, Watts CH (2013) The global prevalence of intimate partner violence against women. Science 340(6140):1527–1528. https://doi.org/10.1126/science.1240937
3. Garcia-Moreno C, Jansen HAFM, Ellsberg M, Heise L, Watts CH (2005) WHO multi-country study on women's health and domestic violence against women: initial results on prevalence, health outcomes and women's responses. World Health Organization, Geneva
4. Howard LM, Oram S, Galley H, Trevillion K, Feder G (2013) Domestic violence and perinatal mental disorders: a systematic review and meta-analysis. PLoS Med 10(5):e1001452. https://doi.org/10.1371/journal.pmed.1001452
5. Lagdon S, Armour C, Stringer M (2014) Adult experience of mental health outcomes as a result of intimate partner violence victimisation: a systematic review. Eur J Psychotraumatol 5:24794. https://doi.org/10.3402/ejpt.v5.24794
6. Devries KM, Mak JY, Bacchus LJ, Child JC, Falder G, Petzold M, Astbury J, Watts CH (2013) Intimate partner violence and incident depressive symptoms and suicide attempts: a systematic review of longitudinal studies. PLoS medicine 10(5):e1001439. https://doi.org/10.1371/journal.pmed.1001439
7. Kalokhe A, Del Rio C, Dunkle K, Stephenson R, Metheny N, Paranjape A, Sahay S (2017) Domestic violence against women in India: a systematic review of a decade of quantitative studies. Glob Public Health 12(4):498–513. https://doi.org/10.1080/17441692.2015.1119293
8. Bradley R, Schwartz AC, Kaslow NJ (2005) Posttraumatic stress disorder symptoms among low-income, African American women with a history of intimate partner violence and suicidal behaviors: self-esteem, social support, and religious coping. J Trauma Stress 18(6):685–696. https://doi.org/10.1002/jts.20077
9. Thompson MP, Kaslow NJ, Short LM, Wyckoff S (2002) The mediating roles of perceived social support and resources in the self-efficacy-suicide attempts relation among African American abused women. J Consult Clin Psychol 70(4):942–949
10. Meadows LA, Kaslow NJ, Thompson MP, Jurkovic GJ (2005) Protective factors against suicide attempt risk among African American women experiencing intimate partner violence. Am J Community Psychol 36(1–2):109–121
11. Coker AL, Smith PH, Thompson MP, McKeown RE, Bethea L, Davis KE (2002) Social support protects against the negative effects of partner violence on mental health. J Womens Health Gend Based Med 11(5):465–476. https://doi.org/10.1089/152460902760137644
12. Sowislo JF, Orth U (2013) Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies. Psychol Bull 139(1):213–240. https://doi.org/10.1037/a0028931
13. Mechanic MB, Weaver TL, Resick PA (2008) Mental health consequences of intimate partner abuse: a multidimensional assessment of four different forms of abuse. Violence Against Women 14(6):634–654. https://doi.org/10.1177/1077801208319283
14. Houry D, Kemball R, Rhodes KV, Kaslow NJ (2006) Intimate partner violence and mental health symptoms in African American female ED patients. Am J Emerg Med 24(4):444-450. https://doi.org/10.1016/j.ajem.2005.12.026
15. Coker AL, Davis KE, Arias I, Desai S, Sanderson M, Brandt HM, Smith PH (2002) Physical and mental health effects of intimate partner violence for men and women. Am J Prev Med 23(4):260–268
16. Stephenson R, Winter A, Hindin M (2013) Frequency of intimate partner violence and rural women's mental health in four Indian states. Violence Against Women 19(9):1133–1150. https://doi.org/10.1177/1077801213501898
17. Vizcarra B, Hassan F, Hunter WM, Munoz SR, Ramiro L, De Paula CS (2004) Partner violence as a risk factor for mental health among women from communities in the Philippines, Egypt, Chile, and India. Inj Control Saf Promot 11(2):125–129. https://doi.org/10.1080/15660970412331292351
18. Tho Tran N, Nguyen HTT, Nguyen HD, Ngo TV, Gammeltoft T, Rasch V, Meyrowitsch DW (2018) Emotional violence exerted by intimate partners and postnatal depressive symptoms among women in Vietnam: a prospective cohort study. PLoS ONE 13(11):e0207108. https://doi.org/10.1371/journal.pone.0207108
19. International Institute for Population Sciences (IIPS) and ICF (2015/2016) National Family and Health Survey (NFHS-4). IIPS, Mumbai, India
20. Nandi A, Maloney S, Agarwal P, Chandrashekar A, Harper S (2016) The effect of an affordable daycare program on health and economic well-being in Rajasthan, India: protocol for a cluster-randomized impact evaluation study. BMC Public Health 16(1):490. https://doi.org/10.1186/s12889-016-3176-9

21. United States Agency for International Development (2014) Domestic violence module: demographic and health surveys methodology. https://dhsprogram.com/pubs/pdf/DHSQMP/DHS6_Module_Domestic_Violence_6Aug2014_DHSQMP.pdf. Accessed 7 June 2019
22. Straus M (1990) Measuring intrafamily conflict and violence: the conflict tactics (CT) scales. In: Straus MA, Gelles RJ (eds) Physical violence in American families: risk factors and adaptations to violence in 8,145 families. Transaction, New Brunswick, pp 29–45
23. Straus MA (1990) The conflict tactics scales and its critics: An evaluation and new data on validity and reliability. In: Straus MA, Gelles RJ (eds) Physical violence in American families: risk factors and adaptations to violence in 8,145 families. Transaction, New Brunswick, NJ, pp 49–73
24. Goldberg DP (1972) The detection of psychiatric illness by questionnaire: a technique for the identification and assessment of non-psychotic psychiatric illness. Oxford University Press, London, UK
25. Gautam S, Nijhawan M, Kamal P (1987) Standardisation of Hindi version of Goldberg's general health questionnaire. Indian J Psychiatry 29(1):63–66
26. Patel V, Pereira J, Mann AH (1998) Somatic and psychological models of common mental disorder in primary care in India. Psychol Med 28(1):135–143
27. Patel V, Araya R, Chowdhary N, King M, Kirkwood B, Nayak S, Simon G, Weiss H (2008) Detecting common mental disorders in primary care in India: a comparison of five screening questionnaires. Psychol Med 38(02):221–228
28. Shidhaye R, Patel V (2010) Association of socio-economic, gender and health factors with common mental disorders in women: a population-based study of 5703 married rural women in India. Int J Epidemiol 39(6):1510–1521. https://doi.org/10.1093/ije/dyq179
29. Shamasundar C, Murthy SK, Prakash OM, Prabhakar N, Krishna DK (1986) Psychiatric morbidity in a general practice in an Indian city. BMJ 292(6537):1713–1715
30. Kolenikov S, Angeles G (2004) The use of discrete data in principal component analysis: theory, simulations, and applications to socio-economic indices. CPC/MEASURE, Chapel Hill, NC
31. Filmer D, Pritchett L (1999) The effect of household wealth on educational attainment: evidence from 35 countries. Popul Dev Rev 25(1):85–120
32. Allison PD (2005) Fixed effects regression methods for longitudinal data using SAS. SAS Institute, Cary, N.C.
33. Hilbe JM (2011) Negative binomial regression. Cambridge University Press, New York, NY
34. Ludermir AB, Lewis G, Valongueiro SA, de Araújo TVB, Araya R (2010) Violence against women by their intimate partner during pregnancy and postnatal depression: a prospective cohort study. Lancet 376(9744):903–910
35. Tsai AC, Weiser SD, Dilworth SE, Shumway M, Riley ED (2015) Violent victimization, mental health, and service utilization outcomes in a cohort of homeless and unstably housed women living with or at risk of becoming infected with HIV. Am J Epidemiol 181(10):817–826. https://doi.org/10.1093/aje/kwu350
36. Follingstad DR, Rutledge LL, Berg BJ, Hause ES, Polek DS (1990) The role of emotional abuse in physically abusive relationships. J Fam Violence 5(2):107–120
37. Garcia-Moreno C, Jansen HAFM, Ellsberg M, Heise L, Watts CH (2006) Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. The Lancet 368(9543):1260–1269
38. Kalokhe AS, Potdar RR, Stephenson R, Dunkle KL, Paranjape A, Del Rio C, Sahay S (2015) How well does the World Health Organization definition of domestic violence work for India? PLoS ONE 10(3):e0120909. https://doi.org/10.1371/journal.pone.0120909
39. Kalokhe AS, Stephenson R, Kelley ME, Dunkle KL, Paranjape A, Solas V, Karve L, del Rio C, Sahay S (2016) The development and validation of the Indian family violence and control scale. PLoS ONE 11(1):e0148120. https://doi.org/10.1371/journal.pone.0148120
40. Kaur R, Garg S (2009) Domestic violence against women: a qualitative study in a rural community. Asia Pac J Public Health 22(2):242–251
41. Tsai AC, Tomlinson M, Comulada WS, Rotheram-Borus MJ (2016) Intimate partner violence and depression symptom severity among South African women during pregnancy and postpartum: population-based prospective cohort study. PLoS Med 13(1):e1001943. https://doi.org/10.1371/journal.pmed.1001943
42. Das S, Bapat U, Shah More N, Alcock G, Joshi W, Pantvaidya S, Osrin D (2013) Intimate partner violence against women during and after pregnancy: a cross-sectional study in Mumbai slums. BMC Public Health 13:817. https://doi.org/10.1186/1471-2458-13-817
43. Chandran M, Tharyan P, Muliyil J, Abraham S (2002) Post-partum depression in a cohort of women from a rural area of Tamil Nadu, India. Incidence and risk factors. Br J Psychiatry 181:499–504
44. McPherson MD, Delva J, Cranford JA (2007) A longitudinal investigation of intimate partner violence among mothers with mental illness. Psychiatr Serv 58(5):675–680. https://doi.org/10.1176/ps.2007.58.5.675
45. Pande R, Nanda P, Bopanna K, Kashyap A (2017) Addressing intimate partner violence in South Asia: evidence for interventions in the health sector, women's collectives, and local governance mechanisms. International Center for Research on Women, New Delhi, India