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## Depression in childhood: The role of children's exposure to intimate partner violence and maternal mental disorders

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### ABSTRACT

**Background:** Intimate partner violence (IPV) is a global problem with high prevalence rates, and is linked to maternal mental disorders (MMD). Children's exposure to IPV (CEIPV) can have impacts on their physical and mental health, including depression.

**Objective:** To analyze the associations between exposure to both CEIPV and MMD and depression in schoolchildren.

**Participants and setting:** 630 mother-child pairs were evaluated in a poor urban district in Recife, Northeast Brazil.

**Methods:** A cohort study investigated the effects of IPV during pregnancy, postpartum and six to nine years after delivery. Women were asked about their experience of IPV, their own mental health, and the exposure of their child to violence. The child's mood was reported by the mother, using the Short Mood and Feelings Questionnaire (SMFQ). Ten types of CEIPV, and the age of onset of exposure, were compared with the child's subsequent risk of depression.

**Results:** IPV was associated with MMD in 31.9% of the women at some period of time. Depressive symptoms were reported in 15.7% of school-age children. All types of CEIPV were associated with depression at school age. Multivariable analyses of exposure to IPV and MMD at different ages showed that exposure to both IPV and MMD in the first year of life had the strongest association with childhood depression (OR = 9.1; 95% CI: 2.4–33.9).

**Conclusions:** The frequency of CEIPV and MMD, and the high prevalence of depression at school age, shows the importance of assessing MMD and identifying exposure to IPV in pregnancy and the early years.

Violence against women, perpetrated by an intimate partner, is a global problem with high prevalence rates ([World Health Organization \[WHO\], 2014](#)), resulting in serious short and long-term consequences for both women and their children. Among the consequences for women are mental disorders, such as depression ([Holmes, Yoon, & Berg, 2017](#)), anxiety ([Trevillion, Oram, Feder, & Howard, 2012](#)) and post-traumatic stress disorder – PTSD ([Ahlf-Dunn & Huth-Bocks, 2014](#)). Associations between intimate partner

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violence (IPV) and mental health have been reported not only during the perinatal period, but also outside this vulnerable time (WHO, 2014). There is evidence of a bidirectional association between IPV and mental disorders (Devries et al., 2013; Oram, Khalifeh, & Howard, 2017). Systematic reviews and meta-analyses have demonstrated that domestic violence increases the likelihood of mental disorders in women (Howard, Oram, Galley, Trevillion, & Feder, 2013) and also there is an association between mental disorders and subsequent domestic violence (Oram, Trevillion, Feder, & Howard, 2013; Trevillion et al., 2012).

In low and middle-income countries (LMIC), the reported prevalence of maternal depression in the perinatal period ranges from 15.9% in pregnant women, to 19.9% in the postpartum period (Fisher et al., 2012). In Brazil, studies using the Edinburgh Postnatal Depression Scale (EPDS) have reported a prevalence of depression during pregnancy between 17.3% and 37.9%, and in the postpartum period between 16.2% and 26.4% (Gelaye, Rondon, Araya, & Williams, 2016).

In a meta-analysis, Howard et al. (2013) found that women with a history of depression during pregnancy were five times more likely to having experienced IPV during pregnancy, and three times more likely if the experience was during their lifetime. A similar pattern was found in women with postpartum depression, and when IPV was reported there was a higher incidence of having anxiety disorders. There is also evidence of a 6 times higher chance of PTSD if women reported IPV during pregnancy (Rodriguez et al., 2008).

The high prevalence rates of IPV throughout women's lives (WHO, 2014) inevitably results in children being exposed to IPV (Gonzalez, MacMillan, Tanaka, Jack, & Tonmyr, 2014; McTavish, MacGregor, Wathen, & MacMillan, 2016). Children's exposure to intimate partner violence (CEIPV) and to maternal mental disorders (MMD) are recognized as risk factors for children's physical (Deyessa et al., 2010) and mental health problems (Flach et al., 2011; Holmes et al., 2017). The negative impact on children's mental health depends on the frequency and severity of CEIPV, as well as on the stage of development the child is going through at the time of exposure (Claessens, Engel, & Curran, 2015). However, most published research analyzes these two factors separately (e.g. Brennan et al., 2000; Gardner, Thomas, & Erskine, 2019), and few studies have assessed whether these exposures act in a cumulative or interactive way (Deyessa et al., 2010; Essex, Klein, Cho, & Kraemer, 2003; Holmes et al., 2017; Whitaker, Orzol, & Kahn, 2006).

One of the common mental health consequences of CEIPV is depression. The overall prevalence of depression among children and adolescents in LMICs is estimated between 10% and 20% (Kieling et al., 2011). In Brazil, the overall reported percentage of depressive symptomatology in children and adolescents varies from 17.0% (Avanci, Assis, Oliveira, & Pires, 2012) to 59.3% (Fidalgo et al., 2018). Depression in girls exposed to violence (20.6%) is higher than that in boys (6.4%) (Gallo et al., 2017). The variability in prevalence rates of depression in children and adolescents reflects different diagnostic methods, the wide variety of depressive symptoms that can present themselves in an atypical way in childhood (Schwan & Ramires, 2011), different settings (eg clinical, school and community samples), and the presence of different risk and protective factors (Kieling et al., 2011).

As there is a bidirectional association between MMD and IPV (Devries et al., 2013; Oram et al., 2017), it is important to assess the contribution of both these conditions to the development of childhood depression. Mothers with depression may have difficulty interacting with their children, provide less cognitive stimuli, and present inappropriate parenting styles (Turney, 2012). Exposure to IPV and MMD can have similar consequences on children's mental health. For instance, attachment disorders can result if there is exposure to IPV (Levendosky, Lannert, & Yaich, 2012) and to MMD (Hayes, Goodman, & Carlson, 2013) in pregnancy and during the early months. Internalizing and externalizing problems can be seen in preschoolers if they are exposed to IPV (Evans, Davies, & Dilillo, 2008) and MMD (Mennen, Negri, Schneiderman, & Trickett, 2018). Schoolchildren and adolescents also show internalizing symptoms as a consequence of exposure to IPV (Howell, Barnes, Miller, & Graham-Bermann, 2016) and MMD (Murray et al., 2011), as well as aggressive behavior resulting from both exposures (Holmes et al., 2017).

The etiology of depression is multifactorial (Colman & Ataullahjan, 2010). To understand the mechanisms by which CEIPV and MMD can influence the development of childhood depression, authors have postulated a number of theories. The life course theory suggests that development is determined by the changes in the context in which the child is being reared and highlights the importance of timing and the interplay of causal factors (Claessens et al., 2015; Colman & Ataullahjan, 2010). Developmental psychopathology postulates that patterns of social behavior, in different periods of development, interact with and are modified by the conditions of the external environment, highlighting the influence of factors such as family violence (Sroufe & Rutter, 1984). The attachment theory (Bowlby, 1977) postulates that infants who grow up in dysfunctional families may not develop a sense of security, resulting in maladaptive patterns of social relations.

A proposed mechanism behind the association of childhood depression with exposures to adverse events in pregnancy is epigenetic change, which postulates that prenatal maternal depression (Teh et al., 2014) and IPV (Radtke et al., 2011) can influence the child's epigenetic pattern (Nemoda & Szyf, 2017), so that children of depressed mothers acquire a tendency towards depressive symptomatology during childhood (Perroud et al., 2014) that might remain throughout life (Gonçalves et al., 2016). Epigenetic changes in certain genes, when combined with a number of stressful experiences (Pizzagalli, 2014), such as abuse (Weder et al., 2014), parents' mental disorders (Aktar & Bögels, 2017), and intra-family violence (Hankin et al., 2015) increase the risk of child depression.

Another mechanism involved in childhood depression, as a consequence of exposure to IPV (Levendosky et al., 2016) and MMD (Braithwaite, Murphy, & Ramchandani, 2016) during pregnancy, is the alteration of the fetal hypothalamic-pituitary-adrenal axis, changing the release of hormones responsible for the biological response to stress, which can alter brain architecture (Martinez-Torteya, Bogat, Levendosky, & von Eye, 2015). Exposure to frequent and/or prolonged adverse events during sensitive periods of development is characterized as toxic stress, which can be reflected in long-term psychological changes (Bucci, Marques, Oh, & Harris, 2016).

Goodman and Gotlib (1999) proposed a model of the risk transmission for depression in the children of depressed mothers, composed of 4 mechanisms: 1) Heredity of depression; 2) Dysfunction of the innate neuro-regulatory mechanism; 3) Exposure to maternal negative affectivity and behaviors; and 4) Stressful context in the children's lives (including marital conflict and, therefore, IPV and CEIPV).

There is a paucity of studies from LMIC settings which analyze the interaction between CEIPV and MMD, both in pregnancy and in the early years of life, and their impact on children's mental health. The present study uses a well characterized prospective cohort from North East Brazil to analyze the associations between depression in schoolchildren and the children's exposure both to IPV committed against the mother, and to maternal mental disorders (MMD). The hypothesis being tested is that the highest depression rates would be found in children exposed to both IPV and to MMD.

## 1. Methods

### 1.1. Study design and population

A prospective cohort study was developed from 2005, with initial enrolment of pregnant participants who were registered in the Family Health Service of the Sanitary District II in the city of Recife, Pernambuco, in the Northeast of Brazil.

Initial interviews (T1) were conducted from July 2005 to October 2006 with 1120 pregnant women aged between 18 and 49, from their 31st week of gestation. In the second stage (T2), the interview was conducted between May and December 2006 with 1057 post-partum women. The third stage (T3) was conducted from July 2013 and December 2014, when the children of the index pregnancy were of school age, and a total of 644 women were interviewed (56% of the original sample and 61% of the sample enrolled in T2). Five mothers of twins, four mothers of children who died, two mothers whose children were adopted, and two whose children lived with another family member, were excluded. A child whose information was not complete was also excluded. The final study sample consisted of 630 mother-child pairs.

In the final sample for analysis, 461 (73.2%) women were over 30 years old, 514 (82.0%) declared themselves to be of non-white ethnicity, 418 (66.4%) earned below the minimum wage, and 318 (50.5%) had not completed fundamental education. Non-white participants were predominately mixed race (brown). The children were between 6 and 9 years old, and 50.8% were female. The majority ( $n = 403$ , 64.0%) were attending the second year of elementary school.

From T1 to T2 there was a loss of only 5.7%, and from T2 to T3 there was a further loss to follow-up of 39% of participants. To assess the magnitude of the selection bias, the characteristics of the women who left the study were compared with those who remained. There were no statistical differences in age, race/ethnicity, marital status, education and reports of IPV between enrolled women who were part of T3 and those who were not (Silva, Lima, & Ludermir, 2017).

### 1.2. Procedures

In T1, pregnant women were identified from the records of Community Health Agents and informed written consent was obtained during a routine prenatal consultation. The initial interview was conducted in a reserved room at the Family Health Unit (FHU), or at home for those high-risk pregnant women who did not attend prenatal care at the FHU.

In T2, after delivery, the women were contacted from the schedule for routine childcare consultations, and contact was made at home for women who did not have scheduled appointments for childcare. The interview was held at the date and place that was most convenient for them.

In the third stage (T3), women were interviewed at a time and place that was most convenient for them (usually their home) about their socioeconomic conditions, mental health, social support, and exposure to violence. The mothers answered a questionnaire about their child's characteristics and the child's exposure to violence and reported on the child's mood.

All interviews were conducted orally in Brazilian Portuguese by trained female researchers, without the partner or any child aged two or more being present. The women interviewed received a guide with information about support services available in the city of Recife, for women and children living in situations of violence.

### 1.3. Measurements

#### 1.3.1. Intimate partner violence

The questions related to IPV were derived from a questionnaire already validated in Brazil, which had previously been used in the WHO's Multicountry Study on Women's Health and Domestic Violence. The questions about IPV characterized physical violence as physical aggression or the use of objects or weapons to cause injury; psychological violence as threatening behavior, humiliation and insults; and sexual violence as sexual relations imposed by physical force or threats, and the imposition of acts considered humiliating. In previous Brazilian studies, when used with non-pregnant women (in São Paulo and in the Zona da Mata area of Pernambuco) the instrument had high internal consistency, with Chronbach's  $\alpha$  0.88 and 0.89, respectively (Schraiber, Latorre, França, Segri, & Oliveira, 2010). The present study also showed high internal consistency (Chronbach's  $\alpha$  0.88). Women who answered "yes" to at least one of the questions that make up each type of violence at any stage of the cohort (T1, T2 and T3) were considered positive cases of IPV.

#### 1.3.2. Maternal mental disorders

In T1, MMD were assessed using the SRQ-20, an instrument developed by the WHO to detect common mental disorders (Harding et al., 1980), which consists of twenty yes/no questions, four of them about physical symptoms and sixteen about psycho-emotional disorders. The SRQ-20 was previously validated in Brazil, with a sensitivity of 85% and a specificity of 80% (Mari & Williams, 1986). The cut-off score for the SRQ-20 for this study was defined as 7/8.

In T2, MMD were assessed using the Edinburgh Postnatal Depression Scale (EPDS), developed by Cox, J, and Sagovsky (1987) to

identify women at risk of postpartum depression. In Brazil it was validated by Santos, Martins, and Pasquali (2000) with a sensitivity of 72% and a specificity of 88%. The EPDS cut-off score for this study was defined as 11/12.

In T3, MMD were assessed with three instruments: the SRQ-20 (to assess common mental disorders), the EPDS (that can be used to screen for postnatal depression and to follow women beyond this period in longitudinal studies and to screen for depression in mothers with older children (Cox, Chapman, Murray, & Jones, 1996), and the Post-Traumatic Stress Disorder Checklist - Civilian (PCL—C) questionnaire (that was added to capture symptoms of post-traumatic stress disorder). The version of the PCL-C used was developed by Weathers, Litz, Herman, Huska, and Keane (1993) to identify signs and symptoms suggestive of Post-Traumatic Stress Disorder (PTSD). The Portuguese version of the PCL-C was translated by Berger, Mendlowicz, Souza, and Figueira (2004), and validated by Bringhenti, Luft, and Oliveira (2010). The PCL-C assesses 17 symptoms for the diagnosis of PTSD, and they are grouped in 5 DSM-IV diagnostic criteria.

A woman was considered as having a MMD if she was above the cut-off on the SRQ-20 and/or the EPDS, and/or fulfilled the criteria for PTSD on the PCL—C.

### 1.3.3. Children's exposure to intimate partner violence (CEIPV)

The mother answered questions about the child's age at the first exposure and the type of IPV experienced. CEIPV was defined according to Holden's classification (Holden, 2003), which describes six types of direct exposure (prenatal, hearing, witnessing, interfering, participating, and being the victim) and four indirect ones (observing initial effects, experiencing immediate consequences, hearing comments from adults, and – apparently – being unaware of the violence, according to the mother's perception). The CEIPV questionnaire has good internal consistency (Chronbach's  $\alpha = 0.83$ ). The child was considered exposed if the mother answered "yes" to at least one of the types of exposure.

### 1.3.4. Child depression

In T3, the mother completed the Short Mood and Feelings Questionnaire (SMFQ-P) (Angold, Costello, Messer, Pickles, & Winder, 1995), a brief instrument (13 items) which provides a series of statements about how the child/adolescent has been feeling or acting in the last two weeks. The maximum score is 26, but a value  $\geq 8$  is considered at risk of depression (this cut-off point was used in this study).

For this study, a cross-cultural adaptation of the SMFQ-P into Brazilian Portuguese was carried out, showing high internal consistency with Chronbach's  $\alpha = 0.81$ . The Portuguese version was then validated using a sample of children and adolescents recruited from a plastic surgery clinic (Sucupira et al., 2017), showing Chronbach's  $\alpha = 0.87$ .

### 1.3.5. Covariables

The following covariables, related to the sociodemographic characteristics of the women, were included in the initial analyses: age (<30 years vs.  $\geq 30$  years), education ( $\leq 9$  vs.  $> 9$  years of study), marital status (with vs. without partner), current partner is the father of the index child (yes vs. no), income ( $\geq 1$  minimum wage vs. without/ $< 1$  minimum wage), house ownership (yes vs. no), head of household (yes vs. no). To assess ethnicity, women were asked to declare themselves as one of the categories (white, black, brown, yellow or indigenous) that are used in the classification adopted by the Brazilian Census (Instituto Brasileiro de Geografia e Estatística [IBGE], 2011), and were grouped as white, black and brown. Economic productivity was categorized according to the Brazilian Census (IBGE, 2011), and we grouped women as unemployed vs. employed. The women's lifestyle variables analyzed were: use of cigarettes (yes vs. no), use of alcohol (yes vs. no) and use of illicit drugs (yes vs. no). The variables of the partner's lifestyle were: use of cigarettes (yes vs. no), abusive use of alcohol (drunkenness) (yes vs. no), drug use (yes vs. no) and involvement in fights outside the household (yes vs. no).

The variables used to measure the profile of the couple's relationship were: duration of the couple's relationship (<6 years vs.  $\geq 6$  years), communication with the partner (good vs. poor), fights (<1 time vs.  $\geq 1$  time a month), voluntary physical aggression from the woman against the partner (yes vs. no), aggression from the woman against the partner by retaliation (yes vs. no). In 70% of cases of IPV reported by the women, the perpetrator was the child's father.

The child's variables were: age (6–7 years old vs. 8–9 years old), gender (female vs. male), having siblings (yes vs. no), number of siblings (None, 1–2 and  $\geq 3$ ), birth order (1st or 2nd child vs. 3rd or later), education ( $\geq 2$ nd vs. 1st grade of elementary school), and school type (private vs. public).

### 1.3.6. Statistical analysis

Statistical analyses were performed using Stata v13.1 for Windows. The analytic strategy used was initial descriptive statistics, then bivariate comparisons followed by logistic regression. The frequencies of the types of IPV suffered by the mother were estimated during pregnancy, postpartum and in the last six to nine years. The frequency of the types and age of onset of CEIPV, the frequency of MMD (independent variables) and the frequency of depression in the children (outcome variable) were estimated. No interaction was observed between the child's exposure to IPV and MMD.

A stratified variable was then constructed using the independent variables: a) Without exposure to IPV and without MMD; b) With exposure to IPV and without MMD; c) Without exposure to IPV and with MMD; and d) With exposure to both IPV and MMD. Four models were then built, based on the different times of evaluation in the cohort: Model 1 – Child's exposure to IPV and MMD during pregnancy (T1); Model 2 – Child's exposure to IPV and MMD up to 12 months after delivery (T2); Model 3 – Child's exposure to IPV and MMD in the 3rd stage of the cohort (T3); and Model 4 – Child exposure to IPV and MMD at any time from T1 to T3 in the cohort.

Potential confounding variables were chosen based on published articles on possible risk factors for the occurrence of IPV (Fleming

et al., 2015) and MMD (Howard et al., 2014) and factors associated with mental health problems in children (Avanci et al., 2012). A bivariate analysis of the covariables was performed using the child's exposure to IPV and MMD with the child's depression. Variables associated at  $p < .20$  with complete data were included in the multivariate logistic regression analysis. The results are presented as Odds Ratios (OR) with 95% confidence intervals (95% CI).

### 1.3.7. Ethical standards

Ethical permission from the municipality's health authority was given to identify the women who were registered at the Family Health Unit, through the records of Community Health Agents.

The first and second stages of the research were approved by the Ethics Committee of the Federal University of Pernambuco (Research protocol number: 303/2004-CEP / CCS). The third stage was approved by the Ethics Committee of the Federal University of Pernambuco (Research protocol number: 194,672). In all stages of the research, the authors followed the ethical standards of research on violence against women and children. Therefore, the research has been carried out in accordance with the ethical standards established in the 1964 Helsinki Declaration and its subsequent amendments. All women participating were given information about social, health, legal, and police services available in the area, regardless of the presence of partner violence. Services were contacted to assist those women interviewed who were in life-threatening situations.

## 2. Results

### 2.1. Child depression

The frequency of each SMFQ item, answered by the mother, is shown in Table 1. Using a cut-off point  $\geq 8$ , depressive symptoms were reported in 15.7% ( $n = 99$ ) of school-age children.

Table 2 shows the bivariate associations between the child's depression and the mothers' sociodemographic characteristics, the woman's and partner's lifestyles, the couple's relationship and the child's characteristics. Depression was more likely in children whose mothers had less than 9 years of schooling, were heads of the household, were smokers, and for those women whose partners used drugs. Children who had the highest scores for depression occupied the third or higher position in the birth order and studied in a public school.

### 2.2. Intimate partner violence and maternal mental disorders

Table 3 shows the frequency and pattern of isolated and combined IPV and MMD. Of all the women interviewed in the 3 stages of the cohort, 52.1% reported some type of IPV in some period (T1, T2 and/or T3). Psychological violence was the most frequently reported (48.7%), followed by physical violence (28.6%) and sexual violence (10.8%). Regarding MMD, depression was the most common, identified in 39.5% of women during pregnancy and in 21% postpartum. At T3, 27.0% of women had depression alone, 10.5% had PTSD and depression, and 2.4% had isolated symptoms of PTSD.

Reports of IPV associated with MMD were identified in 31.9% of the women at some period of time (T1, T2 and/or T3). Fig. 1 illustrates the overlap between IPV and MMD reported in different stages of the study. The prevalence of IPV and MMD combined in each of the stages T1, T2 and T3 was 17.3%, 9.8% and 19.9%, respectively. The odds ratio of experiencing IPV and MMD postpartum if they had been experienced during pregnancy was 11.1 times higher ( $38 \times 497/71 \times 24$ ). If experienced during both pregnancy and postpartum, the odds ratio of experiencing them in T3 was 8.7 times higher ( $22 \times 429/16 \times 68$ ), compared to women without reports of IPV and without mental disorders. If the woman had experienced them in pregnancy and they had ceased in the postpartum period, the odds ratio of experiencing a recurrence in T3 was approximately 4 times higher ( $27 \times 429/44 \times 68$ ) compared to women without

**Table 1**  
Results of the Short Mood and Feelings Questionnaire.  $N = 630$

Items	Yes		No	
	n	%	n	%
1. He/She was in a bad mood or unhappy	164	26.03	466	73.97
2. He/She did not enjoy doing anything	196	31.11	434	68.89
3. He/She felt so tired that only stayed quiet and did not want to do anything	133	21.11	497	78.89
4. He/She was very restless	229	36.35	401	63.65
5. He/She felt like they were not a good child anymore	59	9.36	571	90.63
6. He/She cried a lot	159	25.24	471	74.76
7. He/She had difficulty to think properly or concentrate	108	17.14	522	82.86
8. He/She hated themselves	40	6.35	590	93.65
9. He/She felt like they were a bad person	27	4.28	603	95.71
10. He/She felt alone	91	12.44	539	85.56
11. He/She thought no one loved them	135	21.43	495	78.57
12. He/She thought they could never be as good as the other children	45	7.14	585	92.86
13. He/She felt like they did everything wrong	83	13.18	547	86.83

**Table 2**

Bivariate analysis of the associations between demographic and socioeconomic characteristics of the woman, her partner, and her child and the child's depression.

Variables	N = 630 n (%)	Normal	Suspected case of depression (n = 99)		
		n (%)	n (%)	OR (95% CI)	p
<b>The woman</b>					
<b>Age (years)</b>					
≥ 30	461 (73.2)	383 (72.1)	78 (78.8)	1.0	
< 30	169 (26.8)	148 (27.9)	21 (21.2)	0.7 (0.4–1.2)	0.171
<b>Race<sup>a</sup></b>					
White	113 (18.0)	98 (18.5)	15 (15.1)	1.0	
Black	104 (16.6)	87 (16.5)	17 (17.2)	1.3 (0.6–2.7)	0.524
Brown	410 (65.4)	343 (65.0)	67 (67.7)	1.3 (0.7–2.3)	0.428
<b>Education (years of study)</b>					
> 9	312 (49.5)	272 (51.2)	40 (40.4)	1.0	
≤ 9	318 (50.5)	259 (48.8)	59 (59.6)	1.5 (1.0–2.4)	0.049
<b>Marital status</b>					
With a partner	511 (81.1)	437 (82.3)	74 (74.8)	1.0	
Without a partner	119 (18.9)	94 (17.7)	25 (25.2)	1.6 (0.9–2.6)	0.080
<b>Partner (father of the child)</b>					
Yes	403 (64.0)	340 (64.0)	63 (63.6)	1.0	
No	227 (36.0)	191 (36.0)	36 (36.4)	1.01 (0.7–1.6)	0.940
<b>Productive insertion</b>					
Active	325 (51.6)	276 (52.0)	49 (49.5)	1.0	
Inactive	305 (48.4)	255 (48.0)	50 (50.5)	1.1 (0.7–1.7)	0.650
<b>Income (minimum wage)</b>					
≥ 1 salary	212 (33.6)	182 (34.3)	30 (30.3)	1.0	
No income / Less than 1 salary	418 (66.4)	349 (65.7)	69 (69.7)	1.2 (0.8–1.9)	0.443
<b>Own house</b>					
Yes	435 (69.1)	368 (69.3)	67 (67.7)	1.0	
No	195 (30.9)	163 (30.7)	32 (32.3)	1.07 (0.7–1.7)	0.748
<b>Head of household (Interviewed)</b>					
No	447 (71.0)	386 (72.7)	61 (61.6)	1.0	
Yes	183 (29.0)	145 (27.3)	38 (38.4)	1.7 (1.1–2.6)	0.027
<b>Smoking habit</b>					
No	477 (75.7)	413 (77.8)	64 (64.7)	1.0	
Yes	153 (24.3)	118 (22.2)	35 (35.3)	1.9 (1.2–3.0)	0.006
<b>Use of alcohol</b>					
No	276 (43.8)	237 (44.6)	39 (39.4)	1.0	
Yes	354 (56.2)	294 (55.4)	60 (60.6)	1.2 (0.8–1.9)	0.335
<b>Use of drugs</b>					
No	598 (94.9)	503 (94.7)	95 (96.0)	1.0	
Yes	32 (5.1)	28 (5.3)	4 (4.0)	0.8 (0.3–2.2)	0.609
<b>The partner</b>					
<b>Age (years)<sup>b</sup></b>					
≥ 30	509 (83.0)	429 (83.1)	80 (82.5)	1.0	
< 30	104 (17.0)	87 (16.9)	17 (17.5)	1.0 (0.6–1.9)	0.873
<b>Race<sup>c</sup></b>					
White	198 (31.6)	168 (31.8)	30 (30.6)	1.0	
Black	116 (18.5)	97 (18.4)	19 (19.4)	1.1 (0.6–2.1)	0.772
Brown	312 (49.8)	263 (49.8)	49 (50.0)	1.0 (0.6–1.7)	0.866
<b>Productive insertion</b>					
Active	434 (68.9)	368 (69.3)	66 (66.7)	1.0	
Not active	196 (31.1)	163 (30.7)	33 (33.3)	0.9 (0.6–1.4)	0.603
<b>Income (minimum salary)<sup>d</sup></b>					
≥ 1 salary	399 (73.2)	339 (71.8)	60 (74.1)	1.0	
No income / Less than 1 salary	154 (27.8)	133 (28.2)	21 (25.9)	1.2 (0.7–2.1)	0.416
<b>Smoking habit</b>					
No	437 (69.4)	370 (69.7)	67 (67.7)	1.0	
Yes	193 (30.6)	161 (30.3)	32 (32.3)	1.1 (0.7–1.7)	0.691
<b>Use of alcohol</b>					
No	156 (24.8)	131 (24.7)	25 (25.3)	1.0	
Yes	474 (75.2)	400 (75.3)	74 (74.7)	0.9 (0.6–1.6)	0.902
<b>Abusive use of alcohol (drunkenness)</b>					
No	386 (61.3)	333 (62.7)	53 (53.5)	1.0	
Yes	244 (38.7)	198 (37.3)	46 (46.5)	1.5 (0.9–2.2)	0.092
<b>Drugs<sup>e</sup></b>					
No	543 (89.0)	465 (90.3)	78 (82.1)	1.0	
Yes	67 (11.0)	50 (9.7)	17 (17.9)	2.0 (1.1–3.7)	0.021
<b>Involvement in fights (physical aggression) with another man</b>					

(continued on next page)

Table 2 (continued)

Variables	N = 630 n (%)	Normal n (%)	Suspected case of depression (n = 99)		
			n (%)	OR (95% CI)	p
No	570 (90.5)	484 (91.2)	86 (86.9)	1.0	
Yes	60 (9.5)	47 (8.8)	13 (13.1)	1.6 (0.8–3.0)	0.186
Couple's relationship profile					
Duration of couple's relationship					
≥ 6 years	420 (66.7)	358 (67.4)	62 (62.6)	1.0	
< 6 years	210 (33.3)	173 (32.6)	37 (37.4)	1.2 (0.8–1.9)	0.387
Communication					
Good	500 (79.4)	426 (80.2)	74 (74.8)	1.0	
Poor	130 (20.6)	105 (19.8)	25 (25.2)	0.7 (0.4–1.2)	0.218
Fights (times a month)					
< 1	428 (67.9)	365 (68.7)	63 (63.6)	1.0	
≥ 1	202 (32.1)	166 (31.3)	36 (36.4)	1.3 (0.8–1.9)	0.319
Voluntary physical aggression towards partner					
No	576 (91.4)	490 (92.3)	86 (86.9)	1.0	
Yes	54 (8.6)	41 (7.7)	13 (13.1)	1.8 (0.9–3.5)	0.081
Physical aggression towards partner in retaliation					
No	491 (77.9)	421 (79.3)	70 (70.7)	1.0	
Yes	139 (22.1)	110 (20.7)	29 (29.3)	1.6 (0.98–2.6)	0.060
The child					
Age (years)					
6–7	324 (51.4)	285 (53.7)	39 (39.4)	1.0	
8–9	306 (48.6)	246 (46.3)	60 (60.6)	1.8 (1.2–2.8)	0.010
Gender					
Female	320 (50.8)	269 (50.7)	51 (51.5)	1.0	
Male	310 (49.2)	262 (49.3)	48 (48.5)	0.9 (0.6–1.5)	0.876
Siblings					
No	132 (21.0)	118 (22.2)	14 (14.1)	1.0	
Yes	498 (79.0)	413 (77.8)	85 (85.9)	1.7 (0.95–3.2)	0.073
Number of siblings					
Zero	132 (21.0)	118 (22.2)	14 (14.1)	1.0	
01–02 siblings	265 (42.0)	221 (41.6)	44 (44.5)	1.7 (0.9–3.2)	0.114
03 or more siblings	233 (37.0)	192 (36.2)	41 (41.4)	1.8 (0.9–3.4)	0.076
Birth order					
1st – 2nd position	549 (87.1)	469 (88.3)	80 (80.8)	1.0	
≥ 3rd position	81 (12.9)	62 (11.7)	19 (19.2)	1.8 (1.0–3.2)	0.042
Grade					
≥ 2nd grade	403 (64.0)	347 (65.4)	56 (56.6)	1.0	
≤ 1st grade	227 (36.0)	184 (34.6)	43 (43.4)	1.4 (0.9–2.2)	0.096
Type of school					
Private	298 (47.3)	262 (49.3)	36 (36.4)	1.0	
Public	332 (52.7)	269 (50.7)	63 (63.6)	1.7 (1.1–2.7)	0.018

<sup>a</sup> 3 missing values.

<sup>b</sup> 17 missing values.

<sup>c</sup> 4 missing values.

<sup>d</sup> 77 missing values.

<sup>e</sup> 20 missing values.

exposure.

### 2.3. Child's exposure to IPV

The mothers reported (Table 3) that the most frequent direct types of CEIPV were exposure in utero (28.4%), hearing IPV (41.1%) and witnessing IPV (34.6%), in addition to 13.5% of children becoming victims themselves. Among the indirect types mothers reported that their children experienced the consequences (37.1%) and observed the initial effects (25.6%) of IPV. In the bivariate analysis, all types of CEIPV, except prenatally, showed statistically significant associations with depression at school age, but the largest ORs were observed with participation.

After the prenatal period (28.4%), the most frequent age of onset of CEIPV was 3 to 6 years old (17.9%). The strongest unadjusted associations with childhood depression were found in exposure prenatally (OR = 2.3; 95% CI: 1.3–3.9) and in the first year of life (OR = 2.7; 95% CI: 1.2–6.2).

### 2.4. Association between children's exposure to IPV and MMD with child depression

Table 4 shows the multivariate models of adjusted and unadjusted associations of exposure to IPV and MMD at different ages with

**Table 3**

Bivariate analysis of the association between types and age of the onset of child's exposure to intimate partner violence and child's depression.

Type of child exposure to IPV	Normal		Suspected case of Depression (n = 99)		OR	(95% CI)	p		
	n	(%)	n	(%)					
Woman's exposure to IPV									
(T1 and/or T2 and/or T3)									
Psychological violence	307	48.7	246	46.3	61	61.6	1.9	(1.2–2.9)	0.006
Physical violence	180	28.6	143	26.9	37	37.4	1.6	(1.0–2.5)	0.036
Sexual violence	68	10.8	52	9.8	16	16.2	1.8	(0.97–3.3)	0.064
Any type of IPV at any moment of the cohort	328	52.1	263	49.5	65	65.7	1.9	(1.2–3.1)	0.004
Maternal mental disorders									
(T1) SRQ pregnancy	249	39.5	192	(36.2)	57	(57.6)	2.4	(1.5–3.7)	< 0.0001
(T2) EPDS puerperal	132	21.0	97	(18.3)	35	(35.3)	2.5	(1.5–3.9)	< 0.0001
(T3) Depression alone	170	27.0	135	(25.4)	35	(35.4)	2.8	(1.7–4.7)	< 0.0001
PTSD alone	15	2.4	12	(2.3)	3	(3.03)	2.7	(0.7–10.1)	0.137
Depression + PTSD	66	10.5	37	(6.9)	29	(29.3)	8.5	(4.6–15.6)	< 0.0001
SRQ pregnancy and/or EPDS puerperal (T1 and/or T2)	279	47.5	229	(43.1)	70	(70.7)	3.2	(2.0–5.1)	< 0.0001
Mental disorders at any period of the cohort (T1 and/or T2 and/or T3)	370	58.7	290	(54.6)	80	(80.8)	3.5	(2.0–5.9)	< 0.0001
Child's exposure to IPV (T1 and/or T2 and/or T3)									
Prenatal	179	28.4	143	(26.9)	36	(36.4)	1.6	(0.98–2.4)	0.057
Listen	259	41.1	204	(38.4)	55	(55.6)	2.0	(1.3–3.1)	0.002
Witness	218	34.6	169	(31.8)	49	(49.5)	2.1	(1.4–3.2)	0.001
Interfere	100	15.9	73	(13.8)	27	(27.3)	2.4	(1.4–3.9)	0.001
Participate	19	3.0	9	(1.7)	10	(10.1)	6.5	(2.6–16.5)	< 0.0001
Be the victim	85	13.5	60	(11.3)	25	(25.3)	2.7	(1.6–4.5)	< 0.0001
Observe	161	25.6	113	(21.3)	48	(48.5)	3.5	(2.2–5.4)	< 0.0001
Experience	234	37.1	186	(35.0)	48	(48.5)	1.7	(1.1–2.7)	0.012
Hear comments from adults	84	13.3	57	(10.7)	27	(27.3)	3.1	(1.9–5.2)	< 0.0001
Apparently unaware	114	18.1	79	(14.9)	35	(35.4)	3.1	(1.9–5.0)	< 0.0001
Age of onset of child's exposure to IPV									
No exposure	249	39.5	224	(42.1)	25	(25.3)	1.0	–	
Prenatal	179	28.4	143	(26.9)	36	(36.4)	2.3	(1.3–3.9)	0.004
0–11 months	43	6.8	33	(6.2)	10	(10.0)	2.7	(1.2–6.2)	0.017
1–2 years	46	7.3	37	(6.97)	9	(9.1)	2.2	(0.9–5.0)	0.068
≥ 3 years	113	17.9	94	(17.7)	19	(19.2)	1.8	(0.95–3.4)	0.070

childhood depression. In all models, MMD were associated with childhood depression, but when CEIPV was also present there were stronger associations in all models, even after adjusting for confounding factors of the woman, the partner and the child.

Model 1, which evaluated T1, showed that the child's odds ratio of having depression at school age was 2 times higher when MMD were present, both with (95% CI: 1.2–4.2) and without (95% CI: 1.2–3.6) exposure to IPV, compared to unexposed children.

In model 2, the evaluation in T2, stratification showed that without CEIPV but with MMD, the odds ratio of childhood depression was approximately 2 times higher (OR = 1.9; 95% CI: 1.1–3.1). However, when there was a combination of child exposure to both IPV and MMD, the odds ratio were 9 times higher (OR = 9.1; 95% CI: 2.4–33.9), compared to unexposed children.

In Model 3, stage T1 of the cohort (pregnancy stage) and T2 (postpartum) were excluded. Assessing school aged exposure, the odds ratio were 3.5 times higher (95% CI: 1.7–7.4) in exposure to MMD without CEIPV, increasing to 4 times (95% CI: 2.1–8.4) when CEIPV was combined with MMD.

When the entire cohort period (Model 4) was analyzed, the odds ratio of childhood depression was 3.5 (95% CI: 1.7–7.3) with the combination of CEIPV and MMD.

### 3. Discussion

This prospective cohort study in a LMIC urban setting has shown that depression in school-aged children was most common in those exposed to both IPV and to MMD, confirming the main study hypothesis. The association of mental health problems in children exposed to IPV and MMD is already well documented in the literature, but few studies assess the specific association between both these exposures and childhood depression (Gardner et al., 2019). Understanding the mechanism of transmission and the consequences of this cumulative risk is necessary in order to implement intervention programmes to both prevent the occurrence and recurrence of IPV and the treat the mental health consequences for mothers and children.

The strongest associations for childhood depression were observed with exposure to IPV and MMD in the first year of life, highlighting the importance of early attachment. The first year of life is a period in which the child is extremely dependent on the mother (Murray et al., 2011), and several studies have shown that postpartum depression is associated with an insecure attachment style, which can predict, in addition to vulnerabilities towards depression, various cognitive, affective and behavioral problems at school age (Stein et al., 2014). It is known that postpartum depression is commonly associated with family adversities, such as exposure to IPV



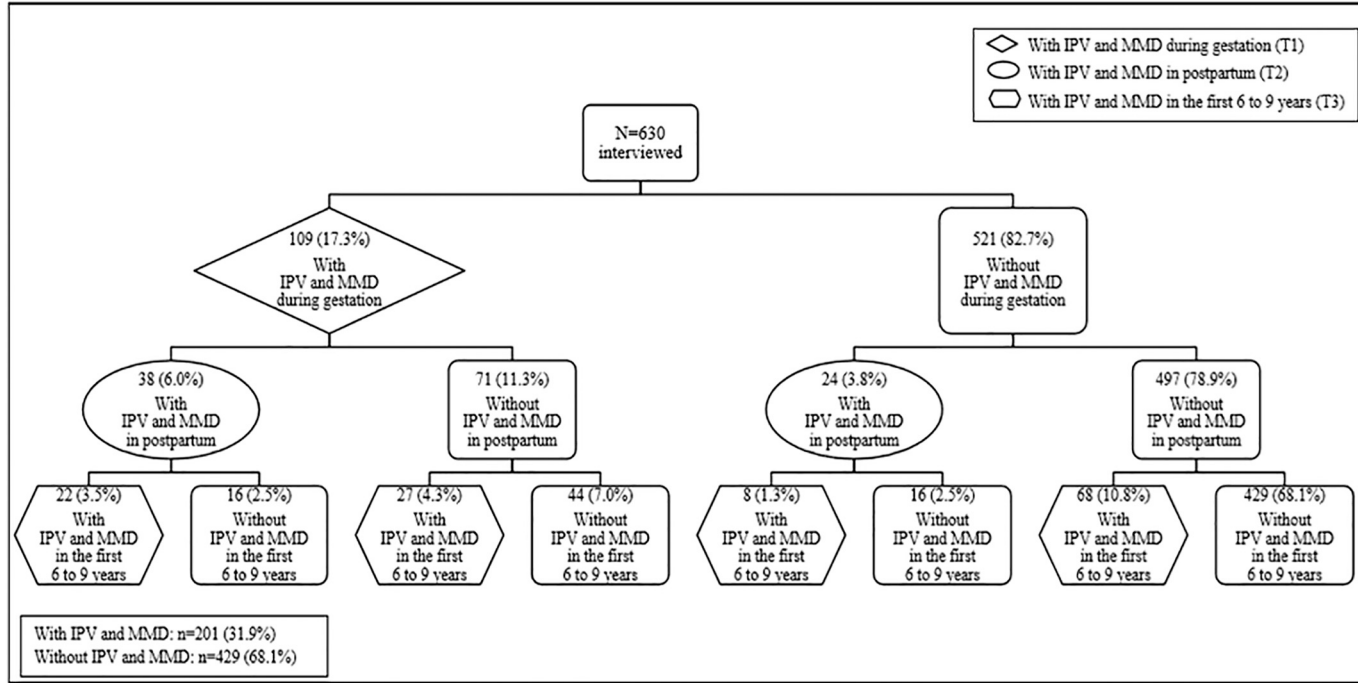


Fig. 1. Frequency and pattern of IPV and MMD in pregnancy (T1), postpartum (T2) and 6 to 9 years after onset of the cohort (T3).

**Table 4**  
Logistic Regression of child's exposure to intimate partner violence and maternal mental disorders with child depression.

	N = 630		Normal		Suspected case of depression (n = 99)				Interaction			
	n	(%)	n	(%)	n	%	OR unadjusted	(95% CI)	p	OR adjusted	(95% CI)	p
Child's exposure to IPV in pregnancy and SRQ pregnancy (T1 of the cohort) – Model 1 <sup>a</sup>												
Without Exposure to IPV and without Maternal mental disorders	311	(49.4)	278	(52.4)	33	(33.3)	1.0					
With Exposure to IPV and without Maternal mental disorders	70	(11.1)	61	(11.5)	9	(9.1)	1.2	(0.6–2.7)	0.588	0.99	(0.4–2.3)	0.991
Without Exposure to IPV and with Maternal mental disorders	140	(22.2)	110	(20.7)	30	(30.3)	2.3	(1.3–3.9)	0.003	2.1	(1.2–3.6)	0.011
With Exposure to IPV and with Maternal mental disorders	109	(17.3)	82	(15.4)	27	(27.3)	2.8	(1.6–4.9)	< 0.0001	2.3	(1.2–4.2)	0.009
Child's exposure to IPV in the 1st year of life and EPDS puerperal (T2 of the cohort) – Model 2 <sup>b</sup>												
Without Exposure to IPV and without Maternal mental disorders	444	(70.5)	390	(73.5)	54	(54.5)	1.0					
With Exposure to IPV and without Maternal mental disorders	32	(5.1)	28	(5.3)	4	(4.0)	1.0	(0.3–3.1)	0.955	1.0	(0.3–3.1)	0.979
Without Exposure to IPV and with Maternal mental disorders	143	(22.7)	108	(20.3)	35	(35.4)	2.3	(1.5–3.8)	< 0.0001	1.9	(1.1–3.1)	0.017
With Exposure to IPV and with Maternal mental disorders	11	(1.8)	5	(0.9)	6	(6.1)	8.7	(2.6–29.3)	0.001	9.1	(2.4–33.9)	0.001
Child's exposure to IPV from 6 to 9 years old and Maternal mental disorders in the 3rd stage (SRQ and/or EPDS and/or PTSD) (T3 of the cohort) – Model 3 <sup>c</sup>												
Without Exposure to IPV and without Maternal mental disorders	215	(34.2)	199	(37.5)	16	(16.2)	1.0					
With Exposure to IPV and without Maternal mental disorders	164	(26.0)	148	(27.9)	16	(16.2)	1.3	(0.7–2.8)	0.423	1.2	(0.6–2.6)	0.657
Without Exposure to IPV and with Maternal mental disorders	82	(13.0)	63	(11.8)	19	(19.1)	3.6	(1.8–7.7)	< 0.0001	3.5	(1.7–7.4)	0.001
With Exposure to IPV and with Maternal mental disorders	169	(26.8)	121	(22.8)	48	(48.5)	4.9	(2.7–9.1)	< 0.0001	4.2	(2.1–8.4)	< 0.0001
Child's exposure to IPV and Maternal mental disorders at any period of the cohort (T1 and/or T2 and/or T3 of the cohort) – Model 4 <sup>d</sup>												
Without Exposure to IPV and without Maternal mental disorders	142	(22.5)	131	(24.7)	11	(11.1)	1.0					
With Exposure to IPV and without Maternal mental disorders	118	(18.7)	110	(20.7)	8	(8.1)	0.9	(0.3–2.2)	0.766	0.8	(0.3–2.1)	0.657
Without Exposure to IPV and with Maternal mental disorders	107	(17.0)	93	(17.5)	14	(14.1)	1.8	(0.8–4.1)	0.170	1.6	(0.7–3.7)	0.295
With Exposure to IPV and with Maternal mental disorders	263	(41.8)	197	(37.1)	66	(66.7)	4.0	(2.0–7.8)	< 0.0001	3.5	(1.7–7.3)	0.001

<sup>a,c</sup>Adjusted by: Woman: age, education, marital status, head of household, smoking, voluntary and retaliation aggression towards partner; Partner: drunkenness, fights outside home; Child: n. of siblings, birth order, type of school.

<sup>b</sup>Adjusted by: Woman: age, education, head of household, smoking, retaliation aggression towards partner; Partner: drunkenness, fights outside home; Child: n. of siblings, birth order, type of school.

<sup>d</sup>Adjusted by: Woman: age, education, head of household, smoking, voluntary and retaliation aggression towards partner; Partner: drunkenness, fights outside home; Child: n. of siblings, birth order, type of school.

(Murray et al., 2011). Both depressed mothers and those who reported IPV in the postpartum period are likely to have fewer positive interactions with their children, which would make it difficult for the child to explore the environment and limit their ability to perceive signs of threat and safety (Peláez, Virues-Ortega, Field, Amir-Kiaei, & Schnerch, 2013), resulting in avoidant attachment styles (Aktar & Bögels, 2017). An association has also been reported between growth delays, attributed to early weaning, with exposure to MMD (Gelaye et al., 2016) and IPV (Moraes, Oliveira, Reichenheim, & Lobato, 2011).

The study results also demonstrate the importance of persisting exposures after the first year of life. The 4th model assessed exposures to IPV and MMD for a longer period of time, reflecting that school-age depression can be a consequence of both exposures during sensitive periods and also the persistence of these adverse events. The pattern of continuity of IPV and MMD suggests that there may have been little or no intervention to help these women, or that there may have been a recurrence of violent events and mental disorders with different partners. In all societies, women with mental disorders and those who are victims of IPV are less able to seek treatment, both for themselves and for their children (Gelaye et al., 2016; Howard et al., 2014; Kiss et al., 2012).

However, effective treatments do exist. A meta-analysis of trials from low income settings (Keynejad, Hanlon, & Howard, 2020) concluded that psychological interventions can treat anxiety effectively in women with current or recent exposure to IPV when delivered by appropriately trained and supervised health-care staff. In Brazil, a cognitive-behavioral intervention that takes into account mothers' history of IPV is Projeto Parceria (The Partnership Project), which takes a psychotherapeutic approach to help mothers overcome the trauma of exposure to IPV, to then be able to implement an educational programme to improve child behavior management (Williams, Santini, & D'Afonseca, 2014). In many LMICs, the problem is access to effective psychological treatments, but interventions supported by mobile phones (mHealth) technologies may help to reduce this gap. For example, the CONEMO trial in Brazil and Peru is testing a low-intensity treatment for depression using a psychoeducational 6-week intervention delivered via mobile phones and assisted by a nurse (Menezes et al., 2019). In high income countries, interventions include advocacy programs to empower women exposed to IPV and improve well-being (Rivas et al., 2015), cognitive behavior therapy for depressed mothers (Ammerman et al., 2013), trauma-focused treatments for mothers and children (Brymer, Gurwitch, & Briggs, 2021; Silverman, Ortiz, & Viswesvaran, 2008), and home visiting programs to promote the well-being of mothers, stimulate competent care of children, as well as to improve physical and mental health of children (Dodge, Goodman, Bai, Donnell, & Murphy, 2019; Olds et al., 2007).

Multiple episodes increase the chance of more prolonged negative effects and both age and persistence of exposure to MMD are strong predictors of childhood depression (Brennan et al., 2000; Claessens et al., 2015; Herba, Glover, Ramchandani, & Rondon, 2016). Both IPV and MMD showed a high continuity rate, also demonstrating a high risk, for the children, of being exposed continuously and living in a stressful life context (Goodman and Gotlib's fourth mechanism). Depression identified at school age can continue in adolescence (Murray et al., 2011) and into adulthood (Plant, Pariente, Sharp, & Pawlby, 2015), indicating that to understand depression, a life course approach is needed (Colman & Ataullahjan, 2010).

It is important to emphasize that not all children exposed to adverse childhood events develop depression. Many show resilience, maintaining good mental health and wellbeing in spite of being exposed to adversity, such as IPV (Howell, 2011). A recent review of profiles of adjustment of children and adolescents exposed to IPV (Cameranesi, Piotrowski, & Brownridge, 2020) identified a number of individual-level (eg child's self-esteem and problem-solving ability), family-level (eg extended family such as grandparents), and environmental-level (eg supportive school environment) factors that were significantly associated with resilient adjustment. In the absence of mental health disorders, the mother has more resources to cope with the effect of IPV and can maintain her capacity for adequate parenting (Martinez-Torteya, Bogat, von Eye, & Levendosky, 2009), to reduce the impact on her child of exposure to IPV and help her child regulate emotional responses to the exposure (Howell, 2011; Martinez-Torteya et al., 2009). However, when MMD are also present the mother may become unable to protect and meet her child's needs (Stein et al., 2014), and expose her child to negative affectivity and behaviors (Goodman and Gotlib's third mechanism), especially in situations of conflict. Therefore, to promote resilience in children, it is necessary to identify mothers exposed to IPV, and support their self-esteem and well-being, in order to effectively help them in their parenting (Santini & Williams, 2016; Williams et al., 2014).

The strengths of this study are: a) it is longitudinal and population-based; b) it has a large sample, with 630 mother-child pairs; c) it evaluated women's reports of IPV and MMD at 3 times, to assess impact of prenatal, postpartum and continuous exposures; d) it analyzed children's exposure to IPV and MMD both separately and combined, making it possible to assess their cumulative impact.

The limitations include: a) like all cohort studies, there was attrition at follow-up 7 years after enrollment, although there were no major demographic differences between those women who were followed up and those who were not, it is probable that the families who were lost had worse experience of maltreatment and so the associations demonstrated could be an underestimate of the reality; b) children's depression was evaluated only through the report of the mother, whose perception of her child's problems can be altered due to her experience with IPV and mental disorders; c) measures of depression, both for the mother and the child, were not clinical evaluations, but used validated questionnaire instruments that capture depressive symptomatology; d) the classification of maternal mental disorders was made using different measures at different times, with overlap between conditions such as anxiety and depression; e) there was no assessment of the mental health of the child's father or of other family members who were in regular contact with the child (studies have shown that the mental health of these parental and family figures may also have a negative or positive influence on the child's mental health [Aktar & Bögels, 2017; Goodman & Gotlib, 1999]); f) the study was undertaken in an urban community in a LMIC, and poverty and social disadvantage were underlying factors.

#### 4. Conclusions

This study assessed the interaction between common problems – IPV, MMD, and childhood depression – in a poor urban community in a LMIC. The frequency of child exposure to IPV and MMD, and the high prevalence of depression at school age, shows the importance

of assessing maternal mental health and identifying exposure to IPV in pregnancy and the early years. To prevent potential risks to the child's mental health and development, maternal mental disorders need to be identified and treated and support provided to empower women to cope with maltreatment and marital conflicts. In addition, it is necessary to involve men in interventions that use techniques to improve communication, manage anger, and encourage problems-solving skills; consequently, preventing the occurrence and recurrence of violent events and reducing the acceptability of IPV.

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The funders of the study had no role in study design, data collection, data analysis, data interpretation, or in the writing of the report. The authors have no conflicts of interest to declare.

The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication

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### Credit authorship contribution statement

EPS is the guarantor for the study and participated in all phases of the study, including the original idea, design, and data analysis and interpretation.

AE interpreted the data, provided advice, and critically revised the manuscript.

ABL conceived and designed the study, trained the data collectors, analyzed and interpreted the data, and critically revised the manuscript.

All authors participated in drafting of the report.

### Declaration of competing interest

The authors declare there are no conflicts of interest.

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