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Intimate partner violence against adult women and its association with major depressive disorder, depressive symptoms and postpartum depression: systematic review and meta-analysis

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Abstract

To date, few systematic reviews of observational studies have been conducted to comprehensively evaluate the co-morbidity of IPV and specific depression outcomes in women. In this systematic review and meta-analysis, the authors summarized the extant literature and estimated the magnitude of the association between IPV and key depressive outcomes (elevated depressive symptoms, diagnosed major depressive disorder and postpartum depression). PubMed (January 1, 1980–Decemer 31, 2010) searches of English-language observational studies were conducted. Most of the selected 37 studies had cross-sectional population-based designs, focused on elevated depressive symptoms and were conducted in the United States. Most studies suggested moderate or strong positive associations between IPV and depression. Our meta-analysis suggested two to three-fold increased risk of major depressive disorder and 1.5 to 2-fold increased risk of elevated depressive symptoms and postpartum depression among women exposed to intimate partner violence relative to non-exposed women. A sizable proportion (9%–28%) of major depressive disorder, elevated depressive symptoms, and postpartum depression can be attributed to lifetime exposure to IPV. In an effort to reduce the burden of depression, continued research is recommended for evaluating IPV preventive strategies.

Keywords

United States; Intimate partner violence; major depressive disorder; elevated depressive symptoms; postpartum depression; meta-analysis

Introduction

Intimate partner violence (IPV) against women is a major public health concern in the United States and worldwide. IPV is often described as a specific type of family or domestic

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violence, in which the perpetrator is a current or former intimate partner of the victim. The Centers for Disease Control and Prevention (CDC) defines IPV as “physical violence, sexual violence, threats of physical/sexual violence, and psychological/emotional abuse perpetrated by a current or former spouse, common-law spouse, non-marital dating partners, or boyfriends/girlfriends of the same or opposite sex” (Chang, Cluss, Ranieri, Hawker, Buranosky, Dado et al., 2005).

IPV is highly prevalent among women in the general population as well as those identified in clinical settings (Coker, Smith, & Fadden, 2005; Kramer, Lorenzon, & Mueller, 2004; Magnussen, Shoultz, Oneha, Hla, Brees-Saunders, Akamine et al., 2004; Peralta & Fleming, 2003; Ross, Walther, & Epstein, 2004). Based on national surveys, 25–30% of women in the United States have reported physical and/or sexual abuse by an intimate partner during their lifetime, whereas 2–12% report physical and/or sexual IPV over the past year (Haggerty & Goodman, 2003; Lipsky, Holt, Easterling, & Critchlow, 2004). Based on clinical studies, the prevalence estimates of physical, sexual and/or emotional abuse against women are 21–55% over a lifetime and 4–44% in the past year (Breiding, Black, & Ryan, 2008; P. Tjaden, Thoennes, N., 2000; P. Tjaden, Thoennes, N., 1998a; P. Tjaden, Thoennes, N., 1998b).

IPV is associated with a wide range of short-term and long-term physical and mental health sequelae. Victims of IPV were shown to be at an increased risk for injury (Burke, Thieman, Gielen, O'Campo, & McDonnell, 2005; Campbell, 2002), disability (Coker et al., 2000a; Coker et al., 2005), chronic pain (Burke et al., 2005; Campbell, 2002; Koopman, Ismailji, Holmes, Classen, Palesh, & Wales, 2005; Kramer et al., 2004), arthritis (Coker et al., 2000a), headaches or migraine (Coker et al., 2000a; Kramer et al., 2004), gastrointestinal signs (Burke et al., 2005; Campbell, 2002), vaginal bleeding and sexually transmitted infections (Burke et al., 2005; Campbell, 2002; Kramer et al., 2004), substance use and abuse (Campbell, 2002; Fals-Stewart & Kennedy, 2005), social dysfunction (Burke et al., 2005; Campbell, 2002), insomnia (Burke et al., 2005; Campbell, 2002), post-traumatic stress disorder (Bradley, Schwartz, & Kaslow, 2005; Koopman et al., 2005; Woods, Page, O'Campo, Pugh, Ford, & Campbell, 2005; Woods, 2005), anxiety (Burke et al., 2005; Campbell, 2002), depression (Al-Modallal, Peden, & Anderson, 2008; Golding, 1999) and suicidal thoughts (Kramer et al., 2004; Meadows, Kaslow, Thompson, & Jurkovic, 2005).

The salience of IPV as a risk factor for mental health problems, in general, and depression, in particular, requires further evaluation. To date, few systematic reviews of observational studies have been conducted to comprehensively evaluate the co-morbidity of IPV and depression in women (Al-Modallal, Peden, & Anderson, 2008; Golding, 1999). In addition, no recent meta-analyses have been conducted to estimate the magnitude of the association between IPV and specific types of depressive outcomes. In 1999, Golding published a meta-analysis to assess the prevalence of mental health problems among women with a history of intimate partner violence. The prevalence of mental health problems among women experiencing IPV was 47.6% in 18 studies of depression, 17.9% in 13 studies of suicidality, 63.8% in 11 studies of posttraumatic stress disorder, 18.5% in 10 studies of alcohol abuse, and 8.9% in 4 studies of drug abuse. Odds ratios (OR) representing associations of these mental health problems with IPV ranged from 3.55–5.62, and were generally consistent across studies (Golding, 1999). In Golding’s meta-analysis, no distinction was made regarding specific types of depression; the estimated OR (95% confidence interval) for the association between IPV and depression was 3.80 (3.16–4.57) (Golding, 1999). In this systematic review and meta-analysis, we conducted a PubMed (1980–2010) search of population-based and clinical studies focusing on pregnant and non-pregnant women to summarize the extant literature and estimate the magnitude of the association between IPV and key depressive outcomes (elevated depressive symptoms (EDS) detected by various

screening instruments, diagnosed major depressive disorder (MDD) and postpartum depression (PPD)).

Materials and Methods

Search methodology

The literature search was conducted systematically using the PubMed database by combining the keywords “depression” and “intimate partner violence.” To avoid heterogeneity in the way these concepts were defined, synonymous keywords were not included in the search. We restricted the literature search to human studies in the English language published between 1 January 1980 and 31 December 2010. Figure 1 shows the result of the search, inclusion and exclusion criteria and the final number of studies.

Inclusion and exclusion criteria

The process of including and excluding studies was initiated by examining the study titles and abstracts and screening them for immediate relevance to our research question. Papers not excluded based on their abstracts were obtained as full text and screened for potential inclusion in the systematic review and meta-analysis. The studies that were included in the systematic review were those that assessed any type of association between IPV and depression (MDD or PPD) or EDS. Studies included in the meta-analysis were those that presented findings in terms of risk ratios (RR), hazard ratios (HR) or odds ratios (OR), and thus had a binary outcome for MDD, EDS or PPD and categorical measurement of IPV (usually binary). Primary reasons for excluding studies were “No relevant data available,” “Study is a randomized controlled trial,” “Study subjects are not adult women,” “Outcome is not MDD, EDS or PPD,” or “Exposure is not IPV”. No restriction was made on age or setting (e.g. population-based *vs.* clinical), and the meta-analysis was carried out on all observational study designs including cross-sectional, prospective and retrospective cohort studies. IPV experienced by individuals less than 18 years of age may be considered as “teenage dating violence”. Nevertheless, we decided to include all studies that included adult women, irrespective of whether some of the subjects were teenagers.

A total of 234 manuscript titles and abstracts were initially identified for screening. The systematic literature search and screening of abstracts yielded 83 potentially relevant papers, from which 37 were eventually selected for review and meta-analysis upon further examination of their full-text (Al-Modallal, Abuidhail, Sowan, & Al-Rawashdeh, 2010; Bauer, Rodriguez, & Perez-Stable, 2000; Beydoun et al., 2010; Bonomi, Anderson, Cannon, Slesnick, & Rodriguez, 2009a; Bonomi, Anderson, Reid, Rivara, Carrell, & Thompson, 2009b; Bonomi, Anderson, Rivara, & Thompson, 2007; Bonomi, Thompson, Anderson, Reid, Carrell, Dimer et al., 2006; Caetano & Cunradi, 2003; Chang, Shen, & Takeuchi, 2009; Coker et al., 2001; Coker et al., 2002; Davis, Coker, & Sanderson, 2002; Deyessa, Berhane, Alem, Ellsberg, Emmelin, Hogberg et al., 2009; Dunn & Oths, 2004; Gao, Paterson, Abbott, Carter, & Iusitini, 2008; Gielen, McDonnell, O'Campo, & Burke, 2005; Gomez-Beloz, Williams, Sanchez, & Lam, 2009; Hathaway, Mucci, Silverman, Brooks, Mathews, & Pavlos, 2000; Hayes, Ta, Hurwitz, Mitchell-Box, & Fuddy, 2010; Hazen, Connelly, Kelleher, Landsverk, & Barth, 2004; Hegarty, Gunn, Chondros, & Small, 2004; Hegarty, Gunn, Chondros, & Taft, 2008; Hillemeier, Weisman, Chase, & Dyer, 2008; Houry, Kemball, Rhodes, & Kaslow, 2006; Hurwitz, Gupta, Liu, Silverman, & Raj, 2006; Lehrer, Buka, Gortmaker, & Shrier, 2006; Lipsky, Caetano, & Roy-Byrne, 2009; Ludermir, Lewis, Valongueiro, de Araujo, & Araya, 2010; Rodriguez, Heilemann, Fielder, Ang, Nevarez, & Mangione, 2008; Romito & Grassi, 2007; Schneider, Burnette, Ilgen, & Timko, 2009; Tiwari, Chan, Fong, Leung, Brownridge, Lam et al., 2008; Vaeth, Ramisetty-Mikler, & Caetano, 2010; Valentine, Rodriguez, Lapeyrouse, & Zhang, 2010; Vung, Ostergren, &

Krantz, 2009; Wong, Huang, DiGangi, Thompson, & Smith, 2008; Yang, Yang, Chang, Chen, & Ko, 2006). As such, a database was created using Endnote version X3 ("Endnote ", 2010) and an Excel sheet was used by two authors to extract data on study characteristics.

Data extraction and pooling of results

We conducted a meta-analysis of selected studies to assess the strength of the association between IPV and various outcomes of interest, namely MDD, EDS and PPD when the study subject was an adult woman. The type of instrument used for each of these outcomes differed among studies and are listed in Table 1. However, the three broad outcome categories were used to conduct the meta-analysis, irrespective of the screening instrument or diagnostic tool used to measure the outcome. IPV exposures, though defined differently across studies (See Table 1), were considered comparable as in the case of the outcomes and were not distinguished for stratification purposes in the meta-analysis. Although physical and/or sexual forms of IPV are likely to have a greater impact on depression than psychological/emotional forms of IPV, the heterogeneity in how IPV was defined and measured in the selected studies precludes its further classification into sub-types. In the meta-analysis, RR estimates from each study were pooled together. However, because many of the effect estimates were OR, a formula was used to convert OR into RR whenever possible (Zhang & Yu, 1998), given that study-specific prevalence of outcome among the unexposed ($Prev_0$) group was available (See Equations 1.1–1.3). If that prevalence was unreported, it was approximated by total outcome prevalence ($Prev_{total}$). The average prevalence across studies was used as an approximation whenever $Prev_0$ and $Prev_{total}$ were unavailable in a particular study.

$$RR_{p,ij}=\frac{OR_{p,ij} \times (1 - P_{0i})}{(P_{0i} \times OR_{p,ij})} \quad \text{Equation 1.1}$$

$$SE_{Ln(RR_{ij})}=SE_{Ln(OR_{ij})}=\frac{Ln(OR_{ucl,ij}) - Ln(OR_{lcl,ij})}{3.92} \quad \text{Equation 1.2}$$

$$RR_{95\%CI,ij}=e^{Ln(RR_{p,ij})\pm 1.96 \times SE_{Ln(RR_{p,ij})}} \quad \text{Equation 1.3}$$

where $RR_{p,ij}$ is the point estimate of RR from each study i and datapoint j; $OR_{p,ij}$ is the point estimate of OR from each study i and data point j; P_{0i} is the study-specific prevalence of outcome among the unexposed group; Ln is natural log; SE is standard error; LCL is lower confidence limit and UCL is upper confidence limit of 95% CI.

The RR were pooled using random effects models if data points included were heterogeneous based on Q-test for homogeneity ($p<0.05$) or fixed effect when the set of data points were homogenous ($p>0.05$). The pooled RR was computed by taking weighted average of the natural logarithm of each relative measure and weighting was done by the inverse of each RR's respective variance (Petitti, 2000). Random effects models incorporating between-study variability were conducted using DerSimonian and Laird's methodology (DerSimonian & Laird, 1986).

The pooling strategy involved preliminary stratification of data points by study design only, that is, data points related to different outcomes were pooled together. As such, a summary RR was provided using forest plots for cross-sectional and cohort studies, separately. At a second stage, estimates were stratified to examine other potential sources of heterogeneity within each pooled RR. Secondary stratification variables included (**A**) Type of outcome: 1.

MDD; 2. EDS; 3. PPD; (**B**) Geographical region of the study: 1. United States; 2. non-United States; (**C**) Study setting: 1. Population-based; 2. Clinical. When selecting data points (i.e. RR with 95% CI) from each study, only fully-adjusted models were considered. These models often included as potential confounders age, a measure of socio-economic status, marital status, parity, and race (if applicable). In addition, some studies also included lifestyle factors among potential confounders (e.g. smoking status, alcohol use, drug use).

Considering current estimates of IPV prevalence in the United States (Breiding et al., 2008; P; P. Tjaden, Thoennes, N., 2000; P. Tjaden, Thoennes, N., 1998a; P. Tjaden, Thoennes, N., 1998b), we computed population attributable risk percentage (PAR%) by pooling data points from all studies together but stratifying by type of outcome.

$$PAR\%_{p,lcl,ucl;ij}=\frac{100 \times (\mathrm{Pr}_{\exp} \times (RR_{p,lcl,ucl;ij}-1))}{1+(\mathrm{Pr}_{\exp}(RR_{p,lcl,ucl;ij}-1)}=(1-\theta_{ij}) \times 100 \quad \text{Equation 2.1}$$

$$Var(\theta_{ij})=Var(1-\theta_{ij})=(1-PAR_{p;ij})^2 \times Var(Ln(1-PAR_{p;ij}))=(1-PAR_{p;ij})^2 \times (Ln(1-PAR_{lcl;ij})-Ln(1-PAR_{ucl;ij})/3.92)^2 \quad \text{Equation 2.2}$$

$$PAR\%_{95\%CI;ij}=PAR\%_{p,ij} \pm 1.96 \times \sqrt{Var(\theta_{ij})} \times 100 \quad \text{Equation 2.3}$$

As shown in Equations 2.1–2.3, RR (point estimates per study and data point; 95% CI) was applied to the formula and $\mathrm{Pr}_{\exp}$ was the estimated prevalence of IPV exposure (recent and lifetime) in the United States. The estimation of SE for PAR% was obtained using the delta method (Hildebrandt, Bender, Gehrmann, & Blettner, 2006).

Finally, we used Begg's funnel plots to examine publication bias; RR point estimates were plotted against their standard errors (SE) for each study on a logarithmic scale (Egger, Smith, & Altman, 2001; Egger, Smith, Schneider, & Minder, 1997). This type of bias was formally tested using Begg-adjusted rank correlation tests (Begg & Mazumdar, 1994) and Egger's regression asymmetry test (Egger, Davey Smith, Schneider, & Minder, 1997). All analyses were conducted with STATA 11.0 (StataCorp, College Station, TX) (STATA, 2009). Type I error was set at 0.05.

Results

Table 1 characterizes the 37 studies included in our systematic review and meta-analysis. Although our literature search spanned publication years of 1980 until 2010, relevant studies which we finally selected were published between the years 2000 and 2010. Twenty-four of the 37 studies were conducted in the United States; 32 were cross-sectional studies while only five were prospective or retrospective cohort studies. Sample sizes ranged between 101 and 7154 surveyed participants, with about 60% of selected studies having a sample size greater than 1000. The minimum in the age range reported for each study was 18 years or more in 27 studies and <18 years in 10 studies. Most studies were population-based (24 of 37), while the remaining 13 were conducted in a clinical setting (e.g. hospital waiting room). In 17 out of 37 selected studies, the primary aim was to examine the relationship between IPV and depression.

For the depression outcome, the majority of studies examined EDS (n=25), whereas only seven examined PPD and five examined MDD. Seven of the 25 studies with EDS as outcome used the 20-item CES-D as the screening tool with a cut-point of 16 commonly

used to reflect minor depressive symptoms (Radloff, 1977). However, other screening tools were also used commonly including the shorter versions of the CES-D. Some examples were the Patient Health Questionnaire (PHQ-9) (Spitzer, Williams, Kroenke, Hornyak, & McMurray, 2000) and its shorter version (n=2) (Berg, 2002; Corson, Gerrity, & Dobscha, 2004; Li, Friedman, Conwell, & Fiscella, 2007; Lowe, Kroenke, & Grafe, 2005; Whooley, Avins, Miranda, & Browner, 1997), Beck Depression Inventory (BDI) (Beck, Steer and Brown, 2000) and its shorter version (n=5) (Shaver, 1991) and the General Health Questionnaire (GHQ) (n=1) (Goldberg, 1972). It is worth noting that the latter study used a 1-question item, which is problematic due to the high proportion of false positives identified using only this item (Goldberg, 1972). For PPD, the most commonly used instrument was the Edinburgh postpartum depression scale (EPDS) (Cox, Holden, & Sagovsky, 1987) (n=4), whereas diagnosis of MDD was conducted using criteria from the International Classification of Diseases (ICD-9 or 10) (WHO, 1992) (n=2) or a combination of Diagnostic and Statistical Manual (DSM-IV) (Kessler & Ustun, 2004) and Composite International Diagnostic Interview (CIDI) (APA, 1994) (n=3). The mean prevalence rates of MDD, EDS and PPD from the selected studies were 11.4% (range: 4.8%, 24.1%), 26.1% (range: 7.0%, 75.0%) and 30.7% (range: 7.5%, 89.8%), respectively.

Although IPV was measured differently across studies, there were commonalities in screening tools among the selected studies. For instance, the AAS (McFarlane et al., 1992), a commonly used tool for the assessment of IPV, was used in seven of the 37 studies, while the CTS (Form R) was used in six studies (Straus, 1990). It is worth noting, however, that even if several studies have relied on the same IPV screening tool, some studies may have used all questions, while others may have used sub-scales to reflect specific IPV sub-types, namely physical, sexual and/or emotional/psychological IPV. One or several data points for each study were entered mainly due to alternative and distinctive ways of defining IPV (e.g. emotional abuse *vs.* sexual abuse *vs.* physical abuse or combinations). Moreover, in studies where dose-response was assessed, all reported measures of association (RR) were considered as independent data points.

RR estimates were adjusted for socio-demographic and other covariates in most cases (25 out of 37 studies). Some of the most commonly controlled for covariates included age (28 out of 37), education (20 out of 37), income (16 out of 37), employment status (13 out of 37) and marital status (13 out of 37). Alcohol and drug dependence was also adjusted for in a number of studies (11 out of 37) and so was childhood sexual abuse (10 out of 37). Other forms of stressful events or types of violence were adjusted for in 9 out of 37 studies.

Major Depression

MDD was the outcome related to IPV in five out of 37 studies (Bonomi et al., 2009b; Chang et al., 2009; Deyessa et al., 2009; Hazen et al., 2004; Lipsky et al., 2009). There was consistent evidence for direct relationship between IPV and MDD in all studies. For instance, Bonomi (Bonomi et al., 2009b) studied 3568 women, 18–64 years, who participated in the Behavioral Risk Factor Surveillance System (BRFSS). MDD was defined according to ICD-9 criteria (Starfield, Weiner, Mumford, & Steinwachs, 1991; Weiner, Starfield, & Lieberman, 1992; Weiner, Starfield, Steinwachs, & Mumford, 1991); IPV was defined according to the WEB scale (Smith et al., 1995a) and 5 questions from the BRFSS (Bonomi et al., 2006; Thompson, Bonomi, Anderson, Reid, Dimer, Carrell et al., 2006). Results indicated that the odds of MDD were 3.26 times higher among women with an IPV history compared to those without an IPV history (Bonomi et al., 2009b).

Depressive symptoms

EDS was the outcome related to IPV in 25 out of 37 studies (Al-Modallal et al., 2010; Bauer et al., 2000; Bonomi et al., 2009a; Bonomi et al., 2007; Bonomi et al., 2006; Caetano & Cunradi, 2003; Coker et al., 2001; Coker et al., 2002; Davis et al., 2002; Dunn & Oths, 2004; Gielen et al., 2005; Hathaway et al., 2000; Hegarty et al., 2004; Hegarty et al., 2008; Hillemeier et al., 2008; Houry et al., 2006; Hurwitz et al., 2006; Lehrer et al., 2006; Rodriguez et al., 2008; Romito & Grassi, 2007; Schneider et al., 2009; Vaeth et al., 2010; Vung et al., 2009; Wong et al., 2008; Yang et al., 2006). Several of the large population-based cross-sectional studies used BRFSS data (Bonomi et al., 2009a; Bonomi et al., 2007; Bonomi et al., 2006; Hathaway et al., 2000; Hurwitz et al., 2006), and the majority of studies provided evidence for a positive association between IPV and EDS. For studies where IPV was defined as a dichotomous variable, the strongest positive IPV-EDS association (OR=4.50) was reported by Vung (Vung et al., 2009), whereas the weakest positive IPV-EDS association (OR=1.85) association was reported by Bonomi (Bonomi et al., 2009a).

Postpartum depression

PPD was the outcome related to IPV in seven out of 37 studies (Beydoun et al., 2010; Gao et al., 2008; Gomez-Beloz et al., 2009; Hayes et al., 2010; Hegarty et al., 2004; Ludermir et al.; Tiwari et al., 2008; Valentine et al., 2010). Most studies were cross-sectional with only two prospective cohort studies (Ludermir et al., 2010; Valentine et al., 2010). For studies that examined IPV as a dichotomous variable in relation to PPD, measures of association between IPV and PPD ranged between 1.40 (Hayes et al., 2010) and 5.38 (Valentine et al., 2010).

Seven studies used odds ratios or relative risks to explicitly examine dose-response relations between exposure and outcome, of which 6 assessed varying degrees of exposure to IPV (Caetano & Cunradi, 2003; Chang et al., 2009; Hazen et al., 2004; Houry et al., 2006; Lehrer et al., 2006; Romito & Grassi, 2007) and one considered association of IPV to magnitude of depression severity (Gomez-Beloz et al., 2009). Among those studies that considered variation in IPV exposure, 5 measured severity (Caetano & Cunradi, 2003; Chang et al., 2009; Hazen et al., 2004; Gomez-Beloz et al., 2009; Lehrer et al., 2006) and 2 used the number of exposures to different categories of abuse (e.g. physical, sexual, emotional, etc.) (Houry et al., 2006; Romito & Grassi, 2007). All trends were in the expected direction, with more severe types or more categories of IPV exposure always associated with increased odds of depression outcomes.

Our meta-analysis relied on 37 studies with adequate measures of association that could be pooled together; 80 data points consisted mainly of adjusted OR from multiple logistic regression models with their CI and were focused on categorical measures of IPV in relation to MDD, EDS and PPD.

Publication bias for the data points (n=80) was assessed using primarily the funnel plot which plotted point estimates of RR, OR and HR on Log_e scale against standard errors. Those data points were selected for fully adjusted models with IPV as the main exposure variable associated with any of the three main outcome variables. This plot indicated that all data points lay within the pseudo 95% confidence limits indicating non-appreciable publication bias. This was confirmed by a Begg-adjusted rank correlation test ($\underline{Z}$=0.37; $\underline{P}$=0.71), which indicated non-significant publication bias (P>0.05), and by Egger's regression asymmetry test (bias (SE): 0.32 (0.42); p=0.48).

Figure 2A–C shows a forest plot for the association between IPV and the three depression outcomes (MDD, EDS and PPD) for fully-adjusted models in each cross-sectional study and findings of our pooled analysis. Pooled RR for IPV and MDD indicated a close to three-fold

increased risk of MDD when IPV was present compared to when IPV was absent (RR=2.70; 95% CI:2.22, 3.29) (Figure 2A). Pooled RR for EDS and PPD were indicative of increased risk of depression in the presence of IPV. Using a random-effects model of 45 data points (from 22 studies) including EDS and IPV, a pooled RR of 1.81 was obtained with a 95% CI of (1.63, 2.01) (Figure 2B). In the case of PPD, the risk was increased by less than 50% (RR=1.43; 95% CI: 1.21, 1.69) (Figure 2C).

The associations between IPV and all depression outcomes in the selected cohort studies are presented in Figure 3. Using a random-effects model, pooled RR from those cohort study data points was found to be 1.87 with a 95% CI of (1.42, 2.46). It is worth noting that this analysis was not stratified by type of outcome at this point due to the singular data point found in the case of MDD. In all pooled analyses, significant heterogeneity between data points were found based on the Q-test ($p<0.001$) except for cross-sectional studies with MDD as outcome ($p=0.19$).

Table 2 presents further subgroup analyses for pooled RR of IPV and depression outcomes. The stratifying variables included depression outcome type, geographical region, minimum age of study subjects and study setting. Heterogeneity was examined overall and within each of the two study designs (i.e. cross-sectional *vs.* cohort studies). RR of IPV and depression did not differ significantly across strata in the case of cohort studies. However, in cross-sectional studies and both study designs combined, significant differences in RR were noted between outcome strata, indicating a considerably stronger association between IPV and MDD, as compared to PPD and EDS. RR were homogenous across all other strata in cross-sectional studies and in both designs combined (based on Q-test, $p>0.05$).

Figure 4 shows PAR% which estimates the proportion of disease (three depression outcomes) in the study population that is attributable to the exposure (IPV: lifetime or recent). When considering lifetime IPV prevalence in the United States (estimated at 25% (Tjaden & Thoennes, 2000; Tjaden & Thoennes, 1998a; Tjaden & Thoennes, 1998b), pooled PAR% were found to be 27.7% (95% CI: 20.6%, 34.8%) for MDD, 16.9% (95% CI: 13.7%, 20.1%) for EDS and 9.0% (95% CI: 4.7%, 13.4%) for PPD, indicating that an appreciable percentage of depression could be averted (on average: 9.0%, 27.7%) by eliminating lifetime IPV among adult women in the United States. Similar results were found when considering recent IPV (e.g. within a year), the prevalence of which in the United States was estimated at 10% (Tjaden & Thoennes, 2000; Tjaden & Thoennes, 1998a; Tjaden & Thoennes, 1998b). On average, PAR% ranged between 3% and 13% indicating that these percentages of depression cases can be prevented by eliminating recent IPV among women in the United States. It is worth noting that 10% of the United States population of women represents approximately 15 million women who have been exposed to IPV over the past year. In addition, about 12 million women in the United States experience clinical depression every year. This PAR% suggests that if IPV was prevented, around one million cases of clinical depression could be averted.

Discussion

In this study, we conducted a systematic review and a meta-analysis of published research articles (1980–2010) that examined the relationship between IPV and various outcomes related to depression, namely MDD, EDS and PPD. Of the selected 37 studies, most had a cross-sectional population-based design, were focused on EDS as the outcome of interest and were conducted in the United States. A large number of studies found a moderate or a strong positive association between IPV and depression. This meta-analysis suggested two to three-fold increased risk of MDD and 1.5 to 2-fold increased risk of EDS and PPD among

women exposed to IPV as opposed to women not exposed to IPV. Finally, a sizable proportion (9–28%) of MDD, EDS and PPD may be attributed to lifetime exposure to IPV.

Careful interpretation of study findings should take into account the strengths and limitations of the studies selected as well as those of our meta-analysis. Whereas most of the selected studies had relatively large sample sizes, most had a cross-sectional design which does not allow for establishing a temporal relationship between IPV and depression. In fact, some studies (Lehrer et al., 2006) actually look at depression as a cause of IPV, not vice versa. Nevertheless, the few prospective cohort studies that were included in our meta-analysis yielded similar estimates of an IPV-depression association when compared to cross-sectional studies. The selected English-language studies were mostly relevant to Western societies and were heterogeneous in various respects, including study design, setting and measurement of exposure and outcome variables. Interpretation of results pertaining to EDS is complicated since the depression disease spectrum covered by different screening instruments varies from mild (not requiring intervention) to severe (requiring intervention). Although search, inclusion and exclusion criteria were clearly outlined, no further efforts were made to obtain additional research articles through cross-references, the “Related Articles” feature on PubMed or by consulting experts in the area. Finally, PubMed was the only database used and no terms synonymous to “intimate partner violence” and “depression” were applied.

To our knowledge, only two similar studies have been conducted so far (Al-Modallal et al., 2008; Golding, 1999). A recent study by El-Modallal and colleagues evaluated childhood and intimate partner physical abuse as risk factors for depressive symptoms among women (Al-Modallal et al., 2008). The scope of our study was greater for the types of exposures and outcomes that were examined (Al-Modallal et al., 2008). In addition, our study included both a systematic review and a meta-analysis. Consistent with our findings, the systematic review by El-Modallal and colleagues indicated an association between physical abuse experiences and depressive symptoms, although the association of other risk factors, including other types of abuse, with depressive symptoms confounded this relationship (Al-Modallal et al., 2008).

Given the global burden of depression on the female population, IPV prevention provides an opportunity for reducing the risk of MDD, EDS and PPD. Preventive efforts can be described as being either universal (population-based approach) or targeted (high-risk approach) interventions, depending on their scope and coverage (Stith, 2006b). Alternatively, primary, secondary and tertiary prevention programs have been designed to reduce the burden of IPV and its health sequelae on society by targeting the appropriate risk factors for IPV. The task of public health is mainly primary prevention (Last, 2001). In the context of IPV, primary prevention is a universal effort targeting entire communities and aimed at warding off maladaptive behaviors that could lead to IPV. Examples of primary prevention strategies include educational and media programs that target entire communities with the goal of preventing IPV before it is initiated (Stith, 2006a). School-based intervention programs initiated in teenage years have been shown to be effective at reducing dating violence, a precursor of IPV, even after four years of program implementation (Foshee, Benefield, Ennett, Bauman, & Suchindran, 2004). By contrast, secondary prevention is usually the task of preventive medicine (Last, 2001). When IPV is considered as the “disease” of interest, secondary prevention involves identification of “high-risk” populations to which future IPV interventions can be targeted. Examples include screening programs for the early detection and treatment of IPV within healthcare settings (Stith, 2006a). A systematic review by the United States Preventive Services Task Force concluded that there was insufficient evidence to warrant universal IPV screening in healthcare settings (Nelson et al., 2004), implying a need for further research in that area. Similar findings were

reported by other researchers in a systematic review (Ramsay et al., 2002) and a randomized trial (MacMillan et al., 2009). Finally, tertiary prevention is mostly the task of rehabilitation (Last, 2001). In the realm of IPV, tertiary prevention involves various strategies that target individuals who have already experienced IPV in the past in order to reduce recurrence risk. Examples of tertiary prevention include “batterer treatment” and “shelter-stay” programs (Stith, 2006a).

In the United States, health care settings are used as venues for IPV screening even though evidence for or against this practice remains inconclusive (Nelson et al., 2004). Certifying organizations such as the Joint Commission on Accreditation on Healthcare Organizations and the CDC have recommendations on screening for IPV. Although there is no standard screening tool for IPV, recommendations have been made in educating all health care providers about identifying and discussing IPV with patients (CDC, 2007). Despite these recommendations, a recent study showed that the compliance for IPV screening in the healthcare setting is relatively poor (VDH, 2009). Acute care settings, such as emergency departments, will often employ a brief IPV screening in triage on all patients regardless of chief complaint. However, a recent study showed a lack of benefit in the use of a brief screening tool for IPV for preventing further violence (Koziol-McLain, Garrett, Fanslow, Hassall, Dobbs, Henare-Toka et al., 2010). Some researchers and agencies (e.g. Health Resources & Services Administration) have already noted a strong relationship of IPV prior to or during pregnancy with PPD, implying that screening during pregnancy can help identify patients with a history of IPV who may at high-risk for developing PPD. These patients may benefit from intervention and closer follow-up. In an effort to reduce the burden of depression and other IPV-related health consequences, continued research is recommended for evaluating various forms of IPV preventive strategies, at the primary, secondary and tertiary levels.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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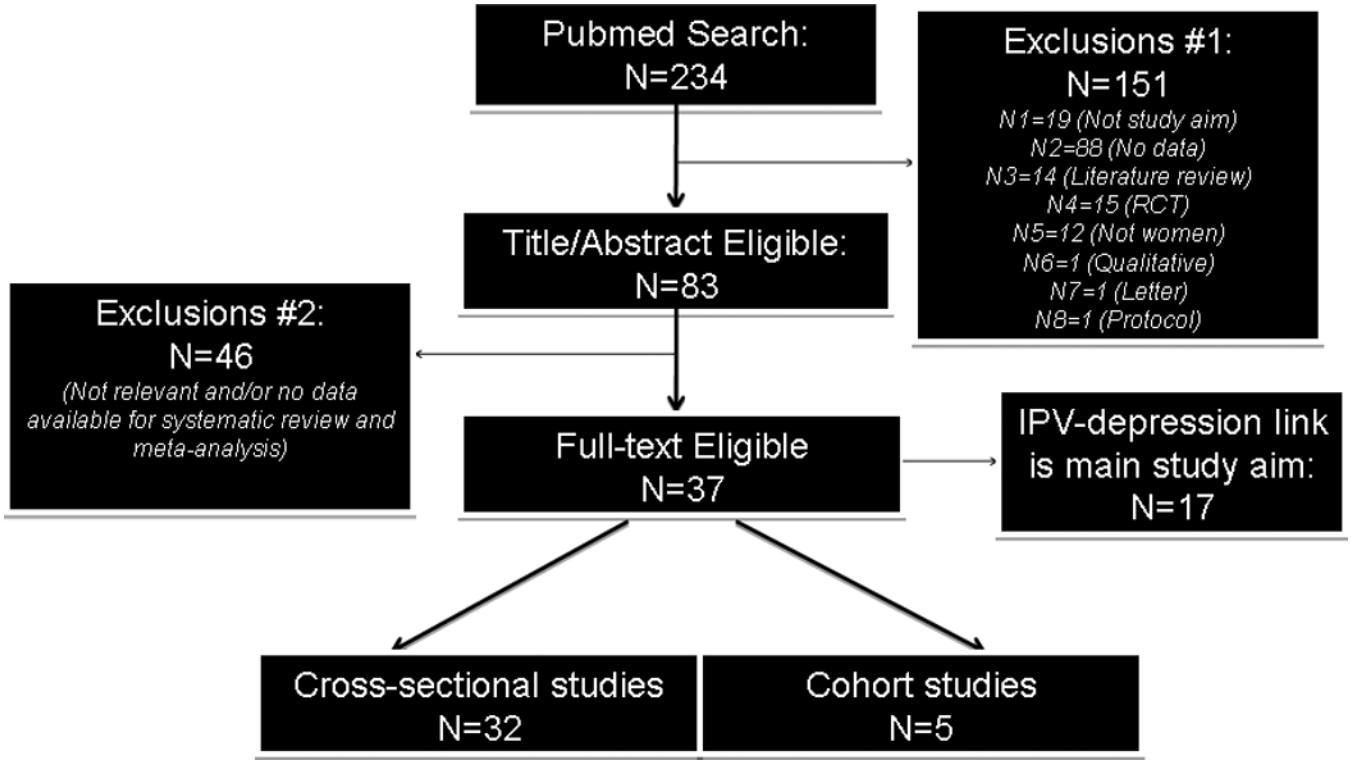
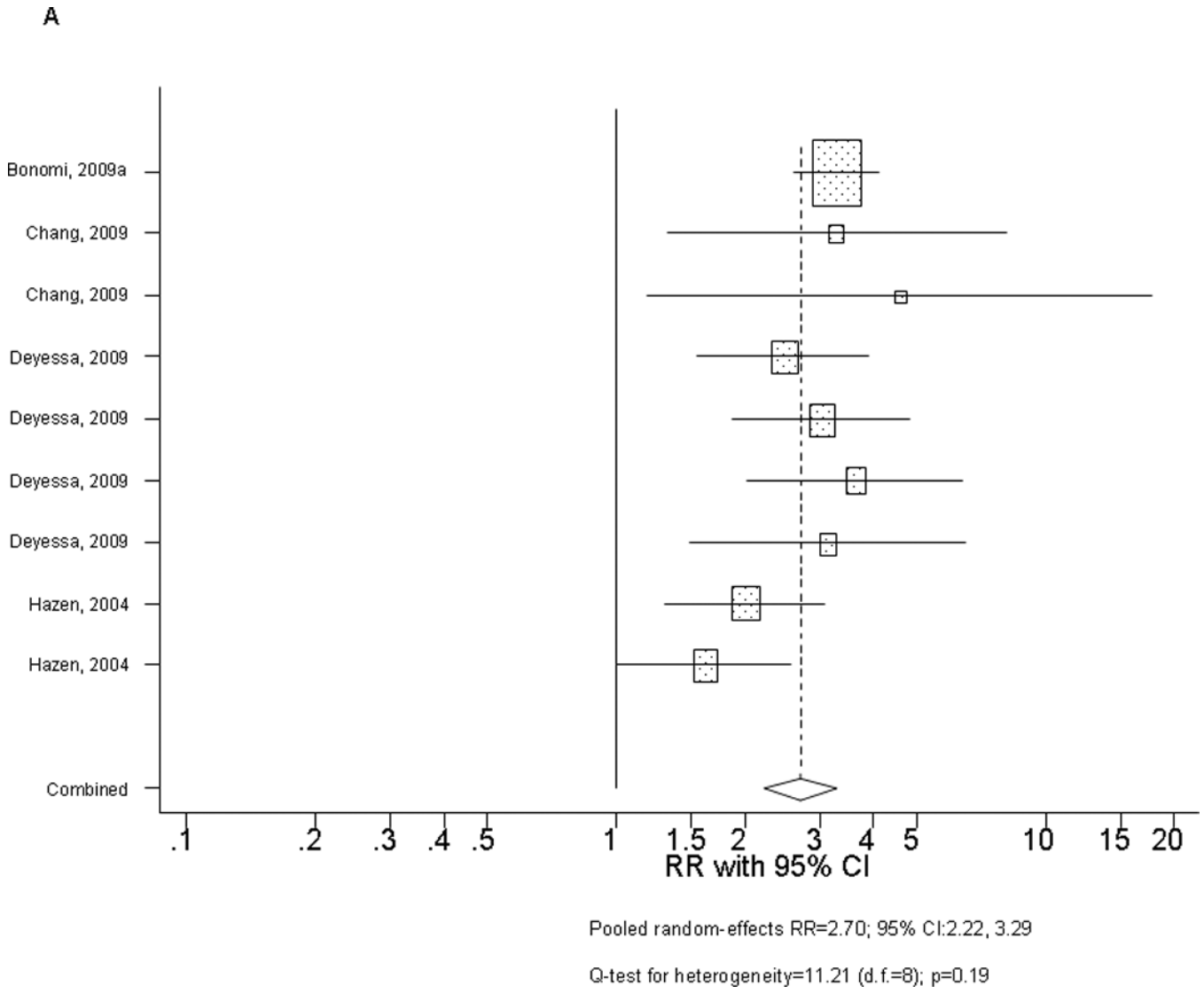
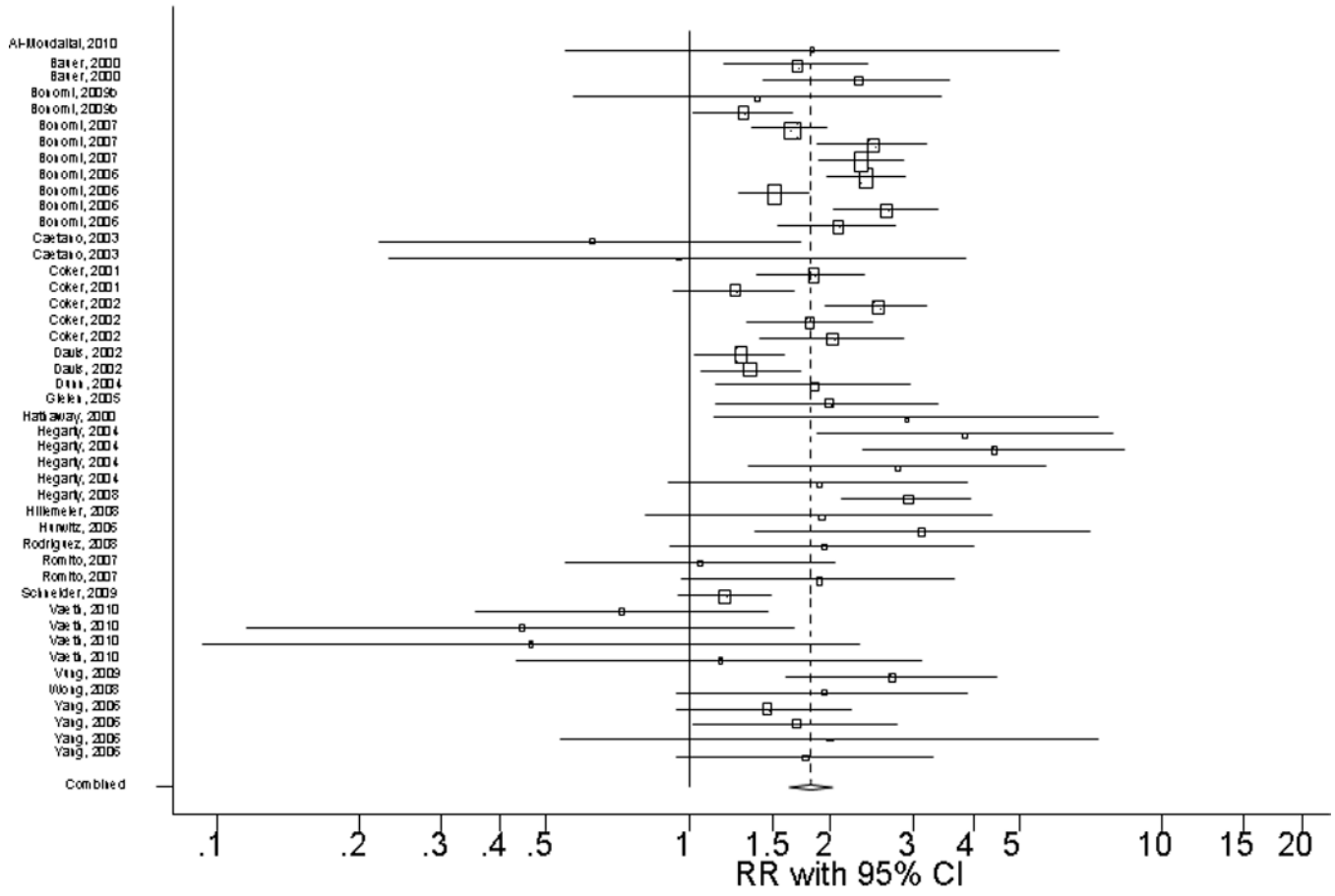


Figure 1.
Flowchart of Study Selection for Systematic Review and Meta-analysis



B



Pooled random-effects RR=1.81; 95% CI:1.63, 2.01

Q-test for heterogeneity=131.8 (d.f.=44); p<0.001

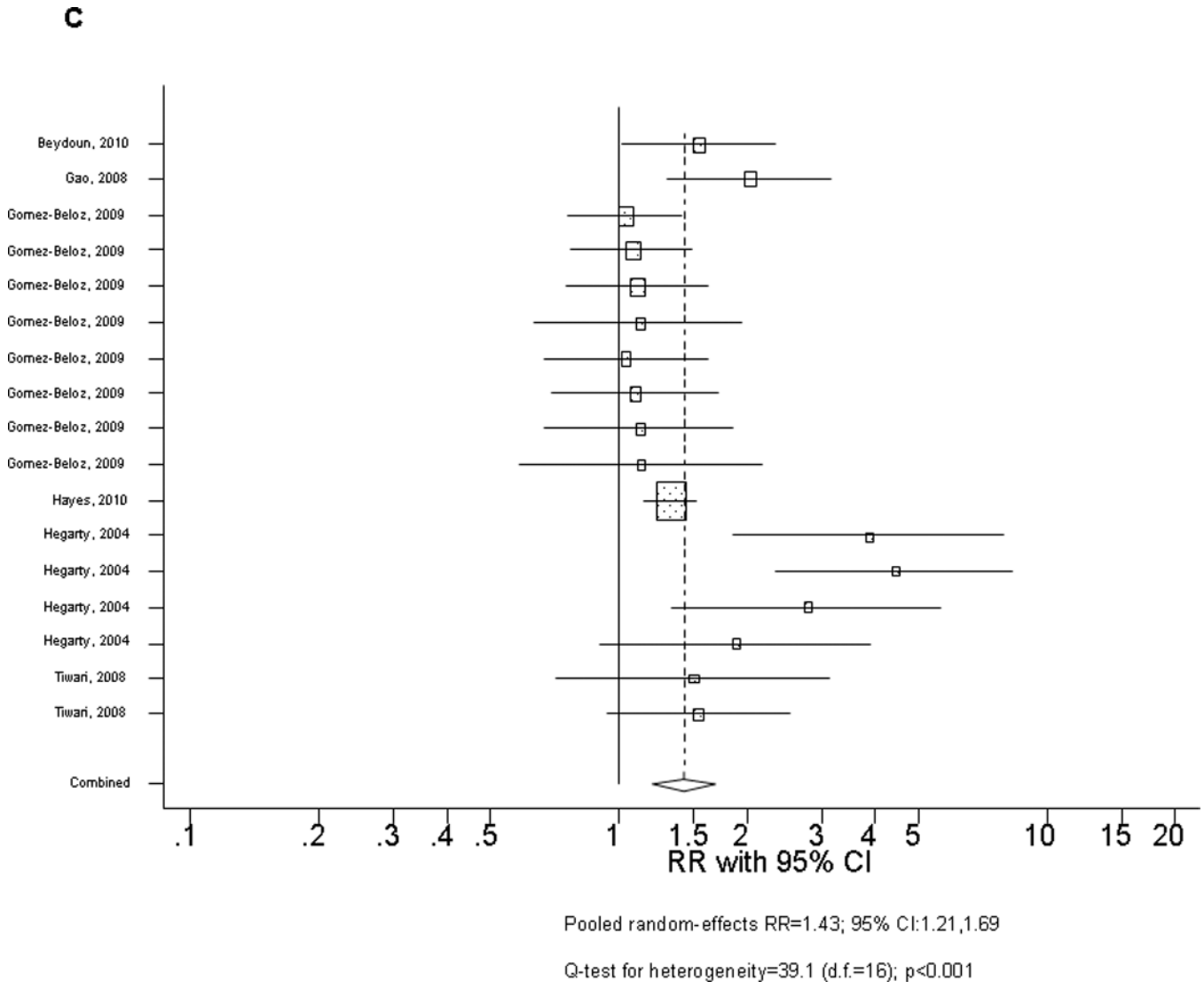


Figure 2.

A. Forest plot for associations between intimate partner violence and major depressive disorder, cross-sectional studies (N=9 datapoints; 4 studies)

B. Forest plot for associations between intimate partner violence vs. elevated depressive symptoms, cross-sectional studies (N=45 datapoints; 22 studies)

C. Forest plot for association between intimate partner violence and postpartum depression, cross-sectional studies (N=17 datapoints; 6 studies)

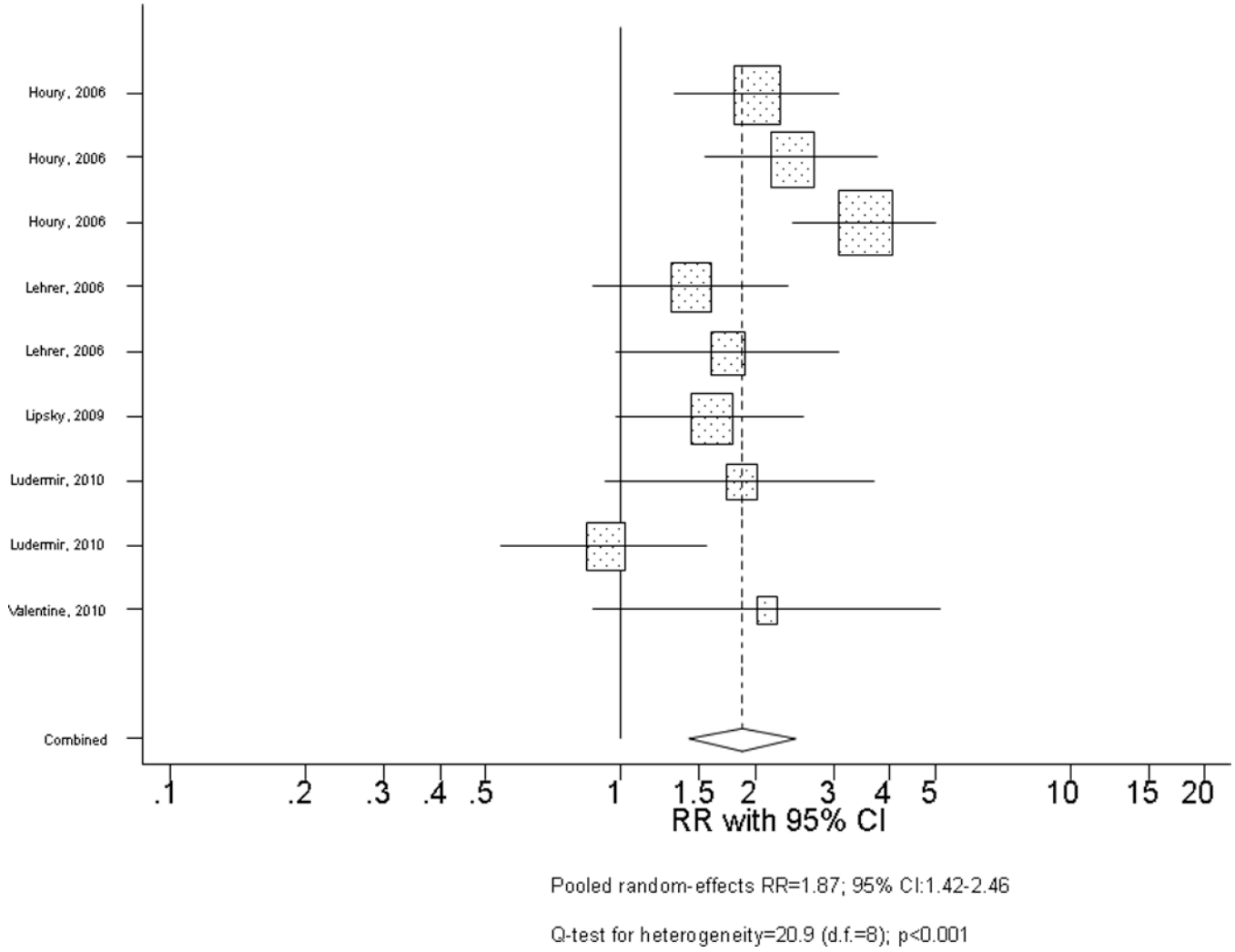


Figure 3.
Forest plot for associations between intimate partner violence and depression (all outcomes), cohort studies (N=9 datapoints; 5 studies)

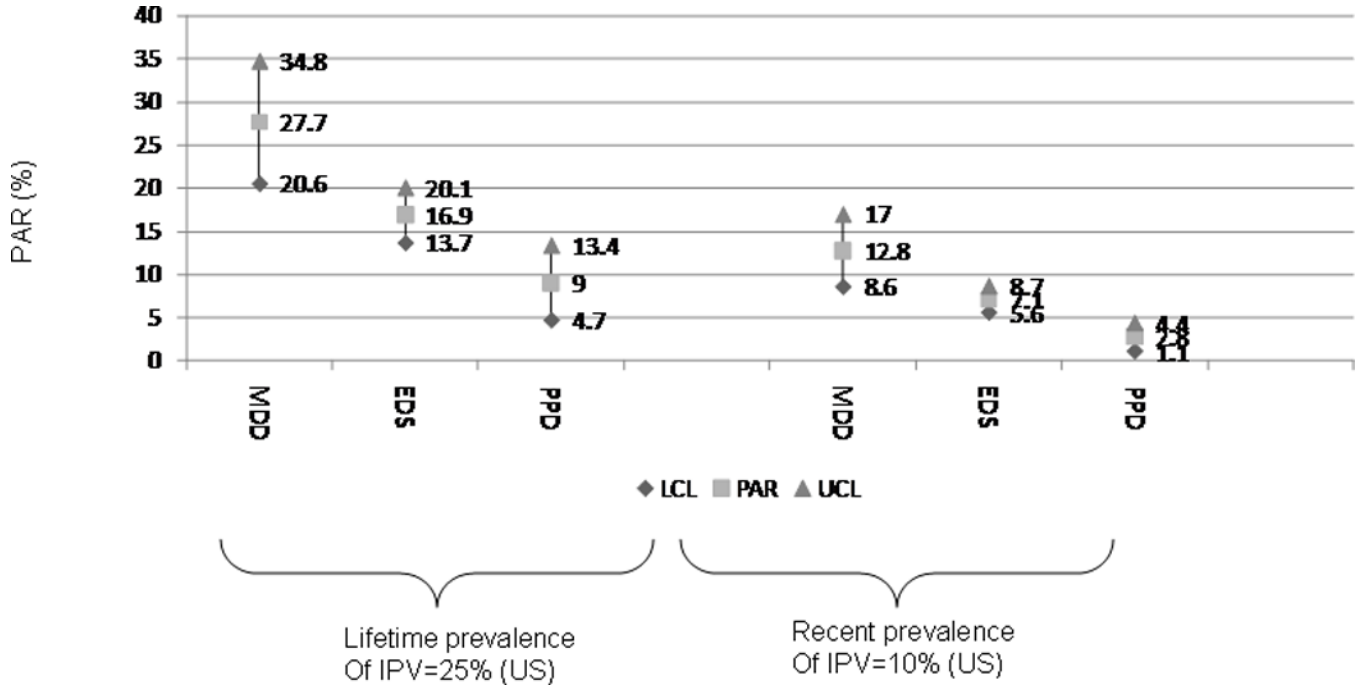


Figure 4.
Population Attributable Risk (PAR) for intimate partner violence vs. Depression (all outcomes; cross-sectional and cohort studies combined)

Table 1

Main characteristics and findings of studies included in the meta-analysis

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
1	(Al-Modallal et al., 2010)	2010	__	Jordan	CX, PB	N=101	n=40 [$Prev_{tot}$=39.6%] [$Prev_0$=36.8%]	Age: 25->40y	EDS, the Center of Epidemiology Study–Depression (CES–D); Score≥16 (Radloff, 1977)	IPV, lifetime spouse abuse, items derived from a congressional report (Office, 1998)	*Spousal abuse vs. EDS* OR = 3.5; 95% CI: 1.05, 11.7	Age, marital status, education, parity, income, health insurance, spouse occupational status.
2	(Bauer et al., 2000)	2000	__	US	CX, PB	N=734	n=242 [$Prev_{tot}$=33%] [$Prev_0$=22%]	Age: 18–46y	EDS, self-report of depressed mood or ahedonia over the past four weeks (Whooley et al., 1997)	IPV, Abuse Assessment Screen (McFarlane et al., 1992)	EDS vs. IPV *Abused in past*: OR=2.1; 95% CI: 1.5, 3.0 *Recent abuse*: OR=3.5; 95% CI:2.2, 5.5	Age and marital status.
3	Beydoun et al., 2010 *	2010	Maternity Experience Survey (MES)	Canada	CX, PB	N=6,421	n=482; [$Prev_{tot}$=7.5%] [$Prev_0$=7%]	Age: 15+y	PPD, Edinburgh Postpartum Depression Scale; Score ≥13 (Cox et al., 1987)	IPV, 10-items screener (MES) (Dzakpasu, Kaczorowski, Chalmers, Heaman, Duggan, & Neusy, 2008)	*IPV vs. PPD*: OR=1.61; 95% CI: 1.06,2.45	Education, income, urban-rural, Immigrant status, province, Age, marital status, number of past pregnancies, pregnancy and delivery-related characteristics (including health and lifestyle).
4	(Bonomi et al., 2009b)	2009a	Behavioral Risk Factor Surveillance System (BRFSS)	US	CX, PB	N=3,568	n=255 [$Prev_{tot}$=13.2%] [$Prev_0$=10.3%]	Age: 18–64y	MDD, ICD-9 (Starfield et al., 1991; Weiner et al., 1992; Weiner et al., 1991)	IPV, Women's Experience with Battering (WEB) Scale (P. H. Smith et al., 1995a) and 5 questions from BRFSS (Bonomi et al., 2006; Thompson et al., 2006)	*IPV vs. MDD*: RR=3.26; 95% CI: 2.59, 4.08.	Age
5	(Bonomi et al., 2009a)	2009b	__	US	CX, PB	N=3,426	n=685 [$Prev_{tot}$=20%] [$Prev_0$ = 13.7%]	Age: 18–64y	EDS, five validated items from the Center of	IPV, Women's Experience with Battering (WEB) Scale,	IPV vs. EDS: *Latinas:* RR= 2.44; 95%CI:	__

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
									Epidemiology Study–Depression (CES–D); Cutoff at 4+; range 0–15 (Bonomi, Kernic, Anderson, Cannon, & Slesnick, 2008; Shrout & Yager, 1989)	and 5 questions from the BRFSS (Coker et al., 2001; P. H. Smith et al., 1995a)	1.35, 4.39 *Non-Latinas*: RR=1.85 95%CI: 1.59, 2.15	
6	(Bonomi et al., 2007)	2007	—	US	CX, PB	N=3,008	n=595 [$Prev_{tot}$=19.8%] [$Prev_0$=13.8%]	Age: 18–64y	EDS, five questions from the Center for Epidemiological Studies-Depression (CES-D) scale. Cutoff at 4+; range 0–15 (Shrout & Yager, 1989).	IPV, Women's Experience with Battering (WEB) Scale, and 5 questions from the BRFSS (P. H. Smith et al., 1995a; Thompson et al., 2006; Verhoek-Oftedahl, Pearlman, & Coutu Babcock, 2000; Vest, Catlin, Chen, & Brownson, 2002)	EDS vs.: *Physical IPV only*: RR=1.64; 95% CI: 1.36, 1.98. *Sexual IPV only*: RR=2.45; 95% CI: 1.87, 3.21 *Physical and sexual IPV*: RR=2.31; 95% CI: 1.88, 2.84.	Age, income, any abuse as a child.
7	(Bonomi et al., 2006)	2006	Behavioral Risk Factor Surveillance System (BRFSS)	US	CX, PB	N=3,429	n=687 [$Prev_{tot}$=20%] [$Prev_0$=13.8%]	Age: 18–64y	EDS, five questions from the Center for Epidemiological Studies-Depression (CES-D) scale. Cutoff at 4+; range 0–15 (Shrout & Yager, 1989).	IPV, the Women's Experience with Battering (WEB) scale and five questions from the BRFSS survey (Coker et al., 2001; Coker et al., 2000a)	EDS vs.: *Recent IPV:* RR=2.38; 95% CI: 1.98, 2.86 *Remote IPV:* RR=1.51; 95% CI: 1.27, 1.80. *Physical IPV*: RR= 2.61 ; 95% CI: 2.02, 3.38 *Non-physical IPV*: RR= 2.06 ; 95% CI: 1.56, 2.73	Age, income, and any physical or sexual abuse as a child.

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
8	(Caetano & Cunradi, 2003) *	2003	__	US	CX, PB	N=673	n=109 [$Prev_{tot}$=16.2%] [$Prev_0$=11.0%]	Age: 18+y	EDS, Center for Epidemiologic Studies-Depression (CES-D) Scale; Score >16 (Radloff, 1977)	IPV, Conflict Tactics Scale, Form R (M.A. Straus, 1990)	All races: *Moderate IPV*: OR=0.59; 95% CI: 0.21, 1.64 *Severe IPV*: OR=0.94; 95% CI: 0.23, 3.81	Race/ethnicity, employment, neighborhood SES, Impulsivity, Childhood physical abuse, exposure to parental violence, alcohol drinking behavior
9	(Chang et al., 2009) *	2009	National Violence Against Women (NVAW)	US	CX, PB	N=1470	n=96 [$Prev_{tot}$=6.5%] [$Prev_0$~5%]	Age: 18+y	MDD, (WMH-CIDI) (Association, 1994). Adapted from DSM IV (R. C. Kessler & Ustun, 2004).	IPV, an adaptation of the minor and severe physical violence subscales of the original Conflict Tactics Scales (CTS) (M. A. Straus, 1979).	Minor IPV vs. MDD: OR=3.72; 95% CI: 1.50, 9.26 Severe IPV vs. MDD: OR=5.67; 95% CI: 1.47, 21.88	Age, education, income, employment status, relationship status, family size, alcohol use, substance abuse, years in the US, Asian ethnicity.
10	(Coker et al., 2001) *	2001	__	US	CX, C	N=1152	n=293 [$Prev_{tot}$=25%] [$Prev_0$=21%]	Age: 18–65y	EDS, CES-D 20-items, cutoff 16 (Radloff, 1977).	IPV, ISA-P (Hudson, 1991) and the Women's Experience with Battering (WEB) (Coker, Smith, McKeown, & King, 2000b; P. H. Smith, Smith, J.B., Earp, J.A., 1998; P. H. Smith, Tessaro, & Earp, 1995b)	*EDS vs. IPV (WEB):* RR=1.82; 95% CI: 1.39, 2.36 *EDS vs. IPV (ISA-P):* RR=1.25; 95% CI:0.93, 1.69	Age and insurance type.
11	(Coker et al., 2002)	2002	__	US	CX,C	N=1152	n=293 [$Prev_{tot}$=25%] [$Prev_0$=21%]	Age: 18–65y	EDS, CES-D 20-items, cutoff 16 (Radloff, 1977).	IPV, the Women's Experience with Battering (WEB) (P. H. Smith et al., 1995a; P. H. Smith, Smith, J.B., Earp, J.A., 1998;	*EDS vs. Sexual IPV*: RR=2.5; 95% CI: 2.0, 3.3 *EDS vs. Physical no sexual IPV*: RR=1.8; 95%CI:1.3, 2.4 *EDS vs. Psychological*	Race, age, Medicaid insurance status.

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
										P. H. Smith et al., 1995b)	*but no physical or sexual IPV*: RR=2.0; 95% CI:1.4, 2.8	
12	(Davis et al., 2002)	2002	National Violence Against Women (NVAW) survey	US	CX, PB	N=6,653	NR	Age: 18–65y	EDS, Short form of the Beck Depression Inventory (BDI) (Shaver, 1991)	IPV, 20-item stalking index (Tjadem, 1998, 2000).	IPV vs. EDS: *Stalked, very afraid*: OR=1.4 ; 95% CI:1.1, 1.7 *Stalked, somewhat afraid*: OR=1.5 ; 95% CI:1.1, 1.8	Age, race, health insurance status, childhood physical or sexual abuse, physical partner violence (The Conflict Tactics Scales) continuous score.
13	(Deyessa et al., 2009)*	2009	WHO multi-country study	Ethiopia	CX, PB	N=1,994	n=96 [$Prev_{tot}$=4.8%] [$Prev_0$=2.7%]	Age: 15–49y	MDD, International Classification of Diseases, 10th edition (ICD-10) (WHO, 1992)	IPV, WHO standardized questionnaire (Garcia-Moreno, Jansen, Ellsberg, Heise, & Watts, 2006)	MDD vs. *Physical violence*: OR=2.56; 95% CI: 1.61, 4.06 *Mild emotional violence*: OR=3.19; 95% CI: 1.98, 5.14 *Severe emotional violence*: OR=3.90; 95% CI: 2.20, 6.93 *High spousal control*: OR=3.30; 95% CI: 1.58, 6.90	Age, residency, education, religion, occupational status, poverty status, khat chewing, marriage type.
14	(Dunn & Oths, 2004)	2004	__	US	CX, C	N=439	NR	Age: 20–34y	EDS, 10-items CES-D, adapted from (Radloff, 1977)	IPV, Abuse Assessment Scale (Parker & McFarlane, 1991)	*IPV vs. EDS*: OR=2.47; 95%CI:1.54, 3.95	Age, ethnicity, education, income, marital status, insurance status, employment status, maternal characteristics, smoking, alcohol, material possessions, stressful life events,

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
												social support, faith.
15	(Gao et al., 2008) *	2008	Pacific Islands Families (PIF) study	New Zealand	CX, PB	N=1,085	n= 165 [$Prev_{tot}$=15%] [$Prev_0$=10.4%]	Age : <20–40+	PPD, Edinburgh Postpartum Depression Scale; Score ≥13 (Cox et al., 1987)	IPV, Form R of the Conflict Tactics Scale (CTS) developed by Straus (M.A. Straus, 1990)	*IPV vs. PPD*: OR=2.3; 95% CI: 1.5, 3.6	Maternal ethnicity, household income, parity, satisfaction with home, difficulty with transport, reaction to pregnancy, satisfaction with infant's sleep patterns, happiness in relationship, and whether stressed due to insufficient money for food that were collected at the baseline 6-week interview.
16	(Gielen et al., 2005) *	2005	Project WAVE (Women, AIDS, and the Violence Epidemic)	US	CX, PB	N=611	n=305 [$Prev_{tot}$=50%] [$Prev_0$=24.5%]	Age: 18+y	EDS, self reported history of depression	IPV, Abuse Assessment Screen (Soeken, 1998)	*IPV vs. EDS*: OR=2.86; 95% CI: 1.67, 4.90 [Note: among HIV-subgroup]	Drug ever use, age, income per capita.
17	(Gomez-Beloz et al., 2009) *	2009	—	Peru	CX, C	N=2,317	n=2,082 [$Prev_{tot}$=89%] [$Prev_0$=87.4%] Mild through Severe PPD.	Age: 16+y	PPD, PHQ-9 (Spitzer et al., 2000). Cutoffs: Mild PPD: 5–9 Moderate PPD: 10–14 Severely moderate PPD:15–19 Severe PPD: 20–27	IPV, Domestic Violence Module (Surveys, 2005) and the WHO multi-country study on violence against women (Garcia-Moreno et al., 2006).	Lifetime IPV: *IPV vs. Mild PPD*: OR=1.39; 95% CI:1.02, 1.88 *IPV vs. Moderate PPD*: OR=2.26; 95% CI:1.64, 3.12 *IPV vs. Severely moderate IPV*: OR=3.88; 95% CI:2.64, 5.70 *IPV vs.*	Age, education, employment.

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
											Severe PPD: OR=5.19; 95% CI: 2.96, 9.10 IPV during pregnancy: *IPV vs. Mild PPD*: OR=1.46; 95% CI:0.94, 2.27 *IPV vs. Moderate PPD*: OR=2.88; 95% CI:1.84, 4.52 *IPV vs. Severely moderate IPV*: OR=5.54; 95% CI:3.35, 9.18 *IPV vs. Severe PPD*: OR=9.88; 95% CI: 5.13, 19.04	
18	(Hathaway et al., 2000)	2000	Behavioral Risk Factor Surveillance System (BRFSS)	US	CX, PB	N=2,043	n=144 [$Prev_{tot}$ =7%] [$Prev_0$=6.3%]	Age: 18–59y	EDS, self-reported history of depression: "Sad/depression for 14+ days over the past month"	IPV, the CDC's 1994 draft Violence Module for the BRFSS (CDC, 1994), the 1996 New Mexico BRFSS (D.O.H., 1996) and Campbell's 1988 Danger Assessment (Stuart & Campbell, 1989).	*IPV vs. EDS*: OR=3.3; 95% CI: 1.3, 8.5	Age, race/ethnicity, and education.
19	(Hayes et al., 2010)	2010	Hawaii Pregnancy Risk Assessment and Monitoring System (PRAMS)	US	CX, PB	N= 7,154	n=1,037 [$Prev_{tot}$=14.5%] [$Prev_0$=13.7%]	Age: 18–44y	PPD, Patient Health Questionnaire-2 (PHQ-2); (Berg, 2002; Corson et al., 2004; Li et al., 2007;	IPV, single question related to physical abuse	*IPV vs. PPD*: OR=1.4; 95% CI: 1.2, 1.6	Race/ethnicity, age, education, pregnancy intention, smoking status, illicit drug use and WIC

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
									Lowe et al., 2005; Whooley et al., 1997)			recipient status.
20	(Hazen et al., 2004)	2004	National Survey of Child and Adolescent Well-Being (NSCAW)	US	CX, PB	N=3,612	n=870 [$Prev_{tot}$=24.1%] [$Prev_0$=19.2%]	Age: Mean:32y	MDD, World Health Organization Composite International Diagnostic Interview Short-Form (CIDI-SF) (R. C. Kessler, Andrews, G., Mroczek, D., Ustun, B., Wittchen, H.-U., 1998).	IPV, The Conflict Tactics Scales (M. A. Straus, 1979).	IPV vs. MDD: *Severe physical violence vs. none*: OR=2.63; 95% CI: 1.71, 4.04. *Less severe physical violence vs. none*: OR=1.88; 95% CI: 1.17, 3.01.	Age, race/ethnicity, marital status, male intimate partner in household, education, poverty status, children in household, alcohol dependence, drug dependence, prior reports of maltreatment.
21	(Hegarty et al., 2004) *	2004	__	Australia	CX, C	N=1,213	n=218 [$Prev_{tot}$=18%] [$Prev_0$=10.7%]	Age: 16–50y	EDS/PPD, Beck depression inventory score of 16 or more or an Edinburgh postnatal depression scale score of 12 or more (Mintz & Cornett, 1997; Sassetti, 1993; Strauss A., 1990)	IPV, Lifetime abuse and history of partner abuse in the past 12 months using the composite abuse scale	EDS/PPD vs. *Severe combined abuse*: OR=5.8; 95%CI: 2.8, 12 *Physical and emotional or harassment*: OR=7.5; 95%CI: 3.9, 14 *Physical only*: OR=3.5; 95% CI: 1.7, 7.2 *Emotional or harassment*: OR=2.1; 95%CI:1.0, 4.3	Child abuse, Age, education, employment status, income source, yearly income, pregnancy status, child cohabiting, postnatal status, SF-36 health status.
22	(Hegarty et al., 2008)	2008	__	Australia	CX, C	N=925	n=216 [$Prev_{tot}$=23.3%] [$Prev_0$=9.6%]	Age: 16–50y	EDS. Self-reported depression	IPV, Composite Abuse Scale (CAS) (Hegarty, Fracgp, Bush, & Sheehan, 2005)	IPV vs. EDS : OR=3.62 ; 95% CI : 2.64, 4.97	Self-reported physical and mental health symptoms.

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
23	(Hillemeier et al., 2008)	2008	the Central Pennsylvania Women's Health Study	US	CX, PB	N=2,002	n=430 [$Prev_{tot}$=21.5%] [$Prev_0$~15%]	Age: 18–45y	EDS, 6-items selected from CES-D (Radloff, 1977); Cutoff of 4 or more.	IPV, 8-item scale adapted from the Conflict Tactics Scale (M. A. Straus, 1979) and used in the Commonwealth Fund 1998 Survey of Women's Health (Collins K.S., 1999).	IPV vs. EDS: OR= 2.25; 95% CI: 0.97, 5.24	Rurality, other psychosocial stress factors, physical health factors, health care access, socio-demographics (age, education, race, marital status, employment and poverty status)
24	(Houry et al., 2006)	2006	__	US	PC, C	N=456	n=109 [$Prev_{tot}$= 24%] [$Prev_0$=14%]	Age: 15–55y	EDS, The Beck Depression Inventory—II (BDI-II) (A. S. Beck, RA.; Brown, GK.); Cutoff 20 or more for moderate to severe depression.	IPV, The George Washington University Universal Violence Prevention Screening Protocol (Dutton, Mitchell, & Haywood, 1996)	IPV vs. EDS: *1 type of IPV vs. none*: OR= 2.4 ;95% CI:1.6, 3.7 *2 types of IPV vs. none*: OR=3.1 ;95% CI:2.0, 4.8 *3 types of IPV vs. none*: OR=5.9 ;95% CI:4.1, 8.5	Age, education, marital status, health insurance, relationship status in past year.
25	(Hurwitz et al., 2006)	2006	__	US	CX, PB	N=208	n=30 [$Prev_{tot}$=14.9%] [$Prev_0$=10.2%]	Age: 18+y	EDS, single-item, number of days depressed over the past 30 days. 7 or more as cutoff	IPV, items from the Massachussets BRFSS ((Massachusse tts))	IPV vs. EDS: OR= 4.1; 95% CI: 1.8, 9.3	Recency of immigration, immigration status, education and income.
26	(Lehrer et al., 2006) *	2006	Ad Health study	US	PC, PB	N=1,659	n=169 [$Prev_{tot}$=10.2%] [$Prev_0$~8%]	Age: Mean~16y Follow-up: 6 years (1995–2002)	EDS, 20-item CES-D (Radloff, 1977); Score>23.	IPV, Ad Health self-report questions on "mild" or "moderate to severe" physical violence.	EDS (wave 2) vs. IPV (wave 3): *Mild IPV*: OR=1.49; 95% CI: 0.91, 2.45 *Moderate to severe IPV*: OR=1.86; 95% CI: 1.05, 3.29	Age, race/ethnicity, parental education, and indicator for parental education missing, childhood sexual/physical abuse and baseline dating violence/forced sex
27	(Lipsky et al., 2009)	2009	__	US	RC, C	N=3,597	n=275 [I_{tot}=8.4%] [I_0=8.1%]	Age: 18–49y	MDD, ICD-9 hospital record	IPV, Police reported	IPV vs. MDD: IRR=1.59; 95% CI: 0.98, 2.58 (Hospitalizatio	Crude IRR.

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
											n rates in ER)	
28	(Ludermir et al., 2010)*	2010	__	Brazil	PC, C	N=1,045	n=270 [$Prev_{tot}$=25.8%] [$Prev_0$=18.0%]	Age : 18–49y Follow-up : Pregnancy To 3–6 weeks after delivery	PPD, Edinburgh Postpartum Depression Scale; Score ≥12 (Patel, Rodrigues, & DeSouza, 2002)	IPV, the international WHO Multi-country Study on Women's Health and Domestic Violence against Women Study Team (Garcia-Moreno et al., 2006)	PPD vs. *Highest frequency of psychological violence vs. lowest*: OR= 2·29; 95% CI: 1·15, 4·57 *Physical or sexual violence*: OR=0.91; 95% CI:0.54, 1.54	Other violence variable in the table (psychological violence *vs* physical or sexual violence) age, race, marital status, years of schooling, employment status, communication with present or most recent partner, controlling behaviour of present or most recent partner, social support, and length of follow-up, history of mental illness and SRQ-20 score during pregnancy
29	(Rodriguez et al., 2008)*	2008	__	US	CX, C	N=210 (Latinas)	n=60 [$Prev_{tot}$=28.6%] [$Prev_0$=18.6%]	Age : 18–42y	EDS, Beck Depression Inventory Fast Screen (BDI-FS) for Medical Patients (A. T. Beck, Steer, & Brown 2000; Steer, Cavalieri, Leonard, & Beck, 1999; Winter, Steer, Jones-Hicks, & Beck, 1999). Defined as score ≥4.	IPV, 4-question Abuse Assessment Screen (McFarlane, Parker, & Soeken, 1995).	*IPV vs. EDS*: OR=2.43; 95%CI: 1.16, 5.11	Mastery, trauma history (other than IPV), age, language and site.
30	(Romito & Grassi, 2007)	2007	__	Italy	CX, PB	N=321	n=80 [$Prev_{tot}$=25%] [$Prev_0$~20%]	University students	EDS, General Health Questionnaire (GHQ) (Goldberg, 1972);	IPV, list of 18 items, concerning abusive behavior	IPV vs. EDS: *Some vs. None*: OR=1.07; 95% CI:0.55,	Other types of violence.

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
									Cutoff at 5/6	performed by a partner or an expartner, including: pressures, controlling behaviors, frequent criticisms, insults, threats, sexual pressures, and physical aggressions.	2.04 *Severe vs. None*: OR=2.41; 95%CI: 1.24, 4.67	
31	(Schneider et al., 2009)	2009	National Treatment Improvement Evaluation Study (NTIES)	US	CX, C	N=1,774	n=1,330 [$Prev_{tot}$=75%] [$Prev_0$=69%]	Age: 18+y	EDS, 2-item screener, 2 weeks or longer.	IPV, single item, "attacked or seriously beaten" by husband, wife or partner.	IPV vs. EDS: OR=2.03; 95% CI: 1.62, 2.54	Age, race, marital status, education, reason for entering treatment (e.g. alcohol, drug), drug use, child abuse, other psychological issues (e.g. anxiety), co-morbid physical conditions (e.g. circulatory, neurologic etc.)
32	(Tiwari et al., 2008) *	2008	___	Hong Kong	CX, C	N=3,245	___	Age: ≥18y Mean~31y	PPD, The Chinese version Edinburgh Postpartum Depression Scale; Score ≥10 (Lee, Yip, Chiu, Leung, Chan, Chau et al., 1998)	IPV, The Abuse Assessment Screen (AAS) (Parker & McFarlane, 1991>)	PPD vs. *Physical and/or sexual abuse*: OR=1.75; 95% CI:0.84, 3.66 *Psychological abuse only*: OR=1.84; 95% CI: 1.12, 3.02	Demographics, socio-economic status (nationality, age, education, marital status, number of children, planned pregnancy, employment, family income, indebtedness, financial assistance, social support, consumption of alcohol), chronic illness in family, and in-law conflict.

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
33	(Vaeth et al., 2010) *	2010	__	US	CX, PB	N=1,052	n=96 [$Prev_{tot}$~9.1%] [$Prev_0$=4.6%]	Age: 18+y	EDS, Center for Epidemiologic Studies-Depression (CES-D), cutoff of 16 (Radloff, 1977).	IPV, Conflict Tactics Scale (M.A. Straus, 1990)	IPV vs. EDS: *Minor psychological IPV only*: OR=0.71; 95% CI: 0.35, 1.44 *Severe psychological IPV*: OR=0.43; 95%CI: 0.11, 1.59 *Physical IPV*: OR=0.45; 95% CI: 0.09, 2.21 *Sexual IPV*: OR=1.17; 95% CI: 0.44, 3.18	Age, education, employment status, marital status, ethnicity, female to male aggression, binge drinking, alcohol problems, childhood abuse, exposure to parental violence and collective efficacy.
34	(Valentine et al., 2010) *	2010	Proyecto Cuna	US	PC, C	N=190	n=83 [$Prev_{tot}$=44%] [$Prev_0$~40%]	Age: Mean~27.7 y ≥18y Follow-up: Preg. Through 13 months postnatal	PPD, Beck Depression Inventory Fast Screen (BDI-FS) for Medical Patients (A. T. Beck et al., 2000)	IPV, The Abuse Assessment Screen (AAS) (Soeken, 1998).	*Recent IPV trauma vs. PPD*: OR=5.38; 95% CI: 2.21, 13.08	Prenatal depression, Parity (# previous live births), Social support, Interview language—Spanish (ref. English), Proportion of life in the USA, Foreign-born (ref. US-born), Poverty score, Marital status—not married (ref. married), Employment status— not working (ref. working).
35	(Vung et al., 2009)	2009	__	Vietnam	CX, PB	N=883	n=193 [$Prev_{tot}$=22%] [$Prev_0$=19.2%]	Age: 17–60y	EDS, 1-item self-report of depression or sadness.	IPV, Women's Health and Life Experiences Questionnaire developed by the WHO (WHO, 2000)	*IPV vs. EDS*: OR=4.5; 95% CI: 2.7, 7.5 (*Note* IPV, physical and/or sexual violence)	Age, educational level, annual household income and husband having more than one wife/partner

Study #	First author	Year	Study name	Country	Design, setting	Sample size	# of outcome cases	Follow-up time, Age	Outcome	Exposure	Main findings	Adjustment
36	(Wong et al., 2008) *	2008	__	South Africa	CX, PB	N=200	n=73 [$Prev_{tot}$=36.5%] [$Prev_0$=29.3%]	Age: ≥18y	EDS, the Center of Epidemiology Study–Depression (CES–D); Score≥16 (Radloff, 1977).	IPV, 33-item scale	*IPV in past 30 days vs. EDS*: OR=3.1; 95% CI: 1.5, 6.2.	Marital status; education; race/ethnicity; and SES score.
37	(Yang et al., 2006)	2006	__	Taiwan	CX, PB	N=840	n=318 [$Prev_{tot}$=38%] [$Prev_0$=36.0%]	Age: 18–50y	EDS, two-question case finding instrument (Whooley et al., 1997)	IPV, Abuse Assessment Screen (AAS) (McFarlane, Parker, & Soeken, 1996).	IPV vs. EDS: *Ever physical IPV*: OR=1.93; 95% CI: 1.26, 2.96. *Current physical IPV*: OR=2.73; 95% CI: 1.65, 4.51 *Ever sexual IPV*: OR=4.41; 95% CI: 1.19,16.36 *Beaten more than once by partner* OR=3.07; 95% CI: 1.65, 5.71	Age, alcohol and drug use, husband's employment status, religious activity and physical abuse during childhood.

*Main aim of the study is to examine IPV-depression link.

†$Prev_{tot}$ was calculated from available tabulated data or obtained directly from text. $Prev_0$ was mainly obtained from tabulation data. In some cases, the denominator was smaller than the one presented under the column (sample size).

Abbreviations: C=Clinical; CX=Cross-sectional; DSM=Diagnostic and statistical Manual; EDS=Elevated Depressive Symptoms; HR=Hazard ratio; IPV=Intimate Partner Violence; IRR=Incidence Rate Ratio; MDD=Major Depressive Disorder; PB=Population-based; PC=Prospective cohort; PPD=Post-partum Depression; NR=Not Reported; OR=Odds ratio; RC=Retrospective cohort; RR=Risk ratio; WHO=World Health Organization; WIC= Women, Infants, and Children program.

Table 2

Subgroup analyses: pooled relative risk (RR) and 95% confidence interval (CI) of IPV and depression outcomes among adult women: fully adjusted models[‡,§]

	Cross-sectional studies		Cohort Studies		Both	
	RR	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**
N (datapoints)	71		9		80	
All	1.79	(1.63, 1.97)	1.87	(1.42–2.46)[†]	1.80	(1.65–1.97)
Depression outcome type						
MDD	2.70	(2.22, 3.29)[†]	1.59	(0.98–2.58)	2.66	(2.05–3.15)[†]
EDS	1.81	(1.63, 2.01)	2.12	(1.59–2.99)	1.85	(1.67–2.04)
PPD	1.43	(1.21, 1.69)	1.43	(0.83–2.46)	1.43	(1.22–1.67)
Geographical region						
US	1.77	(1.57, 1.99)[†]	2.08	(1.61–2.70)	1.81	(1.62–2.02)
Non-US	1.86	(1.58, 2.19)	1.26	(0.64–2.49)	1.82	(1.55–2.13)
Age (minimum, y)						
<18	1.93	(1.57, 2.36)	2.18	(1.59–2.99)	1.96	(1.64–2.34)
18+	1.75	(1.58, 1.95)	1.45	(1.01–2.07)	1.73	(1.57–1.92)
Setting						
Population-based	1.86	(1.65, 2.08)	1.56	(1.07–2.27)	1.84	(1.65–2.06)
Clinical	1.73	(1.46, 2.04)	1.96	(1.39–2.75)	1.77	(1.52–2.06)

[*] P<0.05 for the null hypothesis that lnRR=0. See Table 1 for sources of each estimation.

[†] Significant test for heterogeneity (Q-test) with 1 degrees of freedom, comparing RRs between **(A)** Depression outcome type (MDD vs. EDS vs. PPD), age of study population (minimum: <18y vs. 18+), **(B)** Geographical region of publication (US vs. non-US study); **(C)** Minimum in age range (<18y vs. 18+y); Setting (population-based vs. clinical) : P-value<0.05.

[‡] In most models, socio-demographic factors and other lifestyle and health-related factors were adjusted for (See Table 1 for details).

[§] EDS=Elevated Depressive Symptoms; IPV=Intimate Partner Violence; MDD=Major Depressive Disorder; N: study data point used in fully adjusted models.

PPD=Post-Partum Depression; RR=Relative Risk.