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Recent intimate partner violence against women and health: a systematic review and meta-analysis of cohort studies

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Abstract

Objectives: We reviewed cohort studies to determine the magnitude and temporal direction of the association between recent intimate partner violence (IPV) and health.

Design: Systematic review and meta-analysis.

Methods: Medline, EMBASE and PsycINFO were searched from the first record to November 2016. Recent IPV was defined as occurring up to and including the last 12 months; all health outcomes were eligible for inclusion. Results were combined using random effects meta-analysis.

Results: 33 separate cohort studies were retrieved. Eight studies showed evidence of a positive association between recent IPV and depressive symptoms, of which seven were statistically significant, with a pooled OR from five estimates of 1.76 (95% CI 1.26-2.44, I^2 = 37.5% p=0.172). Five studies demonstrated a positive, statistically significant relationship between depressive symptoms and subsequent IPV; pooled ORs from two studies was 1.72 (95% CI 1.28-2.31, I^2 = 0.0%, p=0.752). Recent IPV was also associated with increased symptoms of postpartum depression in four studies (OR=1.84, 95% CI 1.08-3.15) although there was substantial heterogeneity. There was some evidence of a bi-directional relationship between recent IPV and hard drug use, and marijuana use although studies were limited. There was no evidence of an association between recent IPV and alcohol use or sexually transmitted infections (STIs) although there were few studies and inconsistent measurement of alcohol and STIs.

Conclusions

Exposure to violence has significant impacts. Further longitudinal studies are needed to understand the temporal relationship between recent IPV and different health issues, whilst controlling for potential confounding factors and considering the differential effects of recent versus past exposure to IPV. Improved measurement will enable an understanding of the

immediate and longer-term health needs of women exposed to IPV. Health care providers and IPV organisations should be aware of the bi-directional relationship between recent IPV and depressive symptoms.

Strengths

- This is the first systematic review of cohort studies to measure the magnitude of the association and temporal direction between recent exposure to IPV and health outcomes.
- As the review considers a broad range of outcomes, we identified gaps in the evidence base including a need for cohort studies on recent IPV and non-communicable diseases such as cardiovascular disease hypertension and obesity, as well as posttraumatic stress disorder and anxiety disorder.

Limitations

- Due to the large number of abstracts retrieved and the limited timeframe for the review, we were not able to employ double screening of abstracts. However, two researchers conducted the review of full text papers
- As some studies measured the outcome variable (either IPV or the health condition) continuously, it was not possible to combine all measures of effect, which limited the number of studies in the meta-analyses.
- It was not possible to quantitatively assess publication bias as too few studies were in the meta-analyses of each health condition.

Background

Worldwide, almost a third (30%) of all women who have been in a relationship have experienced physical and/or sexual violence by their intimate partner [1, 2]. Women's lifetime exposure to intimate partner violence (IPV) is associated with myriad health outcomes. Systematic reviews of longitudinal data, find that women who have been physically and/or sexually abused by their partner at some point in their life are twice as likely to have an abortion, twice as likely to suffer from depression, and in some regions are 1.5 times more likely to acquire HIV compared to women who have not experienced IPV [2]. Not surprisingly, given its high prevalence and health effects, lifetime exposure to IPV is estimated to result in a high burden of disease. IPV is the second most common risk factor for disability-adjusted life years (DALY) globally in women aged 20 to 24 years [3].

In our previous systematic reviews, we began to explore the relationships between 'ever' exposure to IPV and specific health outcomes over time, which revealed evidence of a bidirectional association. Devries et al. found evidence suggestive of an association between IPV and incident depressive symptoms (OR=1.97, 95% CI 1.56-2.48) as well as an association in the reverse direction between depressive symptoms and incident IPV (OR=1.93, 95% CI 1.51-2.48) [4]. In another systematic review the authors found increased odds of alcohol use following IPV (OR=1.25, 95% CI 1.02-1.52) and increased odds of IPV following alcohol use (OR=1.27, 95% CI 1.07-1.52). [5].

Although available evidence finds important associations between IPV and a range of mental and physical health outcomes, the nature of the associations are not always clear. It is possible that exposure to IPV results in subsequent mental and physical health outcomes; that

different mental and physical health conditions increase risk of subsequent IPV; or that a bi-directional relationship is present.

Both IPV and some associated health outcomes, such as depression, anxiety and substance abuse, are chronic, episodic conditions, which can occur with varying frequency over longer time periods. Studies that measure lifetime exposure to IPV therefore hide the complexity of the relationship between IPV and mental and physical health outcomes. This is because estimates of 'ever' exposure to IPV are heterogeneous, and may include anything from past year, before the past year and more distant experiences of IPV. Recent violence may lead to more severe health outcomes, but this may be influenced by duration and severity, for example, recent violence with no prior history versus recent violence experienced as part of ongoing historical abuse.

In the current systematic review, we build on this by closely examining the issue of temporality with regard to recent exposure to IPV and a broader range of health outcomes. In this paper we aim to: (i) review what health outcomes have been examined in cohort studies of recent IPV ('recent' defined here as IPV experienced up to and including the last 12 months); (ii) quantify the magnitude of the association between IPV and different health outcomes and (iii) examine the temporal direction of IPV and health outcomes.

Methods

Literature searches

We searched Medline, EMBASE and PsycINFO from the first record up to January 27, 2016 (with an updated search conducted in November 2016). Terms for IPV were adapted from a previous systematic review on the prevalence of IPV and health outcomes which was

conducted for the 2010 Global Burden of Disease of IPV (Devries et al. 2013). Controlled vocabulary terms and text words related to longitudinal studies were used for each database. In order to ensure a wide yield of studies, terms for specific health outcomes were not included. An example search strategy appears in Appendix 1.

Inclusion criteria

English language longitudinal studies reporting on female participants aged 15 and over were considered. Studies were deemed longitudinal if either the exposure or the outcome was measured on at least two occasions. All author definitions of recent IPV victimisation that occurred up to and including 12 months prior, and all author definitions of health outcomes that were measured on at least two occasions were eligible for inclusion. A 12-month cut-off period was chosen for IPV as this is the most commonly used period for prevalence estimates, it is consistent with internationally recognised IPV measures, [6, 7] and has been used in a number of intervention studies for IPV. [8-10]. We included studies where IPV was conceptualised as the independent variable, or where IPV was the dependent variable, in order to capture any evidence of bi-directional causality. Cohort studies reporting on analyses of exposures and outcomes assessed in the same time point were not included. The study selection process is summarised in the flowchart in Figure 1.

Screening and data extraction

Records were initially screened by one reviewer (LJB) and studies not meeting the inclusion criteria were removed. Full-text articles were formally appraised for inclusion by two reviewers (LJB and MR). Data were extracted and entered into an Excel spreadsheet by one reviewer (LJB). Information about the study population, exposure and outcome definitions, length of follow-up, effect estimates and measures of uncertainty were recorded.

Quality appraisal

The quality of each effect estimate was appraised. Consideration was given to whether definitions of IPV and health outcomes were based on valid, reliable measures. We considered whether studies controlled for potential confounders for two reasons. Firstly, because IPV and the health outcomes of interest commonly occur episodically over a period of time, and episodes of either that are incident over the study period may be a continuation of previous IPV or health outcomes. Therefore, we examined whether studies adjusted for time one levels (i.e. at the beginning of the study period) of the outcome variable. Secondly, because both IPV and the health outcomes of interest are associated with demographic characteristics and other risk factors that may explain the association between them. Due to the complexity of the potential causal pathways between IPV and the health outcomes, we did not specify a minimum set of confounders that should be adjusted for. Additionally, it has been noted that it is not always appropriate to adjust for baseline levels of an outcome variable in longitudinal studies. When exposures are associated with baseline health status, bias can arise if change in health status preceded baseline assessment or if the dependent variable measurement is unreliable or unstable [11]. However, we recorded whether key variables were adjusted for and examined the results in the light of these adjustments. Information was also extracted in relation to length of follow-up and attrition rates.

Data Analysis

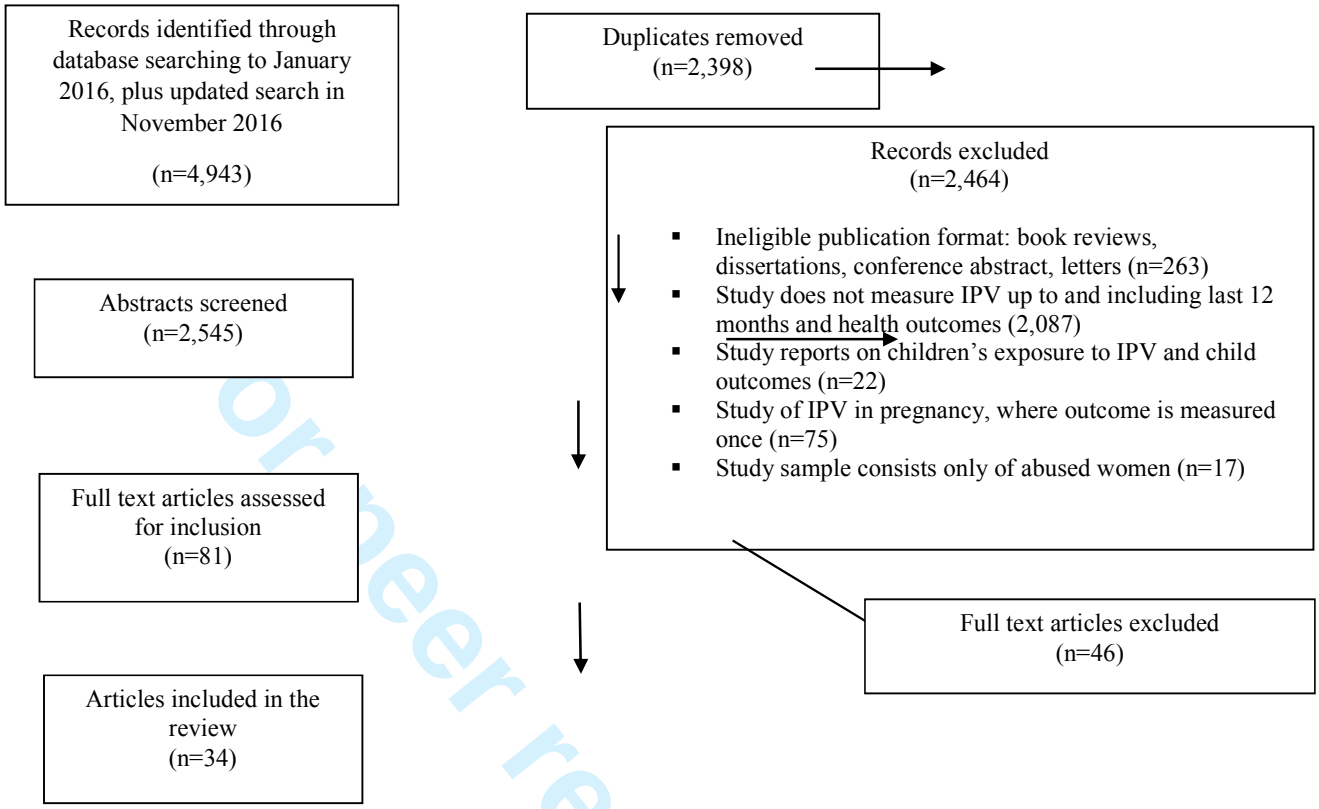
Analyses were conducted by LJB and KD using Stata 14.0. Study characteristics and quality are summarised descriptively. Studies reported a range of effect estimates (e.g. odds ratios, relative risks and correlation coefficients). Where studies did not report odds ratios (ORs), these were calculated from raw data where possible. Studies measured IPV or health outcomes in heterogeneous ways, therefore the results are summarised descriptively for each

health outcome. Where possible, random effects meta-analysis was used to calculate the pooled ORs representing associations between IPV occurring up to and including the last 12 months and various health outcomes. Higgin's I^2 statistic, which describes the percentage of variability in point estimates that is due to heterogeneity rather than sampling error [12], was calculated. Some studies reported multiple estimates using overlapping definitions of IPV on the same sample of participants. In order to avoid double counting participants in these studies, which can lead to falsely precise pooled estimates, preference was given to one estimate using the following algorithm: (i) those derived from multivariate analysis (ii) where the definition of IPV closely matched that of the other studies in the meta-analysis (iii) where the reference group was unexposed to any violence and (iv) where the estimate was most precise (i.e. the smallest confidence interval). Studies that provided multiple estimates but on different sub-samples of participants were included in the meta-analysis.

Ethics Statement

All data used in this review were already in the public domain and ethical approval was not required.

Figure 2: Flow of studies through the review



Results

Study characteristics

Thirty-three separate cohort studies described in 34 articles published between 2002 and 2016 with 47,352 participants met the inclusion criteria and contained 172 effect estimates of association between IPV and health outcomes. Seventeen articles were from the USA [13-29], three from Australia [30-32], two from New Zealand [33, 34], three from South Africa [35-37], two from India [38, 39], one from Puerto Rico [40], one from Spain [41], one from Korea [42], one from Nicaragua [43], one from Kenya [44], one from Japan [45], and one from the UK [46]. Amongst the 33 cohort studies, 11 were household surveys [13, 19, 27, 28, 31, 34, 38, 42, 43, 46, 47], 12 sampled participants from clinical settings [14, 20, 21, 23, 25, 26, 30, 32, 39, 41, 44, 45], seven from schools [16, 17, 22, 24, 29, 35, 48] and three from the local community [15, 37, 40]. Three studies were based on sub-populations of women including those who were receiving methadone maintenance treatment [20, 21], women attending a clinic with depressive symptoms at baseline [30], HIV-positive female sex workers [44] and pregnant women . Six studies focussed on adolescents [16-18, 22, 24, 29] and one included women and young girls [35, 36]. Six studies were of pregnant women [32, 37, 39, 41, 45, 46].

Table 1 presents the different health outcomes measured in the studies, the number of studies that measure each health condition, the overall number of estimates that contribute to each health condition, and the number of estimates that contribute to the meta-analysis.

Table 1: Health outcomes measured in the 33 studies and number of estimates

Health outcome	Number of studies and estimates, refs	Number of estimates in the meta-analysis
Depression	13 studies [13, 17, 19, 22-26, 30, 31, 36, 38, 42]; 13 estimates	7
Postpartum depression	6 studies [32, 37, 39, 41, 45, 46]; 9 estimates	5
Suicide attempts	2 studies [22, 38]; 2 estimates	NA
Perceived stress	2 studies [27, 43]; 3 estimates	NA
General anxiety	1 study [25]; 1 estimate	NA
Self-perceived health status	1 study [41]; 1 estimate	NA
Hard drug use	4 studies [14, 21, 28, 40]; 6 estimates	5
Marijuana use	4 studies [14, 16, 21, 28]; 7 estimates	5
Other combinations of illicit drug/alcohol use	4 studies [14, 16, 22, 23]; 5 estimates	NA
Alcohol use	10 studies [14-16, 19, 21, 27, 29, 34, 47]; 18 estimates	9
HIV infection	2 studies [20, 35]; 3 estimates	NA
Sexually transmitted infections (STI)	3 studies [20, 38, 44]; 2 estimates	NA
Sexual risk behaviours	3 studies [18, 20, 44]; 8 estimates	NA
Abnormal vaginal discharge	1 study [38]; 3 estimates	NA
Dysuria	1 study [38]; 3 estimates	NA
Lower abdominal pain	1 study [38]; 3 estimates	NA
Dyspareunia	1 study [38]; 3 estimates	NA

NA- Not applicable as study estimates were continuous and could not be included in a meta-analysis

Table 2 summarises quality issues in relation to the 34 papers reporting on 33 separate cohort studies included in the review. All, but three of the 33 cohort studies used recognised, validated IPV instruments or used items that were taken from validated instruments [39, 42, 46]. All, but six studies assessed for IPV that occurred in the last 12 months; one measured IPV in the last three months [38], two in the last six months [20, 21, 23], one in the last four months [29], and two measured IPV that occurred during pregnancy [39, 46]. Most of the studies assessed for physical and/or sexual violence from a partner, with some also including threats, emotional or verbal abuse. The attrition rate was reported or calculated in 18 studies and ranged from 9.0% [27] to 37.4% [30]. The length of follow-up ranged from one month [45] to 20 years and the number of waves ranged from two to 10 years [47]. The smallest sample size was 73 adolescents [29] and the largest was 9,683 adult women [31]. Table 3 (Appendix 2) presents all study estimates grouped by health outcome.

Table 2: Quality assessment of 34 papers reporting on 33 studies included in the review

Author	Country	Sample	Number of estimates in the study	Health outcomes measured in study	IPV measure and timeframe	Number of waves and length of follow-up	Attrition at last wave %
Algeria et al. [40]	Puerto Rico	452 adult women	1	Hard drug use	Physical and/or psychological, CTS, last 12 months	3 waves; 3 years	-
Boden et al. [47]	New Zealand	630 adult women	3	Alcohol use	Physical and/or sexual, CTS, last 12 months	4 waves; 10 years	-
Chowdhary et al. [38]	India	1,750 adult women	21	Depression; suicide attempts; STI; abnormal vaginal discharge; dysuria; lower abdominal pain; dyspareunia	Physical, CTS-like, last 3 months	3 waves; 1 year	-
Chuang et al. [13]	USA	1,420 adult women	1	Depression	Physical and/or sexual, CTS-like, last 12 months	2 waves; 2 years	29.1%
Davidson et al. [30]	Australia	494 adult women	1	Depression	Physical and/or sexual, CAS, last 12 months	2 waves; 2 years	37.4%
El-Bassel et al. [20]	USA	405 adult women at a methadone	6	HIV infection; STI; sexual risk behaviour	Physical and/or sexual, CTS, last 6 months	3 waves; 1 year	24.0%
El-Bassel et al. [21]	USA	317 adult women	10	Alcohol use; hard drug use; marijuana use	Physical and/or sexual, CTS, last 6 months	3 waves; 1 year	24.0%
Escriba-Aguir et al. [41]	Spain	888 pregnant women	2	Postpartum depression; self-perceived health status	Psychological abuse, AAS, last 12 months	4 waves, 1 year	33.5%
Flach et al. [46]	UK	5,681 pregnant women	1	Postpartum depression	"Has a partner physically hurt and/or been emotionally cruel since the start of pregnancy"	5 waves; 3.5 years	-
Foshee et al. [24]	USA	1,291 adolescents	1	Depression	Sexual dating violence, CTS, last 12 months	4-5 waves; 4-5 years	-
Gao et al. [34]	New Zealand	636 adult women	4	Alcohol use	Physical and/or verbal, CTS, last 12 months	2 waves; 2 years	16.9%
Gilbert et al. [14]	USA	185 adult women	60	Alcohol use; hard drug use; marijuana use; any illicit drug use	Physical, injurious, sexual, CTS, last 12 months	3 waves; 1 year	23.2%
Jewkes et al. [35]	South Africa	1,099 women and girls	2	HIV infection	Physical and/or sexual, WHO Survey, last 12 months	3 waves; 2 years	12.5%
Keiley et al. [15]	USA	195 couples	2	Alcohol use	Physical, verbal, CTS, last 12 months	2 waves; 2.5 years	-
Kim & Lee [42]	Korea	3,153 adult women	2	Depression	"Physical violence and/or threat of physical violence", last 12 months	4 waves; 4 years	34.2%

Author	Country	Sample	Number of estimates in the study	Health outcomes measured in study	IPV measure and timeframe	Number of waves and length of follow-up	Attrition at last wave %
Kita et al. [45]	Japan	562 pregnant women	1	Postpartum depression	"Physical" and/or "non-physical", ISA, last 12 months	2 waves; 1 month	26.7%
Leher et al. [17]	USA	1,659 adolescents	1	Depression	Physical, CTS-like, last 12 months	3 waves; 7 years	-
Levendosky et al. [26]	USA	150 adults	1	Depression	Physical and/or sexual, SVAWS, last 12 months	5 waves; 4 years	-
Marsh Buzy et al. [29]	USA	73 adolescents	1	Alcohol use	Physical and/or sexual, CTS, last 4 months	2 waves; 4 months	31.1%
Newcomb et al. [23]	USA	113 adult women	2	Depression	Psychological and/or physical, CTS, last 6 months	3 waves; 1 year	24.0%
Nduna et al. [36]	South Africa	995 women and girls	1	Depression	Physical and/or sexual, WHO survey, last 12 months	2 waves; 1 year	22.6%
Nowotny & Graves [16]	USA	2,959 adolescents	12	Alcohol use; marijuana use; any illicit drug use	Minor violence, major violence, sexual violence, injurious violence, CTS-like, last 12 months	2 waves; 6 years	-
Patel et al. [39]	India	235 pregnant women	1	Postpartum depression	"Physical and/or emotional during pregnancy"	3 waves; 6 months	13.0%
Roberts et al. [22]	USA	2,206 adolescents	3	Depression	Physical, CTS, last 12 months	2 waves; 1 year	-
Salazar et al. [43]	Nicaragua	398 adult women	1	Perceived emotional distress	Emotional, physical, sexual, WHO survey, last 12 months	2 waves; 3 years	16.7%
Suglia et al. [25]	USA	1,834 adult women	2	Depression; general anxiety	Physical and/or sexual, CTS, last 12 months	3 waves; 3 years	-
Taft et al. [31]	Australia	9,683 adult women	1	Depression	Physical and/or sexual, CTS, last 12 months	2 waves; 4 years	-
Teitelman et al. [48]	USA	2,629 adolescents	1	HIV risk	Verbal and/or physical, CTS, last 12 months	2 waves; 7 years	-
Testa et al. [27]	USA	494 adult women	4	Alcohol use; perceived stress	Physical aggression, verbal aggression, CTS, last 12 months	2 waves; 2 years	9.0%
Testa et al. [28]	USA	724 adult women	6	Alcohol use; hard drug use; marijuana use	Minor violence, severe violence, CTS, last 12 months	2 waves; 1 year	-
Tsai et al. [37]	South Africa	958 pregnant women	2	Postpartum depression	Physical, CTS, last 12 months	4 waves; 3 years	22.6%

Author	Country	Sample	Number of estimates in the study	Health outcomes measured in study	IPV measure and timeframe	Number of waves and length of follow-up	Attrition at last wave %
Wilson et al. [44]	Kenya	389 HIV-positive female sex workers	7	STI; sexual risk behaviour	Physical and/or sexual, WHO, last 12 months	Unclear - "67.9% had one annual visit and 35.5% had two annual visits"; 2 years	-
Woolhouse et al. [32]	Australia	1,102 pregnant women	3	Postpartum depression	Physical and/or emotional, CAS, last 12 months	6 waves; 4 years	18.1%
Zlotnick et al. [19]	USA	2,905 adult women	2	Depression	Physical, CTS-like, last 12 months	2 waves; 5 years	-

AAS, Abuse Assessment Screen; ADS, Alcohol Dependence Scale; BDI, Beck Depression Inventory; CAS, Composite Abuse Scale; CES-D, Center for Epidemiological Studies-Depression; CIDI-SF, Composite International Diagnostic Interview-Short Form; CTS, Conflict Tactics Scale; ISA, Index of Spouse Abuse; MAST, Michigan Alcoholism Screening Test; SRQ, Self-Report Questionnaire; SVAWS, Severity of Violence Against Women Scale

IPV and depressive symptoms

Thirteen studies examined the relationship between recent IPV and depressive symptoms of which one examined the association in both directions. Of these, nine studies provided nine estimates of association between IPV and subsequent depressive symptoms [13, 19, 22, 23, 25, 30, 31, 38, 42]. Eight of these estimates showed a positive direction of association between experience of IPV and subsequent depressive symptoms, with seven reaching statistical significance.

Five studies provided five estimates of association between depression and subsequent IPV, all of which showed a positive and statistically significant relationship [17, 24, 26, 36, 42]. We were able to include seven estimates reporting binary IPV measures and binary depressive symptoms or disorder measure in the meta-analysis (Figure 3). For IPV and later depressive symptoms or disorder, the pooled OR from five estimates was 1.76 (95% CI 1.26-2.44, I^2 = 37.5% p=0.172). Two estimates, were included in the meta-analysis of the relationship between depressive symptoms and later IPV, resulting in a pooled OR of 1.72 (95% CI 1.28-2.31, I^2 = 0.0%, p=0.752). One study, not included in the meta-analyses examined the bi-directional relationship between IPV and depression [42]. A Korean study of married women found that IPV at Wave 1 was positively associated with the depression level at Wave 1 (Beta=0.030, SE=0.03, p<0.001), but negatively associated with the growth rate of depression over the study period (Beta=-0.03, SE=0.01, p=0.004). IPV experienced at Wave 4 was associated with a larger growth rate of depression in the model (Beta=3.34, SE=0.61, p<0.001) and the experience of IPV at Wave 1 (Beta=0.68, SE=0.11, p<0.001).

Depression measurement: Of the nine estimates that measured IPV and subsequent depressive symptoms, one measured depressive symptoms occurring in the past 12 months,

one in the last two weeks, five in the last week, one "current" and one did not specify a time period. Of the five estimates that measured depressive symptoms and subsequent IPV, three measured depressive symptoms in the past week, one in the past six months and one did not specify a time period.

Of the 18 studies, eight used the Center for Epidemiologic Studies Depression Scale (CES-D) [13, 17, 19, 22, 23, 31, 36, 42], one study used the WHO ICD-10 [38], one used the Composite International Diagnostic Interview-Short Form (CIDI-SF) [25], one used the Patient Health Questionnaire (PHQ) [30], one used the Beck Depression Inventory (BDI) [26], and one used a scale from Kandel and Davies [24].

Common risk factors/confounding: Of the nine estimates that measured IPV and later depressive symptoms and disorder, eight controlled for time one levels of depression. Chowdhary & Patel [38] excluded women with baseline depressive disorder in their analysis, but this may have resulted in the exclusion of cases of IPV that preceded depressive symptoms at baseline and the remaining cases may not have been representative of women experiencing IPV. All, but one of the five estimates that measured depressive symptoms and later IPV, controlled for time one levels of IPV [26]. Of the 18 studies, 11controlled for socio-demographic factors. Other confounders were not comprehensively controlled for. Two studies controlled for childhood physical and/or sexual abuse [17, 30] and two for alcohol use [24, 36], of which one also controlled for childhood adversity [36]. There were no discernible differences in effect estimates regardless of which confounders were adjusted for and studies found similar directions and varying magnitudes of association.

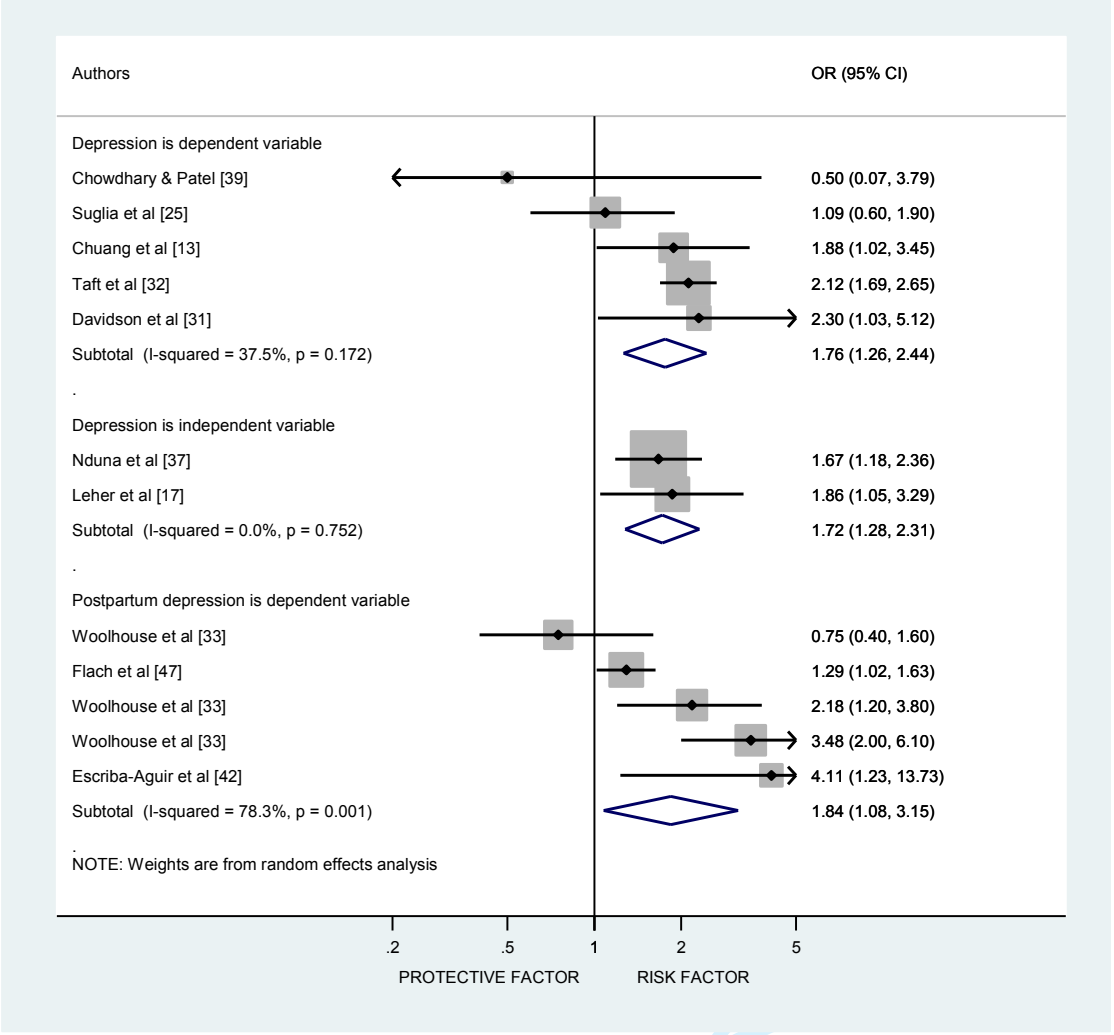
IPV and postpartum depressive symptoms

Six studies provided eight estimates of association between IPV and subsequent postpartum depressive symptoms [32, 37, 39, 41, 45, 46]. Six of these estimates showed a positive direction of association between IPV and subsequent postpartum depressive symptoms, with five reaching statistical significance. Six estimates were included in the meta-analysis of the relationship between IPV and subsequent postpartum depression, resulting in a pooled OR of 1.84 (95% CI 1.08-3.15). This was heterogeneous (I^2 = 78.3%, p=0.001). One study, which examined the bi-directional relationship, found that depression symptom severity was associated with a greater risk of subsequent IPV [37].

Postpartum depression measurement: Of the eight estimates that measured IPV and subsequent depressive symptoms, one measured depressive symptoms occurring in the past 12 months and seven in the last week. One estimate measured postpartum depression in the last week and subsequent IPV. Of the six studies, five used the Edinburgh Postnatal Depression Scale (EPDS) [32, 37, 39, 41, 46] and one used the Hospital Anxiety and Depression Scale (HADS) [45].

Common risk factors/confounding: Four of the six studies of IPV and postpartum depression controlled for time one levels of depressive symptoms and four controlled for socio-demographic factors. One study controlled for HIV serostatus [37].

Figure 3: Forest plot estimates of the association between IPV and depression



Note: Woolhouse estimates are based on different sub-samples and are mutually exclusive

IPV and alcohol use

Ten studies examined the relationship between recent IPV and alcohol use. Of these, eight studies provided 15 estimates of association between IPV and subsequent alcohol use [14-16, 19, 21, 27, 34, 47]. All, but one of these 15 estimates showed a positive direction of association between IPV and subsequent alcohol use, with five reaching statistical significance. Two studies provided three estimates showing a positive direction of association between alcohol use and later IPV [28, 29], of which one was statistically significant. For

IPV and later alcohol use, the pooled OR from six estimates was 1.19 (95% CI 0.91-1.55, I^2 = 0.0%, p=0.523). Three estimates were included in the meta-analysis of the relationship between alcohol use and later IPV, resulting in a pooled OR of 1.11 (95% CI 0.91-1.35, I^2 = 0.0%, p=0.672).

Alcohol use measurement: Of the 15 estimates that measured IPV and subsequent alcohol use, 12 measured alcohol use in the last 12 months, two in the last six months, and one in the last 30 days. Of the three estimates that measured alcohol use and subsequent IPV, two measured alcohol use in the last 12 months and one in the last four months. Alcohol consumption was measured in a variety of ways. Of the 10 studies, one assessed alcohol abuse or dependence using the Composite International Diagnostic Interview-Short Form (CIDI-SF) [47], four measured binge drinking which was based on the number of alcoholic drinks consumed on one occasion [14, 16, 21, 34], three measured heavy drinking which was assessed using a combined quantity-frequency measure [27-29], one used the Alcohol Dependence Scale and the Michigan Alcohol Screening Test [15] and one used the National Survey of Alcohol and Drug Abuse [19].

Common risk factors/confounding: Of the 15 estimates that measured IPV and later alcohol use, only four adjusted for time one levels of alcohol use. All three estimates that examined the association between alcohol use and later IPV adjusted for time one levels of IPV. Of the 10 studies, 7 controlled for socio-demographic factors. Two studies adjusted for a history of trauma. El-Bassel [21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert [14] also controlled for childhood sexual abuse as well as psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power. Regardless of the

confounders controlled for, all but one study found a positive direction of association and reported varying magnitudes of association.

IPV and hard drug use (crack, cocaine, heroin)

Four studies examined the relationship between recent IPV and hard drug use, of which one reported an association in both directions. Two studies provided two estimates of IPV and later hard drug use, both of which showed a positive direction of association although only one was statistically significant [21, 40]. The pooled OR from these studies was 2.05 (95% CI 1.19-3.52, I^2 = 0.0%, p=0.948). Three studies provided four estimates of hard drug use and later IPV, which showed a positive direction of association and three of these were statistically significant [14, 21, 28]. Three of these estimates were included in the meta-analysis, resulting in a pooled OR of 2.20 (95% CI 1.52-3.17, I^2 = 0.0%, p=0.455).

Hard drug use measurement: Of the two estimates that measured IPV and subsequent hard drug use, one study measured drug use in the last 12 months and the other in the last 6 months. Of the four estimates that measured hard drug use and subsequent IPV, two assessed use in the last 12 months and two in the last six months. Of the four studies, two used the Drug Use and Risk Behaviour Questionnaire [14, 21] and two asked about use of specific hard drugs including crack, cocaine and heroin [28, 40]. Of the latter, one of the studies used two methods for assessing hard drug use at each wave including self-report information only and combined self-report and toxicological information [40].

Common risk factors/confounding: Of the two estimates that measured IPV and subsequent hard drug use, one controlled for time one levels of hard drug use. Of the four estimates that measured hard drug use and subsequent IPV, three controlled for time levels of IPV. All four

studies controlled for socio-demographic factors. El-Bassel [21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert [14] controlled for childhood sexual abuse, psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power.

IPV and marijuana use

Four studies examined the relationship between recent IPV and marijuana use, of which two studies reported an association in both directions. Three studies provided three estimates of IPV and subsequent marijuana use, all showing a positive direction of association, although none were statistically significant [14, 16, 21]. Two of these studies were included in the meta-analysis resulting in a pooled OR of 1.52 (95% CI 1.04-2.24, I^2 = 5.4%, p=0.304). Three studies provided four estimates of marijuana use and subsequent IPV [14, 21, 28] of which one showed a positive and statistically significant relationship. Three of these estimates were included in the meta-analysis, resulting in a pooled OR of 1.96 (95% CI 0.8-4.83). This was heterogeneous (I^2 = 85.4%, p=0.001).

Marijuana use measurement: Of the four studies, two measured marijuana use in the last 12 months and two in the last six months. All studies used self-report information to assess for marijuana use.

Common risk factors/confounding: Of the three estimates that measured IPV and subsequent marijuana use, two controlled for time levels of marijuana use. Of the four estimates that measured marijuana use and subsequent IPV, three controlled for time levels of IPV. All the studies controlled for socio-demographic factors. El-Bassel [21] controlled for

childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert [14] controlled for childhood sexual abuse, psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power.

IPV and STIs (excluding HIV)

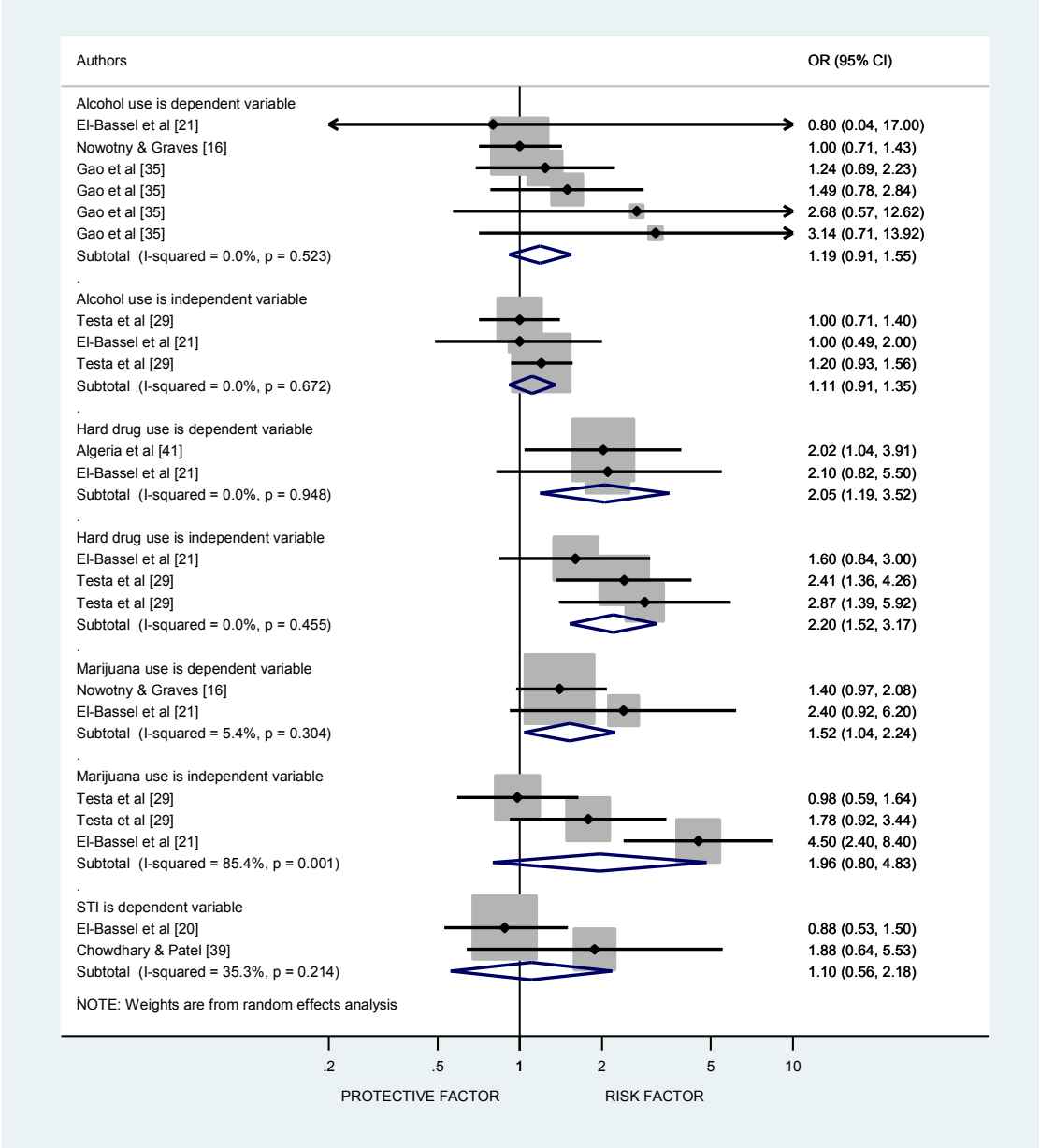
Three studies provided three estimates of the association between recent IPV and later STIs, of which one showed a positive and statistically significant relationship [20, 38, 44]. The meta-analysis of two of these studies resulted in a pooled OR of 1.10 (95% CI 0.56-2.18, I^2 = 35.5%, p=0.214).

STI measurement: One study assessed for STIs (chlamydia, gonorrhoea or trichomoniasis) within the last three months using biological measures [38], another relied on self-report to assess for STIs at the last wave [20] and the third study assessed women quarterly for gonorrhoeae, chlamydia or trichomoniasis [44].

Common risk factors/confounding: All studies controlled for socio-demographic factors. El-Bassel's study [21] of women attending a methadone maintenance clinic adjusted for time one HIV risk factors (i.e. frequency of condom use, frequency of requesting condom use, having unprotected anal sex, exchanging sex for drugs, being HIV positive and having had a sexually transmitted infection), as well as drug and alcohol use. Chowdhary & Patel [38] removed women with an STI at time one from the analysis. However, this would likely have introduced bias in the resulting cases, as it would have excluded women with IPV that preceded the acquisition of an STI at baseline. Wilson's [44] study of HIV positive sex workers did not control for time one sexual risk behaviours, although it did control for a

lifetime history of sexual violence since the age of 15 by someone other than the index partner. Figure 4 presents the forest plots for alcohol use, hard drug use, marijuana use and STIs.

Figure 4: Forest plot estimates of the association between IPV and alcohol use, hard drug use, marijuana use and sexually transmitted infections



Note: Estimates from Gao and Testa are based on different sub-samples and are mutually exclusive

Discussion

Summary of main findings

Our review identified cohort studies that examined the relationship between recent IPV (i.e. IPV occurring up to and including the last 12 months) and depression, postpartum depression, alcohol use, hard drug use, marijuana use and STIs. Although a few other health or health related outcomes were identified (i.e. sexual risk behaviours, HIV infection, general anxiety and gynaecological problems) these could not be included in a meta-analysis because there was very little evidence (only one or two estimates). We found evidence consistent with a bi-directional relationship between recent IPV and depressive symptoms. Recent IPV was also associated with increased symptoms of postpartum depression. There was some evidence of a bi-directional relationship between recent IPV and hard drug use, and IPV and subsequent marijuana use although there were a limited number of studies. There was no evidence of an association between recent IPV and alcohol or sexually transmitted infections (STIs) although the evidence was weak with few studies and inconsistent measurement of alcohol and STIs.

Although the search strategy did not limit the types of health outcomes identified, the review found no cohort studies for recent IPV exposure and non-communicable diseases such as cardiovascular disease, hypertension and obesity. Nor did we find longitudinal evidence for recent experience of IPV and posttraumatic stress disorder or anxiety disorder. There is limited evidence from cross-sectional data that lifetime IPV increases the risk of cardiovascular disease [49]. Cohort studies measuring past history of IPV have reported an association with increased body mass index [50], increased risk for cardiovascular disease [51] and hypertension [52]. Physiological mechanisms may explain the association between IPV and some adverse health outcomes through complex neural, neuroendocrine and immune

responses to acute and chronic stress. For example, sustained and acute elevated stress levels have been linked to cardiovascular disease, hypertension, gastrointestinal disorders and chronic pain. When exposed to prolonged or acute stress, areas of the brain (e.g. hippocampus, amyglada and prefrontal cortex) undergo structural changes that can impact on mental and cognitive functioning, which can lead to mental disorders [53].

We found evidence consistent with a bi-directional relationship between recent experience of IPV and depressive symptoms. The magnitude of the association in either direction is similar to that reported in our previous review of 'ever' IPV and depressive symptoms[4] although there were fewer estimates in our meta-analysis of recent IPV and depressive symptoms.

All the studies on postpartum depressive symptoms conceptualised IPV as the dependent variable and there was evidence that recent experience of IPV or IPV during pregnancy increased symptoms of postpartum depression although there was substantial heterogeneity. The magnitude of the association was lower (OR=1.84, 95% CI 1.08-3.15) compared to Howard et al. [54] who reported a three-fold increase in the levels of depressive symptoms in the postnatal period after having experienced IPV during pregnancy (OR=3.1, 95% CI 2.7-3.6). However, the authors state that study heterogeneity and lack of data on baseline symptoms prevented conclusions on temporality.

There was no evidence of an association between recent IPV and alcohol use in either direction. This might be because there were fewer estimates in the meta-analysis of recent IPV and measurement of problematic alcohol use was conceptualised in a number of different ways which may have diluted the effect, for example, binge drinking, heavy episodic drinking and high risk alcohol use. None of the estimates in the meta-analysis measured

alcohol use disorder. Furthermore, few estimates in the meta-analysis controlled for time one levels of IPV or alcohol use, and none included the perpetrator's alcohol use which may be related to IPV and/or the woman's drinking behaviour. This finding is in contrast to our previous review of 'ever' IPV and alcohol which did find evidence consistent with a bi-directional relationship.[5] The review found evidence consistent with a bi-directional relationship between recent IPV and hard drug use. However, this finding should be treated with caution as there were very few studies overall, and one of the studies was based on a sample of women attending a methadone maintenance clinic. For marijuana use, there were few studies, but the evidence suggests that IPV predicts subsequent marijuana use. Pooled estimates did not support that marijuana use predicts subsequent IPV, although estimates were heterogeneous. The evidence for recent IPV and STI infection was in conflicting directions and there were only two estimates.

Limitations of the review

To our knowledge, this is the first systematic review of cohort studies to measure the magnitude of the association between recent exposure to IPV and health outcomes. Although we conducted an extensive search of the global literature, the review has a number of limitations. Due to the large number of abstracts retrieved and the limited timeframe for the review, we were not able to employ double screening of abstracts. However, two researchers conducted the review of full text papers. One researcher was responsible for extracting data from included papers and we did not contact authors for additional information. As some studies measured the outcome variable (either IPV or the health condition) continuously, it was not possible to combine all measures of effect, which limited the number of studies in the meta-analyses. However, we comment on the direction of the association of studies that were not included in the meta-analysis in the results section for each health condition. It was not

possible to quantitatively assess publication bias as too few studies were in the meta-analyses of each health condition.

Sources of bias and limitations of included studies

One of the main limitations of the included studies relates to the lack of consistency in controlling for key potential confounders. With regard to studies on depression, hard drug use and marijuana use, most controlled for time one levels of the health condition or IPV (where IPV was the dependent variable). Far fewer of the estimates on IPV and later alcohol use and IPV and STI controlled for time one levels of the health outcome.

With regard to the studies on depressive symptoms, only two controlled for early childhood trauma (i.e. childhood sexual and/or physical abuse) and two controlled for alcohol use, even though both are known to increase the risk for depression [55] [56]. This makes it difficult to rule them out as potential contributors to the causation of the outcomes. Nevertheless, we found that studies showed a positive direction of association, regardless of which variables were adjusted for, and there was no clear pattern of differing magnitude of association that indicated the relationship between IPV and depressive symptoms were not likely to be entirely accounted for by shared risk factors.

Little is known about the potential causal mechanisms between depression and subsequent IPV. However, women who are depressed may experience symptoms (e.g. lethargy and withdrawal) that impact their capacity for engaging in self-care behaviours including help-seeking and contact with health care providers and subsequently extricating herself from the relationship. It is also plausible that earlier, perhaps unmeasured experiences of violence, such as childhood sexual abuse and trauma are causing depression and later IPV, or that

depression is mediating the relationship between childhood sexual abuse and later IPV. A path analysis with cross-sectional data supports this hypothesis [56], but few longitudinal studies have explored these relationships.

Only two studies on alcohol use controlled for childhood sexual abuse and one controlled for the partner's level of alcohol use, both of which are potential causes of women's alcohol use. It has been suggested that women who drink heavily are more likely to have a partner who drinks heavily, which can increase their risk of IPV because heavy alcohol use by men is associated with IPV perpetration [57]. This can occur because people tend to choose a partner with similar drinking patterns to themselves or through the influence of their partner's drinking patterns and expectations [58]. Research also suggests that the partner's or the woman's drinking may fuel conflict in the relationship. A nationally representative study from the US found that couples with similar drinking patterns (e.g. both abstinent or both binge drinkers) were less likely to experience IPV in their relationship compared to those with discordant drinking habits [59]. This implies that relationship conflict may result in IPV, as opposed to alcohol use alone because high alcohol use would be more predictive than discordant use. Alcohol use was measured in a variety of ways with most assessing binge drinking or heavy drinking and only two studies measuring alcohol dependence. Although heavy alcohol consumption increases the risk for disease, injury and premature death [60, 61] the adverse consequences may vary considerably between people who sporadically drink heavily and those who develop an alcohol use disorder. Although the evidence points to a bi-directional relationship between IPV and hard drug use and IPV and marijuana use there were too few estimates. Women may self-medicate with alcohol, tobacco or drugs in an attempt to cope with the trauma and stress of living in an abusive relationship, which in themselves are important risk factors for poor health. However, alcohol or drug use by the abuser or the

woman has also been identified as a trigger to violent episodes or a factor that contributes to more severe violence [62]. The evidence for the association between recent IPV and STIs is uncertain.

The majority of the studies were from high income countries, most notably the USA and only six studies were from middle income countries where is it known that the prevalence of past year IPV is higher. Six of the studies were of adolescents, again mostly in high income countries, where these were likely to be dating relationships with no cohabitation. One study included young girls and women. Experiences of IPV in adult and adolescent relationships may be qualitatively different, in that there is a lower likelihood of experiencing systematic and chronic violence in dating relationships [63]. About a third of the studies were drawn from clinical settings, schools or were taken from sub-populations and therefore subject to bias (e.g. HIV positive sex workers, women with depressive symptoms and women on methadone maintenance). More population-based cohort studies are needed in order to generalise the findings. Most studies measured physical violence and some modelled exposure to physical and sexual and other forms of violence separately. However, other forms of violence (e.g. emotional abuse, threats) may also associated with some of the health outcomes. Most studies constructed the reference categories for IPV as binary opposites, meaning that some participants in the reference group may have been exposed to other forms of IPV that were not measured or modelled. This can bias the effect estimates towards the null and underestimate the magnitude of the association between recent IPV and health outcomes. Some studies included only women who were in a relationship for all waves of data collection. However, research shows that the prevalence of IPV is higher among women who are no longer with abuser compared to those currently in a relationship [64] and excluding these women may dilute the association between IPV and health outcomes.

Implications

The evidence on the association between exposure to IPV and mental and physical health outcomes has important implications for the delivery of interventions and services. IPV against women has received increasing attention by public health experts globally [2]. The results of this review indicates that health care providers and specialist IPV organisations should be aware of the bidirectional relationship between recent IPV and depression. Little is known about what pattern of exposure to IPV is more strongly associated with different health outcomes. In order to establish these connections, longitudinal studies of IPV and health are needed that distinguish recent violence with no prior history, from recent violence that is part of ongoing abuse, and historical violence that no longer occurs. Other factors that are known to mediate the relationship such as the duration and severity of IPV, childhood physical and sexual abuse, poverty related stress and risk behaviours such as alcohol and substance abuse should be carefully considered in analyses.

Appendix 1

Search Strategy from Medline

1. domestic violence/ or spouse abuse/
2. Battered Women/
3. (spous* abuse or battered wom*n or intimate partner violence or intimate partner abuse or dating violence or domestic abuse).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
4. (intimate adj4 partner adj4 violence).tw.
5. (intimate adj4 partner adj4 abuse).tw.
6. ((partner or relationship or wom$n or domestic or spous*) adj4 (abus* or violen* victimi* or batter*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
7. Rape/
8. sexual violence.tw.
9. sexual abuse.tw.
10. rape.tw.
11. cohort studies/ or follow-up studies/ or longitudinal studies/ or "national longitudinal study of adolescent health"/ or prospective studies/
12. longitudinal stud*.tw.
13. cohort stud*.tw.
14. panel stud*.tw.
15. follow up stud*.tw.
16. prospective stud*.tw.
17. longitudinal analysis.tw.
18. (longitudinal adj3 analysis).tw.
19. cohort analysis.tw.
20. (cohort adj3 analysis).tw.
21. panel analysis.tw.
22. (panel adj3 analysis).tw.
23. time series.tw.
24. (longitudinal adj3 stud*).tw.
25. (cohort adj3 stud*).tw.
26. (panel adj3 stud*).tw.
27. (follow up adj3 stud*).tw.
28. (prospective adj3 stud*).tw.
29. letter.pt.

30. editorial.pt.
31. comment.pt.
32. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
33. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
34. 29 or 30 or 31
35. 33 not 34
36. 32 and 35 (2,536)

Appendix 2
Table 3. Summary of studies of IPV experienced up to and including last 12 months and health outcomes in women

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
Depressive Symptoms						
Chuang et al. [13]; 1,420 adult women; USA	2 years; 2 waves	Depression	Physical and/or sexual, CTS-like, last 12 months	Depression, CES-D, past week	aOR=1.88 (1.02-3.45)	Yes
Chowdhary & Patel [38]; 1,750 adult women; India	1 year; 3 waves	Depression	Physical, CT-like, last 3 months	Depressive disorder, ICD-10, currently suffering	aOR=0.5 (0.07-3.79)	No, but analysis removes women with baseline depressive disorder
Davidson et al. [30]; 494 adult women; Australia	2 years; 2 waves	Depression	Physical and/or sexual, CAS, last 12 months	Major Depressive Disorder, PHQ-9, past 2 weeks	aOR=2.3 (1.03-5.12), p=0.04	Yes
Kim & Lee [42]; 3,153 adult women; Korea	4 years; 4 waves	Depression	"Physical violence and/or threat of physical violence", last 12 months	Depression, CES-D, past week	Beta=-0.03, SE=0.01, p=0.004	Yes
Newcomb et al. [23] 113 adult women; USA	1 year; 3 waves	Depression	Psychological and/or physical, CTS, last 6 months	Depression, CES-D, period not specified	Path coefficient=0.17, p=<0.05	Yes
Suglia et al. [25]; 1,834 adult women; USA	3 years; 3 waves	Depression	Physical and/or sexual, CTS-like, last 12 months	Depression, CIDI-SF, past 12 months	aOR=1.09 (0.6-1.9)	Yes
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	Depression	Physical, CTS, last 12 months	Depression, CES-D, past week	Beta=0.18 (0.1-0.26) p<0.05	Yes
Taft et al. [31]; 9,683 adult women; Australia	4 years; 2 waves	Depression	Physical and/or sexual, CTS, last 12 months	Depression, CES-D, past week	aOR=2.12 (1.69-2.65)	Yes
Zlotnick et al. [19] 3,104 adult women; USA	5 years; 2 waves	Depression	Physical, CTS-like, last 12 months	Depression, CES-D, past week	Beta=6.69, p=0.003	Yes
Foshee et al. 2004 [24]; 1,291 adolescents; USA	4-5 years; 4-5 waves	IPV	Sexual dating violence, CTS like, last 12 months	Depression symptoms "Kandel and Davis", last 6 months	HR=1.35 (1.05-1.74)	Yes
Kim & Lee [23]; 3,153 adult women; Korea	4 years; 4 waves	IPV	"Physical violence and/or threat of physical violence", last 12 months	Depression, CES-D, past week	Beta=3.34, SE=0.61, p<0.001	Yes
Leher et al. 2006 [17]; 1,659 adolescents; USA	7 years; 3 waves	IPV	Physical, CTS-like, last 12 months	CES-D, past week	aOR=1.86 (1.05-3.29)	Yes
Levendosky et al. [26] 150 adult women; USA	4 years; 5 waves	IPV	Physical and/or sexual, last 12 months, SVAWS	BDI, time period not specified	R=0.23, p<0.05	No

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
Nduna et al. 2010 [36]; 995 women and girls; South Africa	1 year; 2 waves	IPV	Physical and/or sexual, CTS-like (WHO), last 12 months	CES-D, past week	aOR=1.67 (1.18-2.36)	Yes
Postpartum Depression						
Escriba-Aguir et al. [41]; 888 pregnant women; Spain	1 year; 4 waves	Postpartum depression	Psychological, Abuse AAS, past 12 months	Postpartum depression, EPDS, past 12 months	aOR=4.11 (1.23-13.73)	Yes
Flach et al. [46]; 5,681 pregnant women; United Kingdom	3.5 years; 5 waves	Postpartum depression	Has a partner physically hurt and/or been emotionally cruel, during pregnancy	Postnatal depression, EPDS, past 7 days (asked at 8 weeks postpartum)	aOR=1.29 (1.02-1.63)	Yes
Kita et al. [45]; 562 adult women; Japan	1 month; 2 waves	Postpartum depression	Physical and/or non-physical, during pregnancy, ISA	Postnatal depression, HADS, past 7 days	Path coefficients: Antenatal IPV and postnatal depression=0.10 (NS); Antenatal IPV and antenatal depression=0.31; Antenatal depression and postnatal depression=0.57	Yes
Patel et al. [39]; 235 pregnant women; India	6 months; 3 waves	Postpartum depression	"Marital violence" during pregnancy	Postnatal depression, EPDS, past 7 days (asked at 6 months)	RR=2.6 (1.6-4.3) p=0.001	No
Tsai et al. [37]; 958 pregnant women; South Africa	3 years; 4 waves	Postpartum depression	Physical, CTS, last 12 months	Postpartum Depression, EPDS, past 7 days	Coefficient=1.04 (0.61-1.47)	Yes
[b]Woolhouse et al. [32]; 1,102 pregnant women; Australia	4 years; 6 waves	Postpartum depression	Physical and/or emotional, CAS, last 12 months	Depression in the 1st year postpartum only, EPDS	aOR=0.75 (0.4-1.6)	Yes
[b]Woolhouse et al. [33]; 1,102 pregnant women; Australia	4 years; 6 waves	Postpartum depression	Physical and/or emotional, CAS, last 12 months	Depression at 4 years postpartum only, EPDS	aOR=3.48 (2.0-6.1)	Yes
[b]Woolhouse et al. [33]; 1,102 pregnant women; Australia	4 years; 6 waves	Postpartum depression	Physical and/or emotional, CAS, last 12 months	Depression in the 1st year and at 4 years postpartum, EPDS	aOR=2.18 (1.2-3.8)	Yes
Study, Participants,	**Length of**	**Dependent**	**IPV Measure and**	**Health Outcome Measure**	**Effect Estimate**	**Adjusted for**

Country	Follow-up, Number of Waves	Variable – IPV or health outcome	Timeframe	and Timeframe		Time 1 Health Outcome or IPV[d]
Tsai et al. [37]; 958 pregnant women; South Africa	3 years; 4 waves	IPV	Physical, CTS, last 12 months	Postpartum Depression, EPDS, past 7 days	Beta=0.054 (0.030-0.079)	Yes
Suicide Attempts						
Chowdhary & Patel [38]; 1,750 adult women; India	1 year; 3 waves	Suicide attempts	Physical, CT-like, last 3 months	Single question, ever attempted suicide	aOR=7.97 (1.75-36.37)	Yes
Roberts et al. [23]; 2,206 adolescents; USA	1 year; 2 waves	Suicide attempts	Verbal, threats, physical, CTS, last 12 months	Single question, ever attempted suicide	Beta=0.12 (0.02-0.22)	Yes
Perceived Stress						
Salzaar et al. [43]; 398 adults; Nicaragua	3 years; 2 waves	Perceived emotional distress	Emotional, physical, sexual, WHO Survey, last 12 months	Perceived emotional distress, SRQ,	OR=4.59 (2.5-8.45) calculated	No
[b]Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	Perceived stress	Verbal aggression, CTS, last 12 months	Perceived Stress, Cohen et al. 1983 a 14-item measure, past 6 months	Beta=0.18; p<0.001	Yes
[b]Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	Perceived stress	Physical aggression, CTS, last 12 months	Perceived Stress, Cohen et al. 1983 a 14-item measure, past 6 months	Beta=0.11; p<0.05	Yes
General Anxiety						
Suglia et al. [25];1,834 adult women; USA	3 years; 3 waves	General anxiety	Physical and/or sexual, CTS-like, past 12 months	Single question, asking if they had a period of 6 months or more when they felt worried, tense or anxious	aOR=1.95 (1-3.8)	Yes
Self-Perceived Health Status						
Escriba-Aguir et al. [41]; 888 pregnant women; Spain	1 year; 4 waves	Self-perceived health status	Psychological, Abuse AAS, past 12 months	Current self-perceived health status, asking respondents to describe their general health as: very good; good; fair; poor; very poor	aOR=4.32 (1.58-11.87)	Yes
Hard Drug use (Cocaine, Crack, Heroin)						
Algeria et al. [40]; 452 adult women; Puerto Rico	3 years; 3 waves	Hard drug use	Physical and/or psychological, CTS, last 12 months	Hard core drug use, self-report of crack or cocaine, heroin, past 12 months	aOR=2.02 (1.04-3.91)	Yes
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	Hard drug use	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Cocaine use once a week or more, last 6 months	aOR=2.10 (0.82-5.5)	No

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	IPV	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Crack use once a week or more, last 6 months	aOR=1.6 (0.83-3.0)	No
[a]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	IPV	Physical, injurious, sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Hard drug use (cocaine, crack or heroin), last 6 months	RR=1.6 (1.08-2.36)	Yes
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	IPV	Minor violence, CTS, last 12 months	Hard drug use, past year	aOR=2.41 (1.36-4.26)	Yes
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	IPV	Severe violence, CTS, last 12 months	Hard drug use, past year	aOR=2.87 (1.39-5.92)	Yes
Marijuana Use						
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	Marijuana use	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use once a week or more, last 6 months	aOR=2.4 (0.92-6.2)	No
[a]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	Marijuana use	Physical, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use, last 6 months	RR=1.14 (0.81-1.6)	Yes
[a]Nowotny & Graves [16] 2,959 adolescents; USA	6 years; 2 waves	Marijuana use	Sexual, CTS-like, last 12 months	Marijuana use (any), last 12 months	aOR=1.4 (0.97-2.08)	Yes
El-Bassel et al. [22]; 317 adult women; USA	1 year; 3 waves	IPV	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use once a week or more, last 6 months	aOR=4.5 (2.4-8.4)	No
[a]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	IPV	Physical, injurious, sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Hard drug use (cocaine, crack or heroin), last 6 months	RR=0.94 (0.71-1.24)	Yes
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	IPV	Minor violence, CTS, last 12 months	Marijuana use, past year	aOR=0.98 (0.59-1.64)	Yes

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	IPV	Severe violence, CTS, last 12 months	Marijuana use, past year	aOR=1.78 (0.92-3.44)	Yes
Other combinations of illicit drug use (not restricted to Class A) and/or alcohol use						
[a]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	IPV	Physical, injurious, sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", any illicit drug use, last 6 months	RR=1.15 (0.83-1.58)	Yes
[a]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	Any illicit drug use	Physical, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", any illicit drug use, last 6 months	RR=0.9 (0.65-1.26)	
Newcomb et al. [23];113 adult women; USA	1 year; 3 waves	Any illicit drug use	Psychological and/or physical, CTS, past 6 months	Participants asked if they had ever used 16 illegal drugs including cocaine, crack, heroin, marijuana and others not listed.	Path coefficient=0.18, $p<0.05$	Yes
[a]Nowotny & Graves [16]; 2,959 adolescents; USA	6 years; 2 waves	Any illicit drug use	Physical, CTS-like, last 12 months	Drug use (MDMA, inhalents, LSD, heroin, PCP or other illegal drugs), last 12 months	aOR=1.3 (0.8-2.15)	Yes
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	Illicit substance use	Physical, CTS, last 12 months	Illicit substance use measuring overall tobacco, alcohol and marijuana use, last 12 months	Beta=0.16 (0.06-2.26), $p<0.05$	Yes
Alcohol Use						
[b]Boden et al. [47]; 630 adult women; New Zealand	10 years; 4 waves used	Alcohol abuse or dependence	Physical and/or sexual, CTS, last 12 months	CIDI – 1 to 2 symptoms versus none, last 12 months	IRR=1.58 (1.37-1.82)	No
[b]Boden et al. [47]; 630 adult women; New Zealand	10 years; 4 waves used	Alcohol abuse or dependence	Physical and/or sexual, CTS, last 12 months	CIDI – 3 to 5 symptoms versus none, last 12 months	IRR=2.5 (1.88-2.89)	No
[b]Boden et al. [47]; 630 adult women; New Zealand	10 years; 4 waves used	Alcohol abuse or dependence	Physical and/or sexual, CTS, last 12 months	CIDI – > 5 symptoms versus none, last 12 months	IRR=3.38 (2.57-6.03)	No
El-Bassel et al. [21] 317 adult women; USA	1 year; 3 waves	Binge drinking	Physical and/or sexual, CTS, last 6 months	Binge drinking – drinking 4 or more alcoholic drinks within a 6-hour period) once a week or more in the past 6 months	aOR=0.80 (0.04-17.0)	No

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
[b]Gao et al. [34]; 636 adult women; New Zealand	2 years; 2 waves	High risk alcohol use	Verbal aggression at 24 months postpartum only, CTS, last 12 months	High risk alcohol use - drank 6 or more alcoholic drinks on at least one occasion in the last 12 months	aOR=2.68 (0.57–12.62)	No
[b]Gao et al. [34]; 636 adult women; New Zealand	2 years; 2 waves	High risk alcohol use	Verbal aggression at 6 weeks and 24 months postpartum only, CTS, last 12 months	High risk alcohol use - drank 6 or more alcoholic drinks on at least one occasion in the last 12 months	aOR=3.14 (0.71-13.92)	No
[b]Gao et al. [34]; 636 adult women; New Zealand	2 years; 2 waves	High risk alcohol use	Physical at 24 months postpartum only, CTS, last 12 months	High risk alcohol use - drank 6 or more alcoholic drinks on at least one occasion in the last 12 months	aOR=1.24 (0.69-2.23)	No
[b]Gao et al. [34]; 636 adult women; New Zealand	2 years; 2 waves	High risk alcohol use	Physical at 6 weeks and 24 months postpartum only, CTS, last 12 months	High risk alcohol use - drank 6 or more alcoholic drinks on at least one occasion in the last 12 months	aOR=1.49 (0.78-2.84)	No
[a]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	Binge drinking	Physical, CTS, last 12 months	"Drug Use and Risk Behaviour Questionnaire", Binge drinking, last 6 months	RR=1.4 (0.97-2.02)	Yes
Kieley et al. [15]; 195 couples; USA	2.5 years; 2 waves	Alcohol dependence	Physical, CTS, last 12 months	ADS and MAST, last 12 months	Slope=0.011 Quadratic=0.001 NS	Yes
Kieley et al. [15]; 195 couples; USA	2.5 years; 2 waves	Alcohol dependence	Verbal, CTS, last 12 months	ADS and MAST, last 12 months	Slope=-0.009 Quadratic=-0.006	Yes
[a]Nowotny & Graves [16]; 2,959 adolescents; USA		Binge drinking	Threats, minor violence, CTS-like, last 12 months	Binge drinking: drinking five or more drinks during a single occasion at least two to three times a month in the past year	aOR=1.0 (0.71-1.43)	Yes
[b]Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	Heavy drinking	Verbal aggression, CTS, last 12 months	Alcohol consumption, average daily volume. Heavy drinking index, 6+ drinks single occasion and drinking to intoxication (continuous), last 12 months	Beta=-0.4; p<0.05	Yes

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
[b]Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	Heavy drinking	Physical aggression, CTS, last 12 months	Alcohol consumption, average daily volume. Heavy drinking index, 6+ drinks single occasion and drinking to intoxication (continuous), last 12 months	Beta=0.09; p<0.05	Yes
Zlotnick et al. [19]; 2,905 adult women; USA	5 years; 2 waves	Alcohol use	Physical, CTS-like, last 12 months	National Survey of Alcohol and Drug Abuse Questions. Four items coded on a 6-point scale ranging from 0 (abstinent) to 3 (high moderate use) to 5 (binge drinking) past 30 days	Correlation coefficient=1.45, mean=0.19	Yes
Marsh-Buzy et al. [29]; 73 school students; USA	4 months, 2 waves	IPV	Physical and/or sexual, CTS, past 4 months	Alcohol use – quantity/frequency measure, past 4 months	aOR=3.94; p=0.04	Yes
[b]Testa et al. 2003 [28];724 adult women; USA	1 year; 2 waves	IPV	Severe violence, CTS, last 12 months	Heavy episodic drinking in past 12 months consisted of mean response to two questions on frequency of consuming 5 or more drinks in a single day and frequency of drinking until intoxicated	aOR=1.0 (0.71-1.4)	Yes
[b]Testa et al. 2003 [28];724 adult women; USA	1 year; 2 waves	IPV	Minor violence, CTS, last 12 months	Heavy episodic drinking in past 12 months consisted of mean response to two questions on frequency of consuming 5 or more drinks in a single day and frequency of drinking until intoxicated	aOR=1.2 (0.93-1.56)	Yes
HIV Infection						
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	HIV infection	Physical and/or sexual, last 6 months	HIV positive status	aOR=0.21 (0.3-1.6)	Yes
Jewkes et al. [35] 1,099 women and girls; South Africa	2 years; 3 waves	HIV infection	Physical and/or sexual, WHO Survey, last 12 months	HIV infection assessed with blood tests at all three waves	IRR=1.51 (1.04-2.21)	Yes

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
Sexually Transmitted Infection						
Chowdhary & Patel [38]; 1,750 adult women; India	1 year; 3 waves	STI	Physical, CTS-like, last 3 months	STI (chlamydia, gonorrhoea or trichomoniasis) biological testing, past 3 months	aOR=1.88 (0.64-5.53)	No, but removes women who had STI at baseline
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	STI	Physical and/or sexual, CTS, last 6 months	STI infection at wave 3	aOR=0.88 (0.53-1.5)	Yes
Wilson et al. [44]; 389 adult women; Kenya	Up to 2 years; unclear	STI	Physical and/or sexual, WHO, last 12 months	STI at quarterly examination, Presence of gonorrhoeae, chlamydia trachomstis, or trichomonas vaginalis detected by nucleic acid amplification test	aRR=0.88 (0.57-1.37)	No
Sexual Risk Behaviour						
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	Unprotected anal sex	Physical and/or sexual, last 6 months	Unprotected anal sex	aOR=1.8 (0.58-5.5)	Yes
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	Condom use consistency	Physical and/or sexual, last 6 months	Condom use consistency	aOR=0.41 (0.24-0.71)	Yes
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	Condom request consistency	Physical and/or sexual, last 6 months	Condom request consistency	aOR=0.42 (0.22-0.82)	Yes
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	Multiple concurrent partners	Physical and/or sexual, last 6 months	Multiple concurrent partners	aOR=3.1 (0.89-11.0)	Yes
Teitelman et al. [48]; 2,629 adolescents; USA	7 years; 2 waves Is it 2 waves	HIV risk (condom use)	Verbal and/or physical, CTS, last 12 months	HIV risk (condom use), last 12 months	aOR=1.59 (1.16-2.18)	Yes
Wilson et al. [44]; 389 adult women; Kenya	Up to 2 years; unclear	Unprotected anal and/or vaginal sex	Physical and/or sexual, WHO, last 12 months	Unprotected anal and/or vaginal sex, past week	aRR=1.91 (1.32-2.78)	No
Wilson et al. [44]; 389 adult women; Kenya	Up to 2 years; unclear	100% condom use	Physical and/or sexual, WHO, last 12 months	100% condom use, past week	aRR=0.90 (0.82-0.99)	No
Wilson et al. [44]; 389 adult women; Kenya	Up to 2 years; unclear	2 or more sexual partners	Physical and/or sexual, WHO, last 12 months	2 or more sexual partners, past week	aRR=0.96 (0.76-1.21)	No
Wilson et al. [44]; 389 adult women; Kenya	Up to 2 years; unclear	3 or more sex acts	Physical and/or sexual, WHO, last 12 months	3 or more sex acts, past week	aRR=1.0 (0.79-1.26)	No
Wilson et al. [44]; 389 adult women; Kenya	Up to 2 years; unclear	Semen detection	Physical and/or sexual, WHO, last 12 months	Semen detection by prostate specific antigen test PSA as a biomarker of unprotected sex	aRR=1.54 (1.17-2.04)	No
Wilson et al. [44]; 389 adult women; Kenya	Up to 2 years; unclear	No sex	Physical and/or sexual, WHO, last 12 months	No sex in the past week	aRR=0.67 (0.54-0.83)	

Study, Participants, Country	Length of Follow-up, Number of Waves	Dependent Variable – IPV or health outcome	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Effect Estimate	Adjusted for Time 1 Health Outcome or IPV[d]
Other health outcomes						
[a]Chowdhary & Patel [38]; 1,750 adult women; India	1 year; 3 waves	Abnormal vaginal discharge	Physical, CTS-like, last 3 months	Abnormal vaginal discharge, last 3 months	aOR=1.06 (0.44-2.58)	No, but removes women who had condition at baseline
[a]Chowdhary & Patel [38]; 1,750 adult women; India	1 year; 3 waves	Dysuria	Sexual, CTS-like, last 3 months	Dysuria, last 3 months	aOR=1.57 (0.6-4.14)	No, but removes women who had condition at baseline
[a]Chowdhary & Patel [38]; 1,750 adult women; India	1 year; 3 waves	Lower abdominal pain	Physical, CTS-like, last 3 months	Lower abdominal pain, last 3 months	aOR=1.2 (0.63-2.32)	No, but removes women who had condition at baseline
[a]Chowdhary & Patel [38]; 1,750 adult women; India	1 year; 3 waves	Dyspareunia	Physical, CTS-like, last 3 months	Dyspareunia, last 3 months	aOR=2.15 (0.8-5.82)	No, but removes women who had condition at baseline

[a]More than one estimate reported in the study, but preference given to one estimate using the following algorithm: estimate derived from multivariate analysis; the definition of IPV closely matches that of other studies in the health outcome group; where the reference group was unexposed to any violence; where the estimate was most precise
[b]Estimates are mutually exclusive as based on different sub-samples
[c]p-value if no confidence interval reported
AAS, Abuse Assessment Screen; ADS, Alcohol Dependence Scale; BDI, Beck Depression Inventory; CAS, Composite Abuse Scale; CES-D, Center for Epidemiological Studies-Depression; CIDI-SF, Composite International Diagnostic Interview-Short Form; CTS, Conflict Tactics Scale; HADS, Hospital Anxiety and Depression Scale; ISA, Index of Spouse Abuse; MAST, Michigan Alcoholism Screening Test; PHQ-9, Patient Health Questionnaire; SRQ, Self-Report Questionnaire; SVAWS, Severity of Violence Against Women Scale
[d] Refers to the dependent variable

Declarations

Ethics approval

Not applicable

Consent for publication

Not applicable

Availability of data and material

All data generated or analysed during this study are included in this published article [and its supplementary files].

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Conceived and designed the study: LJB KD. Data collection: LJB. Analysed the data: LJB, KD. Wrote the first draft of the manuscript: LJB. Contributed to the writing of the manuscript: LJB CW KD MR. Agreed with manuscript results and conclusions: LJB CW KD MR.

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Recent intimate partner violence against women and health: a systematic review and meta-analysis of cohort studies

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Abstract

Objectives: We reviewed cohort studies to determine the magnitude and temporal direction of the association between recent intimate partner violence (IPV) and a range of adverse health outcomes or health risk behaviours.

Design: Systematic review and meta-analysis.

Methods: Medline, EMBASE and PsycINFO were searched from the first record to November 2016. Recent IPV was defined as occurring up to and including the last 12 months; all health outcomes were eligible for inclusion. Results were combined using random effects meta-analysis.

Results: 35 separate cohort studies were retrieved. Eight studies showed evidence of a positive association between recent IPV and subsequent depressive symptoms, with a pooled OR from five estimates of 1.76 (95% CI 1.26-2.44, I^2 = 37.5% p=0.172). Five studies demonstrated a positive, statistically significant relationship between depressive symptoms and subsequent IPV; pooled ORs from two studies was 1.72 (95% CI 1.28-2.31, I^2 = 0.0%, p=0.752). Recent IPV was also associated with increased symptoms of subsequent postpartum depression in five studies (OR=2.19, 95% CI 1.39-3.45 p=0.000) although there was substantial heterogeneity. There was some evidence of a bi-directional relationship between recent IPV and hard drug use, and marijuana use although studies were limited. There was no evidence of an association between recent IPV and alcohol use or sexually transmitted infections (STIs) although there were few studies and inconsistent measurement of alcohol and STIs.

Conclusions

Exposure to violence has significant impacts. Longitudinal studies are needed to understand the temporal relationship between recent IPV and different health issues, whilst considering the differential effects of recent versus past exposure to IPV. Improved measurement will

enable an understanding of the immediate and longer-term health needs of women exposed to IPV. Health care providers and IPV organisations should be aware of the bi-directional relationship between recent IPV and depressive symptoms.

Systematic review registered on Prospero (CRD42016033372).

Strengths

- This is the first systematic review of cohort studies to measure the magnitude of the association and temporal direction between recent exposure to IPV and health outcomes.
- As the review considers a broad range of outcomes, we identified gaps in the evidence base including a need for cohort studies on recent IPV and non-communicable diseases such as cardiovascular disease hypertension and obesity, as well as posttraumatic stress disorder and anxiety disorder.

Limitations

- Due to the large number of abstracts retrieved and the limited timeframe for the review, we were not able to employ double screening of abstracts. However, two researchers conducted the review of full text papers, with a third reviewer the full texts of papers where there was uncertainty about their inclusion.
- As some studies measured the outcome variable (either IPV or the health condition) continuously, it was not possible to combine all measures of effect, which limited the number of studies in the meta-analyses.
- It was not possible to quantitatively assess publication bias, as too few studies were in the meta-analyses of each health condition.

Background

Worldwide, almost a third (30%) of all women who have been in a relationship have experienced physical and/or sexual violence by their intimate partner.[1 2] Women's lifetime exposure to IPV is associated with myriad health outcomes. Systematic reviews of longitudinal data, find that women who have been physically and/or sexually abused by their partner at some point in their life are twice as likely to have an abortion, twice as likely to suffer from depression, and in some regions are 1.5 times more likely to acquire HIV compared to women who have not experienced IPV.[2] Not surprisingly, given its high prevalence and adverse health effects, lifetime exposure to IPV is estimated to result in a high burden of disease. IPV is the second most common risk factor for disability-adjusted life years (DALY) globally in women aged 20 to 24 years.[3]

In our previous systematic reviews, we began to explore the relationships between 'ever' exposure to IPV and depressive symptoms and alcohol use, which revealed evidence of a bidirectional association. Devries et al. found evidence suggestive of an association between IPV and incident depressive symptoms (OR=1.97, 95% CI 1.56-2.48) as well as an association in the reverse direction between depressive symptoms and incident IPV (OR=1.93, 95% CI 1.51-2.48).[4] In another systematic review the authors found increased odds of alcohol use following IPV (OR=1.25, 95% CI 1.02-1.52) and increased odds of IPV following alcohol use (OR=1.27, 95% CI 1.07-1.52).[5]

Although available evidence finds important associations between IPV and a range of mental and physical health outcomes, the nature of the associations are not always clear. It is possible that exposure to IPV results in subsequent mental and physical health outcomes; that

different mental and physical health conditions increase risk of subsequent IPV; or that a bi-directional relationship is present.

Both IPV and some associated health outcomes, such as depression, anxiety and substance abuse, are chronic, episodic conditions, which can occur with varying frequency over longer time periods. Studies that measure lifetime exposure to IPV therefore hide the complexity of the relationship between IPV and mental and physical health outcomes. This is because estimates of 'ever' exposure to IPV are heterogeneous, and may include anything from past year, before the past year and more distant experiences of IPV. Recent violence may lead to more severe health outcomes, but this may be influenced by duration and severity, for example, recent violence with no prior history versus recent violence experienced as part of ongoing historical abuse.

In the current systematic review, we build on this by closely examining the issue of temporality with regard to recent exposure to IPV and a broader range of health outcomes. In this paper we aim to: (i) review what health outcomes have been examined in cohort studies of recent IPV ('recent' defined here as IPV experienced up to and including the last 12 months); (ii) quantify the magnitude of the association between IPV and different health outcomes and (iii) examine the temporal direction of IPV and health outcomes.

Methods

A systematic review protocol was registered on PROSPERO on the 18th March 2016 (CRD42016033372) and is available from http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016033372

Literature searches

We searched Medline, EMBASE and PsycINFO from the first record up to January 27, 2016 (with an updated search conducted in November 2016). Terms for IPV were adapted from a previous systematic review on the prevalence of IPV and health outcomes which was conducted for the 2010 Global Burden of Disease of IPV. [1] Controlled vocabulary terms and text words related to longitudinal studies were used for each database. In order to ensure a wide yield of studies, terms for specific health outcomes were not included. An example search strategy appears in Appendix 1. Reference list screening was undertaken for key systematic review papers. One study was included from a systematic review on IPV and perinatal mental health disorders published in 2017 which we identified whilst this paper was under review.

Inclusion criteria

- English language publications
- Longitudinal studies reporting on female participants aged 15 and over were considered. Studies were deemed longitudinal if either the exposure or the outcome was measured on at least two occasions.
- Studies where IPV was conceptualised as the independent variable, or where IPV was the dependent variable, in order to capture any evidence of bi-directional causality.
- All author definitions of recent IPV victimisation that occurred up to and including 12 months prior.
- All author definitions of women related health outcomes that were measured on at least two occasions.

A 12-month cut-off period was chosen for recent IPV as this is the most commonly used period for prevalence estimates, it is consistent with internationally recognised IPV measures,[6 7] and has been used in a number of intervention studies for IPV.[8-10]

Screening and data extraction

Records were initially screened by one reviewer (LJB) and studies not meeting the inclusion criteria were removed. Full text articles were reviewed by one reviewer (LJB) and where there was uncertainty about the inclusion of an article it was referred to the senior author (KD). The final set of full-text articles were formally appraised by two reviewers (LJB and MR). Data were extracted and entered into an Excel spreadsheet by one reviewer (LJB). The study selection process including the number of studies abstracts and full texts screened with reasons for exclusion is summarised in the flowchart in Figure 1.

Quality appraisal

The quality of each effect estimate was appraised and presented in Table 1 which correspond to the major relevant domains of potential bias in quality assessment tools. Consideration was given to whether definitions of IPV and health outcomes were based on valid, reliable measures. We considered whether studies controlled for potential confounders for two reasons. IPV and the health outcomes of interest commonly occur episodically over a period of time, and episodes of either that are incident over the study period may be a continuation of previous IPV or health outcomes. Therefore, we examined whether studies adjusted for time one levels (i.e. at the beginning of the study period) of the outcome variable. Additionally, IPV and the health outcomes of interest are associated with demographic characteristics and other risk factors that may explain the association between them such as childhood sexual abuse. Due to the complexity of the potential causal pathways between IPV

and the health outcomes, we did not specify a minimum set of confounders that should be adjusted for. Additionally, it has been noted that it is not always appropriate to adjust for baseline levels of an outcome variable in longitudinal studies. When exposures are associated with baseline health status, bias can arise if change in health status preceded baseline assessment or if the dependent variable measurement is unreliable or unstable.[11] However, we recorded whether key variables were adjusted for and examined the results in the light of these adjustments. Information was also extracted in relation to mode of administration of surveys, length of follow-up number of waves and attrition rates.

Data Analysis

Analyses were conducted by LJB and KD using Stata 14.0. Study characteristics and quality are summarised descriptively. Studies reported a range of effect estimates (e.g. odds ratios, relative risks and correlation coefficients). Adjusted odds ratios (ORs) were extracted directly from the publications with the exception of one unadjusted OR which was calculated for a study on perceived stress which is not one of the health outcomes included in the meta-analyses. Studies measured IPV or health outcomes in heterogeneous ways, therefore the results are summarised descriptively for each health outcome. Where there were at least two estimates, random effects meta-analysis was used to calculate the pooled ORs representing associations between IPV occurring up to and including the last 12 months and various health outcomes. Higgin's I^2 statistic, which describes the percentage of variability in point estimates that is due to heterogeneity rather than sampling error [12], was calculated. Some studies reported multiple estimates using overlapping definitions of IPV on the same sample of participants. In order to avoid double counting participants in these studies, which can lead to falsely precise pooled estimates, preference was given to one estimate using the following algorithm implemented in the following sequence: (i) those derived from multivariate

analysis (ii) where the definition of IPV closely matched that of the other studies in the meta-analysis (iii) where the reference group was unexposed to any violence and (iv) where the estimate was most precise (i.e. the smallest confidence interval). This algorithm was applied to 3 studies. Studies that provided multiple estimates, but on different sub-samples of participants were included in the meta-analysis. Studies that reported other types of estimate (e.g. correlations coefficients, betas, risk ratios) are documented separately.

Ethics Statement

All data used in this review were already in the public domain and ethical approval was not required.

Patient and public involvement

Patients and the public were not involved in this systematic review.

Table 1. Quality assessment of 36 papers reporting on 35 studies included in the review and effect estimates

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of Administration	Effect Estimate
Depressive symptoms as dependent variable									
Chuang et al. [13]; 1,420 adult women; USA	2 years; 2 waves	29.1%	Physical and/or sexual, CTS-like, last 12 months	Depression, CES-D, past week	Yes	No	IPV; age group; race; education; marital status; income (for the step 1 regression model)	Telephone interview	aOR=1.88 (1.02-3.45)
Chowdhary & Patel [39]; 1,750 adult women; India	1 year; 3 waves	-	Physical, CT-like, last 3 months	Depressive disorder, ICD-10, currently suffering	No, but analysis removes women with baseline depressive disorder	No	Age; literacy; household per capita income	Interviewer administered	aOR=0.5 (0.07-3.79)
Davidson et al. [31]; 494 adult women; Australia	2 years; 2 waves	37.4%	Physical and/or sexual, CAS, last 12 months	Major Depressive Disorder, PHQ-9, past 2 weeks	Yes	Yes	Social function; social structure; lives alone; economic disadvantage; neuroticism; child sexual abuse; child physical abuse	Self-administered	aOR=2.3 (1.03-5.12), p=0.04
Kim & Lee [43]; 3,153 adult women; Korea	4 years; 4 waves	34.2%	"Physical violence and/or threat of physical violence", last 12 months	Depression, CES-D, past week	Yes	No	Age; education; social support; household income; past year physical violence at time 1	Interviewer administered	Beta=-0.03, SE=0.01, p=0.004
Newcomb et al. [23] 113 adult women; USA	1 year; 3 waves	24.0%	Psychological and/or physical, CTS, last 6 months	Depression, CES-D, period not specified	Yes	No	Age; education; relationship status	Interviewer administered	Path coefficient=0.17, p=<0.05
Suglia et al. [25]; 1,834 adult women; USA	3 years; 3 waves	-	Physical and/or sexual, CTS-like, last 12 months	Depression, CIDI-SF, past 12 months	Yes	No	Age; ethnicity; education; marital status; economic hardship; IPV	Interviewer administered	aOR=1.09 (0.6-1.9)
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	-	Physical, CTS, last 12 months	Depression, CES-D, past week	Yes	No	Sociodemographic factors; highest level of abuse by a partner prior to wave 1; number of sexual partners between wave 1 and 2; time elapsed between wave 1 and wave 2; level of risk behaviour at wave 1 (alcohol use/illicit substance us)	Computer assisted personal and self- interview	Beta=0.18 (0.1-0.26) p<0.05

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Taft et al. [32]; 9,683 adult women; Australia	4 years; 2 waves	-	Physical and/or sexual, CTS, last 12 months	Depression, CES-D, past week	Yes	No	Depression time 1; number of children; marital status; age; education level; occupation; health insurance status; country of birth; area of residence; state of residence; Aboriginal or Torres Strait identity	Self-administered	aOR=2.12 (1.69-2.65)
Zlotnick et al. [19] 3,104 adult women; USA	5 years; 2 waves	-	Physical, CTS-like, last 12 months	Depression, CES-D, past week	Yes	No	Age	Self-administered and interviewer administered	Beta=6.96, p=0.003
Depressive symptoms – IPV as dependent variable									
Foshee et al. 2004 [24]; 1,291 adolescents; USA	4-5 years; 4-5 waves	-	Sexual dating violence, CTS like, last 12 months	Depression symptoms "Kandel and Davis", last 6 months	Yes	No	Demographics; peer environment; family environment; social norms; personal competencies; depression; problem behaviour; alcohol use	Self-administered	HR=1.35 (1.05-1.74)
Kim & Lee [43]; 3,153 adult women; Korea	4 years; 4 waves	34.2%	"Physical violence and/or threat of physical violence", last 12 months	Depression, CES-D, past week	Yes	No	Age; education; social support; household income	Interviewer administered	Beta=3.34, SE=0.61, p<0.001
Leher et al. 2006 [17]; 1,659 adolescents; USA	7 years; 3 waves	-	Physical, CTS-like, last 12 months	Depression, CES-D, past week	Yes	Yes	Age; race/ethnicity; parental education; childhood physical abuse; dating violence/forced sex	Computer assisted self- interview	aOR=1.86 (1.05-3.29)
Levendosky et al. [26] 150 adult women; USA	4 years; 5 waves	-	Physical and/or sexual, last 12 months, SVAWS	Depression, BDI, time period not specified	No	No	Unadjusted	Interviewer administered	R=0.24, p<0.05
Nduna et al. 2010 [37]; 995 women and girls; South Africa	1 year; 2 waves	22.6%	Physical and/or sexual, CTS-like (WHO), last 12 months	Depression, CES-D, past week	Yes	Yes	Socio-economic status; experiences of childhood adversity; alcohol abuse; education; study design	Interviewer administered	aOR=1.67 (1.18-2.36)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Postpartum depression as dependent variable									
Escriba-Aguir et al. [42]; 888 pregnant women; Spain	1 year; 4 waves	33.5%	Psychological, Abuse AAS, past 12 months	Postpartum depression, EPDS, past 12 months	Yes	No	Sociodemographic factors (age, marital status, education, employment status, native country); negative life events	Self-administered, interviewer administered and telephone interview	aOR=4.11 (1.23-13.73)
Plach et al. [47]; 5,681 pregnant women; United Kingdom	3.5 years; 5 waves	-	Has a partner physically hurt and/or been emotionally cruel, during pregnancy	Postnatal depression, EPDS, past 7 days (asked at 8 weeks postpartum)	Yes	No	Paternal postnatal depressive symptoms; size of child for gestational age	Self-administered	aOR=1.29 (1.02-1.63)
Kita et al. [46]; 562 adult women; Japan	1 month; 2 waves	26.7%	Physical and/or non-physical, during pregnancy, ISA	Postnatal depression, HADS, past 7 days	Yes	No	Mother to infant bonding; age, parity	Self-administered	Path coefficients: Antenatal IPV and postnatal depression=0.10 (NS); Antenatal IPV and antenatal depression=0.31; Antenatal depression and postnatal depression=0.57
Patel et al. [40]; 335 pregnant women; India	6 months; 3 waves	13.0%	"Marital violence" during pregnancy	Postnatal depression at 6 months, EPDS, past 7 days	No	No	Unadjusted	Interviewer administered	RR=2.6 (1.6-4.3) p=0.001
Tsai et al. [38]; 258 pregnant women; South Africa	3 years; 4 waves	22.6%	Physical, CTS, last 12 months	Postpartum Depression, EPDS, past 7 days	Yes	No	Intervention or control arm; age; completion of high school; household wealth; employment full time or part time; whether father or baby is with participant; HIV serostatus; high blood pressure	Interviewer administered	Coefficient=1.04 (0.61-1.47)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[b]Woolhouse et al. [33]; 1,102 pregnant women; Australia	4 years; 6 waves	18.1%	Physical and/or emotional, CAS, last 12 months	Depression in the 1st year postpartum only, EPDS, past 7 days	Yes	No	Maternal age at baseline; number of children at 4 years postpartum; IPV; relationship transitions; family income at 4 years postpartum; stressful life events/social adversity in past 12 months - this estimate for IPV in first year postpartum only	Self-administered	aOR=0.75 (0.4-1.6)
				Depression at 4 years postpartum only, EPDS, past 7 days					aOR=3.48 (2.0-6.1)
				Depression in the 1st year and at 4 years postpartum, EPDS, past 7 days					aOR=2.18 (1.2-3.8)
Rogathi et al. [48]; 1013 pregnant women; Tanzania	14 months; 4 waves	4.6%	Physical, sexual, emotional, WHO survey, during pregnancy	Postpartum depression up to 40 days post-delivery, EPDS, past 7 days	No, as not significant in bivariate test	No	Age; reported history of depression; reported history of hypertension; HIV/AIDS diagnosis; emotional support; number of pregnancies; exposure to at least one type of IPV	Interviewer administered and telephone interview	aOR=2.51 (1.67-3.76)
Valentine et al. [30]; 210 pregnant women; USA	1 year; 4 waves	-	Physical, sexual, psychological, AAS, during or within 12 months or current pregnancy	Postpartum depression, BDI, time period not specified	Yes	No	Recent IPV; remote IPV; social support	Interviewer administered and telephone interview	aOR=5.38 (2.21-13.08)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Postpartum depression – IPV as dependent variable									
Tsai et al. [38]; 658 pregnant women; South Africa	3 years; 4 waves	22.6%	Physical, CTS, last 12 months	Postpartum Depression, EPDS, past 7 days	Yes	No	Intervention or control arm; age at baseline; completion of high school; household wealth; employment full time or part time; whether father or baby is with participant; HIV serostatus; high blood pressure	Interviewer administered	Beta=0.054 (0.030-0.079)
Suicide attempts as dependent variable									
Chowdhary & Patel [39]; 8,750 adult women; India	1 year; 3 waves	-	Verbal, CTS-like, last 3 months	Single question, ever attempted suicide	Yes	No	Age; literacy; household per capita income	Interviewer administered	aOR=2.84 (0.55-14.73)
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	-	Verbal, threats, physical, CTS, last 12 months	Single question, ever attempted suicide	Yes	No	Sociodemographic factors; highest level of abuse by a partner prior to wave 1; number of sexual partners between wave 1 and 2; time elapsed between wave 1 and wave 2; level of risk behaviour at wave 1 (alcohol use/illicit substance us)	Computer assisted self- interview	Beta=0.12 (0.02-0.22)
Perceived stress as dependent variable									
Salzaar et al. [44]; 398 adults; Nicaragua	3 years; 2 waves	16.7%	Emotional, physical, sexual, WHO Survey, last 12 months	Perceived emotional distress, SRQ,	No	No	None	Interviewer administered	OR=4.59 (2.5-8.45) calculated
Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	9.0%	Verbal aggression, CTS, last 12 months Physical aggression, CTS, last 12 months	Perceived Stress, Cohen et al. 1983 a 14-item measure, past 6 months	Yes	No	Race; have a child/pregnant; time 1 marital satisfaction; time 1 verbal aggression	Self-administered at time 1 and interviewer administered or telephone interview at time 2	Beta=0.18; p<0.001 Beta=0.11; p<0.05
Study, Participants,	**Length of Follow-up;**	**Attrition at Last Wave**	**IPV Measure and Timeframe**	**Health Outcome**	**Adjusted for Time 1**	**Adjusted for CSA**	**Other Variables Adjusted For**	**Mode of administration**	**Effect Estimate**

Country	Number of Waves			Measure and Timeframe	Dependent Variable[a]				
General anxiety as dependent variable									
Suglia et al. [25];1,834 adult women; USA	3 years; 3 waves	-	Physical and/or sexual, CTS-like, past 12 months	Single question, asking if they had a period of 6 months or more when they felt worried, tense or anxious	Yes	No	Age; ethnicity; education; marital status; economic hardship; IPV	Interviewer administered	aOR=1.95 (1-3.8)
Self-perceived health status as dependent variable									
Escriba-Aguir et al. [42]; 888 pregnant women; Spain	1 year; 4 waves	33.5%	Psychological, Abuse AAS, past 12 months	Respondents asked to report their general health as: very good; good; fair; poor; very poor	Yes	No	Sociodemographic factors (age, marital status, education, employment status, native country); negative life events	Self-administered, interviewer administered and telephone interview	aOR=4.32 (1.58-11.87)
Hard drug use (cocaine, crack, heroin) as dependent variable									
Algeria et al. [41]; 452 adult women; Puerto Rico	3 years; 3 waves	-	Physical and/or psychological, CTS, last 12 months	Hard core drug use, self-report of crack or cocaine, heroin, past 12 months	Yes	No	Education; employment; very severe partner violence; alcohol use in last year	Computer assisted personal interview	aOR=2.02 (1.04-3.91)
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Cocaine use once a week or more, last 6 months	No	Yes	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=2.10 (0.82-5.5)
Hard drug use (cocaine, crack, heroin) – IPV as dependent variable									
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Crack use once a week or more, last 6 months	No	Yes	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=1.6 (0.84-3.0)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, injurious, sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Hard drug use (cocaine, crack or heroin), last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support	Interviewer administered	RR=1.6 (1.08-2.36)
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	-	Minor violence from same partner, CTS, last 12 months Severe violence from same partner, CTS, last 12 months	Hard drug use, past year	Yes	No	Race; age; cohabiting; married; time 1 psychological aggression; marijuana use	Computer assisted self-interview, and self-administered postal survey	aOR=2.41 (1.36-4.26) aOR=2.87 (1.39-5.92)
Marijuana use as dependent variable									
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use once a week or more, last 6 months	No	Yes	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=2.4 (0.92-6.2)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use, last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support; baseline IPV	Interviewer administered	RR=1.14 (0.81-1.6)
Nowotny & Graves [16] 2,959 adolescents; USA	6 years; 2 waves	-	Sexual, CTS-like, last 12 months	Marijuana use (any), last 12 months	Yes	No	Age; married; education; employment; personal income	Computer assisted personal and self-interview	aOR=1.4 (0.97-2.08)
Marijuana use – IPV as dependent variable									
El-Bassel et al. [22]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use once a week or more, last 6 months	No	No	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=4.5 (2.4-8.4)
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves		Physical, injurious, sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Hard drug use (cocaine, crack or heroin), last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support	Interviewer administered	RR=0.94 (0.71-1.24)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	-	Minor violence from same partner, CTS, last 12 months Severe violence from same partner, CTS, last 12 months	Marijuana use, past year	Yes	No	Race; age; cohabiting; married; time 1 psychological aggression; marijuana use	Computer assisted self-interview, and self- administered postal survey	aOR=0.98 (0.59-1.64) aOR=1.78 (0.92-3.44)
Other combinations of illicit drug use and/or alcohol use as dependent variable									
Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, injurious, sexual, CTS, last 6 months Physical, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", any illicit drug use, last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support; baseline IPV	Interviewer administered	RR=1.15 (0.83-1.58) RR=0.9 (0.65-1.26)
Newcomb et al. [23];113 adult women; USA	1 year; 3 waves	24.0%	Psychological and/or physical, CTS, past 6 months	Participants asked if they had ever used 16 illegal drugs including cocaine, crack, heroin, marijuana and others not listed.	Yes	No	Age, education, relationship status	Interviewer administered	Path coefficient=0.18, p<0.05

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[c]Nowotny & Graves [16]; 3,959 adolescents; USA	6 years; 2 waves	-	Physical, CTS-like, last 12 months	Drug use (MDMA, inhalents, LSD, heroin, PCP or other illegal drugs), last 12 months	Yes	No	Age; married; education; employment; personal income	Computer assisted personal and self-interview	aOR=1.3 (0.8-2.15)
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	-	Physical, CTS, last 12 months	Tobacco, alcohol and/or marijuana use, last 12 months	Yes	No	Sociodemographic factors; highest level of abuse by a partner prior to wave 1; number of sexual partners between wave 1 and 2; time elapsed between wave 1 and wave 2	Computer assisted self- interview	Beta=0.16 (0.06-2.26), p<0.05
Alcohol use as dependent variable									
[b]Boden et al. [49]; 630 adult women; New Zealand	10 years; 4 waves used	-	Physical and/or sexual, CTS, last 12 months	CIDI - 1 to 2 symptoms versus none, last 12 months CIDI - 3 to 5 symptoms versus none, last 12 months CIDI - > 5 symptoms versus none, last 12 months	No	No	Unadjusted	Not reported	Population averaged IRR=1.58 (1.37-1.82) Population averaged IRR=2.5 (1.88-2.89) Population averaged IRR=3.38 (2.57-6.03)
El-Bassel et al. [21] 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	Binge drinking – drinking 4 or more alcoholic drinks within a 6-hour period) once a week or more in the past 6 months	No	No	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=0.80 (0.04-17.0)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[b]Gao et al. [35]; 636 adult women; New Zealand	2 years; 2 waves	16.9%	Verbal aggression at 24 months postpartum only, CTS, last 12 months Verbal aggression at 6 weeks and 24 months postpartum only, CTS, last 12 months Physical at 24 months postpartum only, CTS, last 12 months Physical at 6 weeks and 24 months postpartum only, CTS, last 12 months	High risk alcohol use - drank 6 or more alcoholic drinks on at least one occasion in the last 12 months	No	No	Age; education; ethnicity; duration living in New Zealand; marital status; household income; whether born in New Zealand; cultural orientation; composite measures of verbal and physical violence	Interviewer administered	aOR=2.68 (0.57–12.62) aOR=3.14 (0.71-13.92) aOR=1.24 (0.69-2.23) aOR=1.49 (0.78-2.84)
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, CTS, last 12 months	"Drug Use and Risk Behaviour Questionnaire", Binge drinking, last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support; baseline IPV	Interviewer administered	RR=1.4 (0.97-2.02)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Keiley et al. [15]; 195 couples; USA	2.5 years; 2 waves	-	Physical, CTS, last 12 months Verbal, CTS, last 12 months	ADS and MAST, last 12 months	Yes	No	Socio-economic status; race; wife's reports of their own anxiety and depression; wife's reports of their own physical and verbal aggression towards husband; wife's reports of their husband's physical and verbal aggression towards them	Self-administered and interviewer administered	Slope=0.011 Quadratic=0.001 NS Slope=-0.009 Quadratic=-0.006 NS
Nowotny & Graves [16]; 2,959 adolescents; USA	6 years; 2 waves	-	Threats, minor violence, CTS-like, last 12 months	Binge drinking: drinking five or more drinks during a single occasion at least two to three times a month in the past year	Yes	No	Age; married; education; employment; personal income	Computer assisted personal and self-interview	aOR=1.0 (0.71-1.43)
Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	9.0%	Verbal aggression, CTS, last 12 months Physical aggression, CTS, last 12 months	Alcohol consumption, average daily volume. Heavy drinking index, 6+ drinks single occasion and drinking to intoxication (continuous), last 12 months	Yes	No	Race; have a child/pregnant; time 1 marital satisfaction; time 1 verbal aggression	Self-complete questionnaire at time 1 and in-person/telephone interview and self-complete questionnaire at time 2	Beta=-0.4; NS Beta=0.09; p<0.05

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Zlotnick et al. [19]; 2,905 adult women; USA	5 years; 2 waves	-	Physical, CTS-like, last 12 months	National Survey of Alcohol and Drug Abuse Questions. Four items coded on a 6-point scale ranging from 0 (abstinent) to 3 (high moderate use) to 5 (binge drinking) past 30 days	No	No	Unadjusted	Self-administered and interviewer administered	IPV: Weighted mean score=1.45 (SE=0.19) No IPV: Weighted mean score=0.87 (SE=0.06) NS
Alcohol use – IPV as dependent variable									
Marsh-Buzy et al. [29]; 73 school students; USA	4 months, 2 waves	31.1%	Physical and/or sexual, CTS, past 4 months	Alcohol use – quantity/frequency measure, past 4 months	Yes	No	None	Self-administered	aOR=3.94; p=0.04
Testa et al. 2003 [28];724 adult women; USA	1 year; 2 waves	-	Severe violence from same partner, CTS, last 12 months Minor violence from same partner, CTS, last 12 months	Heavy episodic drinking in past 12 months consisted of mean response to two questions on frequency of consuming 5 or more drinks in a single day and frequency of drinking until intoxicated	Yes	No	Race; age; cohabiting; married; time 1 psychological aggression; marijuana use; hard drug use	Computer assisted self-interview, and self- administered postal survey	aOR=1.0 (0.71-1.4) aOR=1.2 (0.93-1.56)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
HIV infection as dependent variable									
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, last 6 months	HIV positive status	Yes	No	Age; ethnicity; education; drug and alcohol use; baseline HIV risk behaviours	Interviewer administered	aOR=0.21 (0.03-1.6)
Jewkes et al. [36] 1,099 women and girls; South Africa	2 years; 3 waves	12.5%	Physical and/or sexual, WHO Survey, last 12 months	HIV infection assessed with blood tests at all three waves	Yes	No	Age; study treatment group; stratum; person years of exposure to HIV (years from baseline to last negative HIV test), herpes simplex virus at basline	Interviewer administered	IRR=1.51 (1.04-2.21)
Sexually transmitted infection as dependent variable									
Chowdhary & Patel [40]; 1,750 adult women; India	1 year; 3 waves	-	Physical, CTS-like, last 3 months	STI (chlamydia, gonorrhoea or trichomoniasis) biological testing, past 3 months	No, but removes women who had STI at baseline	No	Age; literacy; household per capita income	Interviewer administered	aOR=1.88 (0.64-5.53)
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	STI infection at wave 3	Yes	No	Age; ethnicity; education; drug and alcohol use; baseline HIV risk behaviours	Interviewer administered	aOR=0.88 (0.53-1.5)
Wilson et al. [45]; 389 adult women; Kenya	Up to 2 years; unclear	-	Physical and/or sexual, WHO, last 12 months	STI at quarterly examination, Presence of gonorrhoeae, chlamydia trachomstis, or trichomonas vaginalis detected by nucleic acid amplification test	No	No	Age; baseline alcohol use level; lifetime history of sexual violence since age of 15 by someone other than the index partner	Interviewer administered	aRR=0.88 (0.57-1.37)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Sexual risk behaviour as dependent variable									
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, last 6 months	Unprotected anal sex Condom use consistency Condom request consistency Multiple concurrent partners	Yes	No	Age; ethnicity; education; drug and alcohol use; baseline HIV risk behaviours	Interviewer administered	aOR=1.8 (0.58-5.5) aOR=0.41 (0.24-0.71) aOR=0.42 (0.22-0.82) aOR=3.1 (0.89-11.0)
Teitelman et al. [50]; 2,629 adolescents; USA	7 years; 2 waves Is it 2 waves	-	Verbal and/or physical, CTS, last 12 months	HIV risk (condom use), last 12 months	Yes	No	Age; race/ethnicity; family income	Computer assisted personal and self-interview	aOR=1.59 (1.16-2.18)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Wilson et al. [45]; 389 adult women; Kenya	Up to 2 years; unclear	-	Physical and/or sexual, WHO, last 12 months	Unprotected anal and/or vaginal sex, past week	No	No	Age; baseline alcohol use level; lifetime history of sexual violence since age of 15 by someone other than the index partner	Interviewer administered	aRR=1.91 (1.32-2.78)
				100% condom use, past week					aRR=0.90 (0.82-0.99)
				2 or more sexual partners, past week					aRR=0.96 (0.76-1.21)
				3 or more sex acts, past week					aRR=1.0 (0.79-1.26)
				Semen detection by prostate specific antigen test PSA as a biomarker of unprotected sex					aRR=1.54 (1.17-2.04)
				No sex in the past week					aRR=0.67 (0.54-0.83)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Gynaecological problems as dependent variable									
[c]Chowdhary & Patel [39]; 1,750 adult women; India	1 year; 3 waves	-	Physical, CTS-like, last 3 months	Abnormal vaginal discharge, last 3 months	No, but removes women who had condition at baseline	No	Age; literacy; household per capita income	Interviewer administered	aOR=1.06 (0.44-2.58)
			Sexual, CTS-like, last 3 months	Dysuria, last 3 months					aOR=1.57 (0.6-4.14)
			Physical, CTS-like, last 3 months	Lower abdominal pain, last 3 months					aOR=1.2 (0.63-2.32)
			Physical, CTS-like, last 3 months	Dyspareunia, last 3 months					aOR=2.15 (0.8-5.82)

[a] Refers to the dependent variable

[b] Estimates are mutually exclusive as based on different sub-samples

[c]More than one estimate reported in the study, but preference given to one estimate using the following algorithm: estimate derived from multivariate analysis; the definition of IPV closely matches that of other studies in the health outcome group; where the reference group was unexposed to any violence; where the estimate was most precise

NS, Not statistically significant

CSA, Childhood sexual abuse

AAS, Abuse Assessment Screen; ADS, Alcohol Dependence Scale; BDI, Beck Depression Inventory; CAS, Composite Abuse Scale; CES-D, Center for Epidemiological Studies-Depression; CIDI-SF, Composite International Diagnostic Interview-Short Form; CTS, Conflict Tactics Scale; HADS, Hospital Anxiety and Depression Scale; ISA, Index of Spouse Abuse; MAST, Michigan Alcoholism Screening Test; PHQ-9, Patient Health Questionnaire; SRQ, Self-Report Questionnaire; SVAWS, Severity of Violence Against Women Scale

Results

Study characteristics

Thirty-five separate cohort studies described in 36 articles published between 2002 and 2017 with 48,863 participants met the inclusion criteria and contained 174 effect estimates of association between IPV and health outcomes. Eighteen articles were from the USA,[13-30] three from Australia,[31-33] two from New Zealand,[34 35] three from South Africa,[36-38] two from India,[39 40] one from Puerto Rico,[41] one from Spain,[42] one from Korea,[43] one from Nicaragua,[44] one from Kenya,[45] one from Japan,[46] one from the UK,[47] and one from Tanzania.[48] Amongst the 35 cohort studies, 11 were household surveys,[13 19 27 28 32 35 39 43 44 47 49] 14 sampled participants from clinical settings,[14 20 21 23 25 26 30 31 33 {Rogathi, 2017 #4192 40 42 45 46] seven from schools,[16 17 22 24 29 36 50] and three from the local community.[15 38 41] Some studies were based on sub-populations of women including one study (reported in two papers) of women receiving methadone maintenance treatment,[20 21] women attending a clinic with depressive symptoms at baseline,[31] HIV-positive female sex workers,[45] and eight studies of pregnant women.[30 33 38 40 42 46-48] Six studies focussed on adolescents[16-18 22 24 29] and one (reported in two papers) included women and young girls.[36 37]

Table 2 presents the different health outcomes measured in the studies, the number of studies that measure each health condition, the overall number of estimates that contribute to each health condition, and the number of estimates that contribute to the meta-analysis.

Table 2: Health outcomes/health risk behaviours measured in the 35 studies and number of estimates

Health outcome	Number of studies and estimates, refs	Number of estimates in the meta-analysis
Depression	13 studies; [13 17 19 22-26 31 32 37 39 43] 13 estimates	7
Postpartum depression	8 studies; [30 33 38 40 42 46-48] 11 estimates	7
Suicide attempts	2 studies; [22 39] 2 estimates	NA
Perceived stress	2 studies; [27 44] 3 estimates	NA
General anxiety	1 study; [25] 1 estimate	NA
Self-perceived health status	1 study; [42] 1 estimate	NA
Hard drug use	4 studies; [14 21 28 41] 6 estimates	5
Marijuana use	4 studies; [14 16 21 28] 7 estimates	5
Other combinations of illicit drug/alcohol use	4 studies; [14 16 22 23] 5 estimates	NA
Alcohol use	10 studies; [14-16 19 21 27 29 35 49] 18 estimates	9
HIV infection	2 studies; [20 36] 3 estimates	NA
STIs	3 studies; [20 39 45] 2 estimates	NA
Sexual risk behaviours	3 studies; [18 20 45] 8 estimates	NA
Abnormal vaginal discharge	1 study; [39] 3 estimates	NA
Dysuria	1 study; [39] 3 estimates	NA
Lower abdominal pain	1 study; [39] 3 estimates	NA
Dyspareunia	1 study; [39] 3 estimates	NA

NA- Not applicable as study estimates were continuous and could not be included in a meta-analysis

Table 1 summarises quality issues in relation to the 36 papers reporting on 35 separate cohort studies included in the review. All but three of the 35 cohort studies used recognised, validated IPV instruments or used items that were taken from validated instruments.[40 43 47] All, but nine studies assessed for IPV that occurred in the last 12 months; one measured IPV in the last three months,[39] two in the last six months,[20 21 23] one in the last four months,[29] four measured IPV that occurred during pregnancy,[40 46-48] and one measure IPV during or within 12 months of pregnancy.[30] Most of the studies assessed for physical and/or sexual violence from a partner, with some also including threats, emotional or verbal abuse. The attrition rate was reported or calculated in 19 studies and ranged from 4.6%[48] to 37.4%.[31] The length of follow-up ranged from one month[46] to ten years[49] and the number of waves ranged from two (multiple studies) to six.[33] The smallest sample size was 73 adolescents[29] and the largest was 1,303 adult women[48]. Table 1 presents all study estimates grouped by health outcome.

IPV and depressive symptoms

Thirteen studies examined the relationship between recent IPV and depressive symptoms[13 17 19 22-26 31 32 37 39 43] of which one examined the association in both directions.[43] Of these, nine studies provided nine estimates of association between IPV and subsequent depressive symptoms.[13 19 22 23 25 31 32 39 43] Eight of these estimates showed a positive direction of association between experience of IPV and subsequent depressive symptoms.[9 13 19 22 23 31 32 39] Of the nine estimates of the association between IPV and subsequent depression, all but two reached statistical significance.[25 39] Five studies provided five estimates of association between depression and subsequent IPV, all of which showed a positive and statistically significant relationship.[17 24 26 37 43]

We were able to include seven estimates reporting binary IPV measures and binary depressive symptoms or disorder measures in the meta-analysis. For IPV and subsequent depressive symptoms or disorder, the pooled OR from five estimates[13 25 31 32 39] was 1.76 (95% CI 1.26-2.44, I^2 = 37.5% p=0.172). Two estimates[17 37] were included in the meta-analysis of the relationship between depressive symptoms and subsequent IPV, resulting in a pooled OR of 1.72 (95% CI 1.28-2.31, I^2 = 0.0%, p=0.752). One study, not included in the meta-analyses examined the bi-directional relationship between IPV and depression.[43] A Korean study of married women found that IPV at Wave 1 was positively associated with the depression level at Wave 1 (Beta=0.030, SE=0.03, p<0.001), but negatively associated with the growth rate of depression over the study period (Beta=-0.03, SE=0.01, p=0.004). IPV experienced at Wave 4 was associated with a larger growth rate of depression in the model (Beta=3.34, SE=0.61, p<0.001) and the experience of IPV at Wave 1 (Beta=0.68, SE=0.11, p<0.001). See Figure 2.

Depression measurement: Of the nine studies that measured IPV and subsequent depressive symptoms, one measured depressive symptoms occurring in the past 12 months,[25] one in the last two weeks,[31] five in the last week,[13 19 22 32 43] one "current",[39] and one did not specify a time period.[23] Of the five studies that measured depressive symptoms and subsequent IPV, three measured depressive symptoms in the past week,[17 37 43] one in the past six months,[24] and one did not specify a time period.[26]

All but one of the studies used screening questionnaires that measured depressive symptoms as opposed to diagnostic tools. Of the 13 studies, eight used the Center for Epidemiologic Studies Depression Scale (CES-D),[13 17 19 22 23 32 37 43] one study used the WHO ICD-10,[39] one used the Composite International Diagnostic Interview-Short Form (CIDI-SF),[25] one used the Patient Health Questionnaire (PHQ),[31] one used the Beck Depression Inventory (BDI),[26] and one used a scale from Kandel and Davies.[24]

Common risk factors/confounding: Of the nine studies that measured IPV and subsequent depressive symptoms and disorder, all but one controlled for time one levels of depression. Chowdhary & Patel[39] excluded women with baseline depressive disorder in their analysis, but this may have resulted in the exclusion of cases of IPV that preceded depressive symptoms at baseline and the remaining cases may not have been representative of women experiencing IPV. All, but one of the five studies that measured depressive symptoms and later IPV, controlled for time one levels of IPV.[26] Of the 13 studies, all but 2 controlled for socio-demographic factors.[26 39] Other confounders were not comprehensively controlled for. Two studies controlled for childhood physical and/or sexual abuse[17 31] and two for alcohol use,[24 37] of which one also controlled for childhood adversity which measured emotional and physical neglect, and physical and sexual abuse.[37] There were no discernible differences in effect

estimates regardless of which confounders were adjusted for and studies found similar directions and varying magnitudes of association.

IPV and postpartum depressive symptoms

Eight studies provided eleven estimates of association between IPV and subsequent postpartum depressive symptoms.[30 33 38 40 42 46-48] All eleven estimates showed a positive direction of association between IPV and subsequent postpartum depressive symptoms, with all but one of the estimates reaching statistical significance.[46] Seven estimates from three studies were included in the meta-analysis of the relationship between IPV and subsequent postpartum depression,[33 47 42 30 48] resulting in a pooled OR of 2.19 (95% CI 1.39-3.45). This was heterogeneous (I^2 = 79.8%, p=0.000). One of the studies examined the bi-directional relationship and found that depression symptom severity was associated with a greater risk of subsequent IPV.[38] Each five point difference in the Edinburgh Postnatal Depression Scale was associated with a 0.9 to 2.3 point difference in subsequent IPV risk (Beta=0.054; 95% CI 0.030-0.079).

Postpartum depression measurement: Of the eight studies that measured IPV and subsequent depressive symptoms, one measured depressive symptoms occurring in the past 12 months,[42] six studies measured depressive symptoms in the last week,[33 38 40 46 47 48] and one study did not specify the time period.[30] One study measured postpartum depression in the last week and subsequent IPV [38]. Of the eight studies, six used the Edinburgh Postnatal Depression Scale (EPDS),[33 38 40 42 47 48] one used the Hospital Anxiety and Depression Scale (HADS),[46] and one used the Beck Depression Inventory (BDI).[30]

Common risk factors/confounding: Six of the eight studies that examined IPV and subsequent postpartum depression controlled for time one levels of depressive symptoms.[33 38 42 46 47 30] One study did not control for time one levels of depressive symptoms as it was not significant in the bivariate analysis.[48] Five studies controlled for socio-demographic factors.[33 38 42 46 48] One study controlled for HIV serostatus[38] and one controlled for HIV/AIDS diagnosis.[48]

IPV and alcohol use

Ten studies examined the relationship between recent IPV and alcohol use. Of these, eight studies provided 15 estimates of association between IPV and subsequent alcohol use.[14-16 19 21 27 35 49] All, but one of these 15 estimates showed a positive direction of association between IPV and subsequent alcohol use,[15] with two studies providing five estimates which reached statistical significance.[27 49] Two studies[28 29] provided three estimates showing a positive direction of association between alcohol use and subsequent IPV, of which one was statistically significant.[29]

For IPV and later alcohol use, the pooled OR from six estimates provided by three studies[16 21 35] was 1.19 (95% CI 0.91-1.55, I^2 = 0.0%, p=0.523). Three estimates from two studies[28 29] were included in the meta-analysis of the relationship between alcohol use and subsequent IPV, resulting in a pooled OR of 1.11 (95% CI 0.91-1.35, I^2 = 0.0%, p=0.672).

Alcohol use measurement: Of the eight studies that measured IPV and subsequent alcohol use, five measured alcohol use in the last 12 months,[15 16 27 35 49] two in the last six months,[21 14] and one in the last 30 days.[19] Of the two studies that measured alcohol use and subsequent IPV, one measured alcohol use in the last 12 months[28] and one in the last four months.[29]

Alcohol consumption was measured in a variety of ways. Of the 10 studies, one assessed alcohol abuse or dependence using the CIDI-SF,[49] four measured binge drinking which was based on the number of alcoholic drinks consumed on one occasion,[14 16 21 35] three measured heavy drinking which was assessed using a combined quantity-frequency measure,[27-29] one used the Alcohol Dependence Scale (ADS) and the Michigan Alcohol Screening Test (MAST),[15] and one used the National Survey of Alcohol and Drug Abuse (NSDUH).[19]

Common risk factors/confounding: Of the eight studies that measured IPV and subsequent alcohol use, only four adjusted for time one levels of alcohol use.[14-16 27] Both studies that examined the association between alcohol use and subsequent IPV adjusted for time one levels of IPV.[28 29] Of the 10 studies, 7 controlled for socio-demographic factors.[14-16 21 27 28 35] Two studies adjusted for a history of trauma. El-Bassel[21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert[14] also controlled for childhood sexual abuse as well as psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power. Regardless of the confounders controlled for, all but one study found a positive direction of association and reported varying magnitudes of association.

IPV and hard drug use (crack, cocaine, heroin)

Four studies examined the relationship between recent IPV and hard drug use,[14 21 28 41] of which one reported an association in both directions.[21] Two studies provided two estimates of IPV and subsequent hard drug use, both of which showed a positive direction of association although only one was statistically significant.[21 41] The pooled OR from these studies was 2.05 (95% CI 1.19-3.52, I^2 = 0.0%, p=0.948). Three studies provided four estimates of hard drug use and subsequent IPV, which showed a positive direction of association and three of

these were statistically significant.[14 21 28] Three of these estimates were included in the meta-analysis, resulting in a pooled OR of 2.20 (95% CI 1.52-3.17, I^2 = 0.0%, p=0.455).

Hard drug use measurement: Of the two studies that measured IPV and subsequent hard drug use, one study measured drug use in the last 12 months[41] and the other in the last 6 months.[21] Of the three studies that measured hard drug use and subsequent IPV, one assessed use in the last 12 months[28] and two in the last six months.[14 21] Of the four studies, two used the Drug Use and Risk Behaviour Questionnaire[14 21] and two asked about use of specific hard drugs including crack, cocaine and heroin.[28 41] Of the latter, one of the studies used two methods for assessing hard drug use at each wave including self-report information only and combined self-report and toxicological information.[41]

Common risk factors/confounding: Of the two studies that measured IPV and subsequent hard drug use, one controlled for time one levels of hard drug use [41]. Of the three studies that measured hard drug use and subsequent IPV, two controlled for time one levels of IPV.[14 28] All four studies controlled for socio-demographic factors. El-Bassel[21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert[14] controlled for childhood sexual abuse, psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power.

IPV and marijuana use

Four studies examined the relationship between recent IPV and marijuana use,[14 16 21 28] of which two studies reported an association in both directions.[14 21] Three studies provided three estimates of IPV and subsequent marijuana use, all showing a positive direction of

association, although none were statistically significant.[14 16 21] Two of these studies were included in the meta-analysis resulting in a pooled OR of 1.52 (95% CI 1.04-2.24, I^2 = 5.4%, p=0.304). Three studies provided four estimates of marijuana use and subsequent IPV[14 21 28] of which one showed a positive and statistically significant relationship. Three of these estimates were included in the meta-analysis, resulting in a pooled OR of 1.96 (95% CI 0.8-4.83). This was heterogeneous (I^2 = 85.4%, p=0.001).

Marijuana use measurement: Of the four studies, two measured marijuana use in the last 12 months [16 28] and two in the last six months.[14 21] All studies used self-report information to assess for marijuana use.

Common risk factors/confounding: Of the three studies that measured IPV and subsequent marijuana use, two controlled for time levels of marijuana use.[14 16] Of the three studies that measured marijuana use and subsequent IPV, two controlled for time levels of IPV.[14 28] All the studies controlled for socio-demographic factors. El-Bassel[21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert[14] controlled for childhood sexual abuse, psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power.

IPV and STIs (excluding HIV)

Three studies provided three estimates of the association between recent IPV and subsequent STIs[20 39 45] of which one showed a positive and statistically significant relationship.[39] The meta-analysis of two of these studies[20 39] resulted in a pooled OR of 1.10 (95% CI 0.56-2.18, I^2 = 35.5%, p=0.214).

STI measurement: One study assessed for STIs (chlamydia, gonorrhoea or trichomoniasis) within the last three months using biological measures,[39] another relied on self-report to assess for STIs at the last wave[20] and the third study assessed women quarterly for gonorrhoeae, chlamydia or trichomoniasis.[45]

Common risk factors/confounding: All the studies controlled for socio-demographic factors. El-Bassel's study[21] of women attending a methadone maintenance clinic adjusted for time one HIV risk factors (i.e. frequency of condom use, frequency of requesting condom use, having unprotected anal sex, exchanging sex for drugs, being HIV positive and having had an STI), as well as drug and alcohol use. Chowdhary & Patel[39] removed women with an STI at time one from the analysis. However, this would likely have introduced bias in the resulting cases, as it would have excluded women with IPV that preceded the acquisition of an STI at baseline. Wilson's[45] study of HIV positive sex workers did not control for time one sexual risk behaviours, although it did control for a lifetime history of sexual violence since the age of 15 by someone other than the index partner. Figure 3 presents the forest plots for alcohol use, hard drug use, marijuana use and STIs.

Discussion

Summary of main findings

Our review identified cohort studies that examined the relationship between recent IPV (i.e. IPV occurring up to and including the last 12 months) and depression, postpartum depression, alcohol use, hard drug use, marijuana use and STIs. Although a few other health or health related outcomes were identified (i.e. sexual risk behaviours, HIV infection, general anxiety, perceived stress and gynaecological problems) these could not be included in a meta-analysis because there was only one estimate. We found evidence consistent with a bi-directional relationship between recent IPV and depressive symptoms. Recent IPV was also associated

with increased symptoms of postpartum depression. There was some evidence of a bi-directional relationship between recent IPV and hard drug use, and IPV and subsequent marijuana use although there were a limited number of studies. There was no evidence of an association between recent IPV and alcohol or STIs although the evidence was weak with few studies and inconsistent measurement of alcohol and STIs.

Although the search strategy did not limit the types of health outcomes identified, the review found no cohort studies for recent IPV exposure and non-communicable diseases such as cardiovascular disease, hypertension and obesity. Nor did we find longitudinal evidence for recent experience of IPV and posttraumatic stress disorder or anxiety disorder. There is limited evidence from cross-sectional data that lifetime IPV increases the risk of cardiovascular disease.[51] Cohort studies measuring past history of IPV have reported an association with increased body mass index,[52] increased risk for cardiovascular disease[53] and hypertension.[54] Physiological mechanisms may explain the association between IPV and some adverse health outcomes through complex neural, neuroendocrine and immune responses to acute and chronic stress. For example, sustained and acute elevated stress levels have been linked to cardiovascular disease, hypertension, gastrointestinal disorders and chronic pain. When exposed to prolonged or acute stress, areas of the brain (e.g. hippocampus, amyglada and prefrontal cortex) undergo structural changes that can impact on mental and cognitive functioning, which can lead to mental disorders.[55]

We found evidence consistent with a bi-directional relationship between recent experience of IPV and depressive symptoms. The magnitude of the association in either direction is similar to that reported in our previous review of 'ever' IPV and depressive symptoms[4] although there were fewer estimates in our meta-analysis of recent IPV and depressive symptoms.

All the studies on postpartum depressive symptoms conceptualised IPV as the dependent variable and there was evidence that recent experience of IPV or IPV during pregnancy increased symptoms of subsequent postpartum depression although there was substantial heterogeneity. The magnitude of the association was slightly lower (OR=2.19, 95% CI 1.39-3.45) compared to Howard et al.[56] who reported a three-fold increase in the levels of depressive symptoms in the postnatal period after having experienced IPV during pregnancy (OR=3.1, 95% CI 2.7-3.6). However, the authors state that study heterogeneity and lack of data on baseline symptoms prevented conclusions on temporality. In addition, we excluded one study that was included in the Howard et al review as it measures postnatal depressive symptoms using the Edinburgh Postnatal Depression Scale (EPDS) at the final wave, but assesses common mental health disorders during pregnancy with the Self-Reporting Questionnaire (SRQ-20).[57] A recently published systematic review explored studies of IPV during pregnancy and perinatal mental disorders in low and middle income countries. However, most of the studies were cross-sectional and consider partner violence experienced during pregnancy. Furthermore, estimates were not pooled in a meta-analysis.[58]

There was no evidence of an association between recent IPV and alcohol use in either direction. This might be because there were fewer estimates in the meta-analysis of recent IPV and measurement of problematic alcohol use was conceptualised in a number of different ways for example, binge drinking, heavy episodic drinking and high risk alcohol use, which may have diluted the effect. None of the estimates in the meta-analysis measured alcohol use disorder. Furthermore, few estimates in the meta-analysis controlled for time one levels of IPV or alcohol use, and none included the perpetrator's alcohol use which may be related to IPV and/or the woman's drinking behaviour. This finding is in contrast to our previous review of 'ever' IPV and alcohol use which did find evidence consistent with a bi-directional

relationship.[5] Although the pooled estimates in both reviews are based studies that assess binge drinking, the Devries review includes estimates of IPV that occurred in the distant past (i.e. before the last 12 months).

Our review found evidence consistent with a bi-directional relationship between recent IPV and hard drug use. However, this finding should be treated with caution as there were very few studies overall, and one of the studies was based on a sample of women attending a methadone maintenance clinic. For marijuana use, there were few studies, but the evidence suggests that IPV predicts subsequent marijuana use. Pooled estimates did not support that marijuana use predicts subsequent IPV, although estimates were heterogeneous. The evidence for recent IPV and STI infection was in conflicting directions and there were only two estimates. Our review adds to previous systematic reviews as it focuses on longitudinal studies that measure recent experiences of IPV. Furthermore it includes a broader range of health or health related outcomes and explores bi-directionality. The review also highlights that longitudinal studies on recent IPV are lacking for important health outcomes that are known to be associated with partner violence.

Limitations of the review

To our knowledge, this is the first systematic review of cohort studies to measure the magnitude of the association between recent exposure to IPV and health outcomes. Although we conducted an extensive search of the global literature, the review has a number of limitations. Due to the large number of abstracts retrieved and the limited timeframe for the review, we were not able to employ double screening of abstracts. Citation tracking was not undertaken although we conducted reference list screening of key systematic review papers. However, two researchers reviewed the final set of included papers. One researcher was

responsible for extracting data from included papers. As some studies measured the outcome variable (either IPV or the health condition) continuously, it was not possible to combine all measures of effect, which limited the number of studies in the meta-analyses. However, we comment on the direction of the association of studies that were not included in the meta-analysis in the results section for each health condition. It was not possible to quantitatively assess publication bias as too few studies were in the meta-analyses of each health condition.

Sources of bias and limitations of included studies

One of the main limitations of the included studies relates to the lack of consistency in controlling for key potential confounders. With regard to studies on depression, hard drug use and marijuana use, most controlled for time one levels of the health condition or IPV (where IPV was the dependent variable). Far fewer of the estimates on IPV and later alcohol use and IPV and STI controlled for time one levels of the health outcome.

With regard to the studies on depressive symptoms, only two controlled for early childhood trauma (i.e. childhood sexual and/or physical abuse) and two controlled for alcohol use, even though both are known to increase the risk for depression.[59 60] This makes it difficult to rule them out as potential contributors to the causation of the outcomes. Nevertheless, we found that studies showed a positive direction of association, regardless of which variables were adjusted for, and there was no clear pattern of differing magnitude of association that indicated the relationship between IPV and depressive symptoms were not likely to be entirely accounted for by shared risk factors.

Little is known about the potential causal mechanisms between depression and subsequent IPV. However, women who are depressed may experience symptoms (e.g. lethargy and

withdrawal) that impact their capacity for engaging in self-care behaviours including help-seeking and contact with health care providers that could enable them to extricate themselves from the relationship. It is also plausible that earlier, perhaps unmeasured experiences of violence, such as childhood sexual abuse and trauma are causing depression and later IPV, or that depression is mediating the relationship between childhood sexual abuse and later IPV. A path analysis with cross-sectional data supports this hypothesis [60], but few longitudinal studies have explored these relationships.

Only two studies on alcohol use controlled for childhood sexual abuse and one controlled for the partner's level of alcohol use, both of which are potential causes of women's alcohol use. It has been suggested that women who drink heavily are more likely to have a partner who drinks heavily, which can increase their risk of IPV because heavy alcohol use by men is associated with IPV perpetration.[61] This can occur because people tend to choose a partner with similar drinking patterns to themselves or through the influence of their partner's drinking patterns and expectations.[62] Research also suggests that the partner's or the woman's drinking may fuel conflict in the relationship. A nationally representative study from the US found that couples with similar drinking patterns (e.g. both abstinent or both binge drinkers) were less likely to experience IPV in their relationship compared to those with discordant drinking habits.[63] This implies that relationship conflict may result in IPV, as opposed to alcohol use alone because high alcohol use would be more predictive than discordant use. Alcohol use was measured in a variety of ways with most assessing binge drinking or heavy drinking and only two studies measuring alcohol dependence. Although heavy alcohol consumption increases the risk for disease, injury and premature death[64 65] the adverse consequences may vary considerably between people who sporadically drink heavily and those who develop an alcohol use disorder. Although the evidence points to a bi-directional

relationship between IPV and hard drug use and IPV and marijuana use there were few estimates. Women may self-medicate with alcohol, tobacco or drugs in an attempt to cope with the trauma and stress of living in an abusive relationship, which in themselves are important risk factors for poor health. However, alcohol or substance abuse by the abuser or the woman has also been identified as a trigger to violent episodes or a factor that contributes to more severe violence.[66] The evidence for the association between recent IPV and STIs is uncertain.

It was not possible to examine whether the duration or severity of the violence influenced the relationship between IPV and health. Studies conceptualised violence as physical, sexual, verbal, or emotional (or psychological), with most using a combination of types of violence. Only one study provided estimates of minor and severe violence. Studies reported the time frame in which the violence occurred, but not the duration.

The majority of the studies were from high income countries, most notably the USA and only seven studies were from middle income countries where is it known that the prevalence of past year IPV is higher. Six of the studies were of adolescents, again mostly in high income countries, where these were likely to be dating relationships with no cohabitation. One study included young girls and women. Experiences of IPV in adult and adolescent relationships may be qualitatively different, in that there is a lower likelihood of experiencing systematic and chronic violence in dating relationships.[67] About a third of the studies were drawn from clinical settings, schools or were taken from sub-populations and therefore subject to bias (e.g. HIV positive sex workers, women with depressive symptoms and women on methadone maintenance). More population-based cohort studies are needed in order to generalise the findings. Most studies measured physical violence and some modelled exposure to physical

and sexual and other forms of violence separately. However, other forms of violence (e.g. emotional abuse, threats) may also associated with some of the health outcomes. Most studies constructed the reference categories for IPV as binary opposites, meaning that some participants in the reference group may have been exposed to other forms of IPV that were not measured or modelled. This can bias the effect estimates towards the null and underestimate the magnitude of the association between recent IPV and health outcomes. Some studies included only women who were in a relationship for all waves of data collection. However, research shows that the prevalence of IPV is higher among women who are no longer with abuser compared to those currently in a relationship[68] and excluding these women may dilute the association between IPV and health outcomes.

Implications

The evidence on the association between exposure to IPV and mental and physical health outcomes has important implications for the delivery of interventions and services. IPV against women has received increasing attention by public health experts globally.[2] The results of this review indicates that health care providers and specialist IPV organisations should be aware of the bidirectional relationship between recent IPV and depression. Women with depression may be at risk of IPV, including IPV that is ongoing and services, particularly health care, should be trained to enquire about IPV experiences and respond and refer appropriately. Little is known about what pattern of exposure to IPV is more strongly associated with different health outcomes. In order to establish these connections, longitudinal studies of IPV and health are needed that distinguish recent violence with no prior history, from recent violence that is part of ongoing abuse, and historical violence that no longer occurs. Other factors that are known to mediate the relationship such as the duration and severity of IPV, childhood physical and sexual abuse, poverty related stress and

risk behaviours such as alcohol and substance abuse should be carefully considered in analyses.

Figure 1: Flow of studies through review

Figure 2: Forest plot estimates of the association between IPV and depression

Figure 3: Forest plot estimates of the association between IPV and alcohol use, hard drug use, marijuana use and STIs

Declarations

Ethics approval

Not applicable

Consent for publication

Not applicable

Availability of data and material

All data generated or analysed during this study are included in this published article [and its supplementary files].

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Conceived and designed the study: LJB KD. Data collection: LJB. Analysed the data: LJB, MR, KD. Wrote the first draft of the manuscript: LJB. Contributed to the writing of the manuscript: LJB CW KD MR. Agreed with manuscript results and conclusions: LJB CW KD MR.

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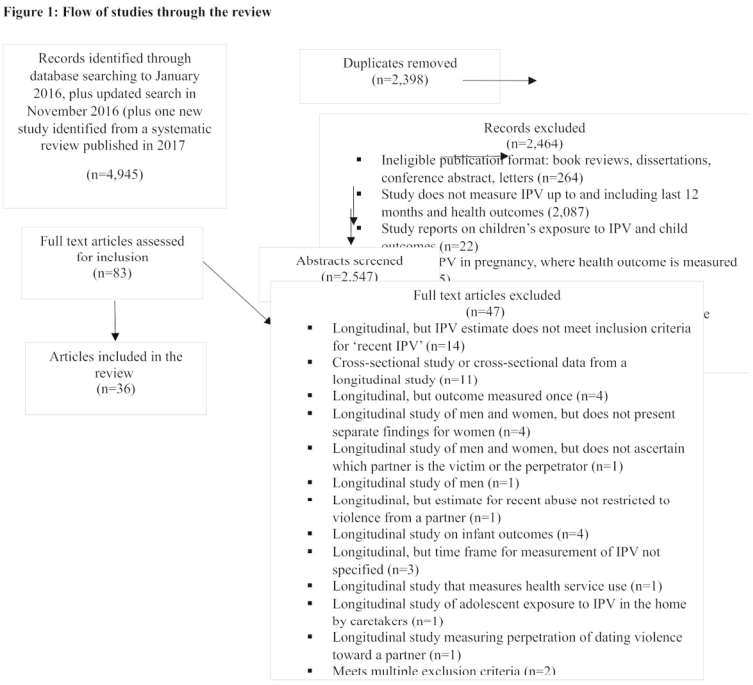
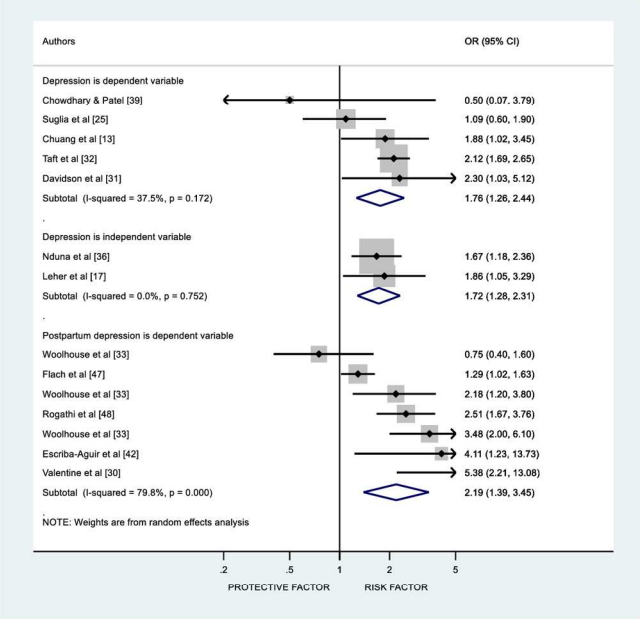


Figure 1: Flow of studies through review

583x825mm (72 x 72 DPI)

Figure 2: Forest plot estimates of the association between IPV and depression

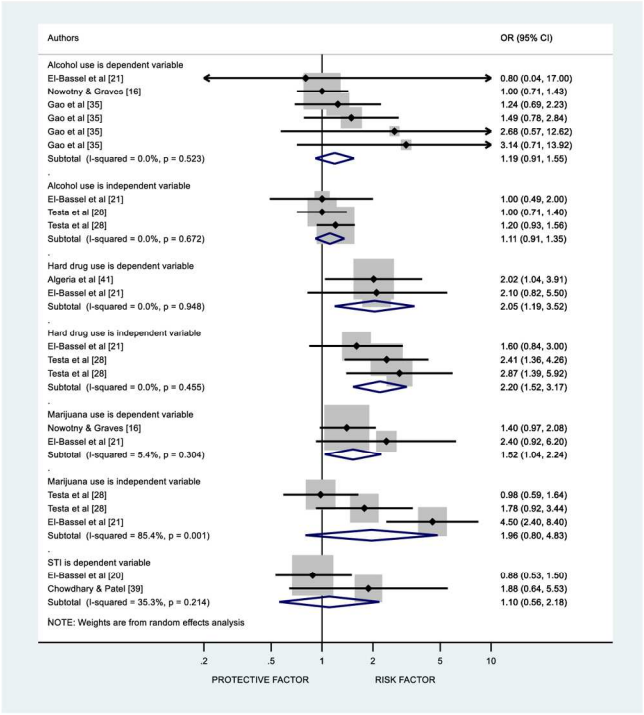


Notes: Woolhouse estimates are based on different sub-samples and are mutually exclusive.
Meta-analysis with depression as the dependent variable was also undertaken excluding the Chowdhary study, but it did not materially change the overall pooled estimate (OR=1.83; 95% CI 1.35-2.49; I^2 = 35.1%, p=0.202)

Figure 2: Forest plot estimates of the association between IPV and depression

210x297mm (200 x 200 DPI)

Figure 3: Forest plot estimates of the association between IPV and alcohol use, hard drug use, marijuana use and STIs



Note: Estimates from Gao and Testa are based on different sub-samples and are mutually exclusive

Figure 3: Forest plot estimates of the association between IPV and alcohol use, hard drug use, marijuana use and STIs

210x297mm (200 x 200 DPI)

Appendix 1

Search Strategy from Medline

1. domestic violence/ or spouse abuse/
2. Battered Women/
3. (spous* abuse or battered wom*n or intimate partner violence or intimate partner abuse or dating violence or domestic abuse).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
4. (intimate adj4 partner adj4 violence).tw.
5. (intimate adj4 partner adj4 abuse).tw.
6. ((partner or relationship or wom$n or domestic or spous*) adj4 (abus* or violen* victimi* or batter*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
7. Rape/
8. sexual violence.tw.
9. sexual abuse.tw.
10. rape.tw.
11. cohort studies/ or follow-up studies/ or longitudinal studies/ or "national longitudinal study of adolescent health"/ or prospective studies/
12. longitudinal stud*.tw.
13. cohort stud*.tw.
14. panel stud*.tw.
15. follow up stud*.tw.
16. prospective stud*.tw.
17. longitudinal analysis.tw.
18. (longitudinal adj3 analysis).tw.
19. cohort analysis.tw.
20. (cohort adj3 analysis).tw.
21. panel analysis.tw.
22. (panel adj3 analysis).tw.
23. time series.tw.
24. (longitudinal adj3 stud*).tw.
25. (cohort adj3 stud*).tw.
26. (panel adj3 stud*).tw.
27. (follow up adj3 stud*).tw.
28. (prospective adj3 stud*).tw.
29. letter.pt.

30. editorial.pt.

31. comment.pt.

32. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10

33. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28

34. 29 or 30 or 31

35. 33 not 34

36. 32 and 35 (2,536)

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	5
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	28
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6-7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	8-9
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	8-9

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	3 & 23
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7 and in Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table 2 p.30 and 12-18
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	12-18
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	12-18
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	12-18
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	3 & 23
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	20-22
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	23-26
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	26-27
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	47

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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BMJ Open

Recent intimate partner violence against women and health: a systematic review and meta-analysis of cohort studies

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Recent intimate partner violence against women and health: a systematic review and meta-analysis of cohort studies

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Word count: 6,944

Abstract

Objectives: We reviewed cohort studies to determine the magnitude and temporal direction of the association between recent intimate partner violence (IPV) and a range of adverse health outcomes or health risk behaviours.

Design: Systematic review and meta-analysis.

Methods: Medline, EMBASE and PsycINFO were searched from the first record to November 2016. Recent IPV was defined as occurring up to and including the last 12 months; all health outcomes were eligible for inclusion. Results were combined using random effects meta-analysis.

Results: 35 separate cohort studies were retrieved. Eight studies showed evidence of a positive association between recent IPV and subsequent depressive symptoms, with a pooled OR from five estimates of 1.76 (95% CI 1.26-2.44, I^2 = 37.5% p=0.172). Five studies demonstrated a positive, statistically significant relationship between depressive symptoms and subsequent IPV; pooled ORs from two studies was 1.72 (95% CI 1.28-2.31, I^2 = 0.0%, p=0.752). Recent IPV was also associated with increased symptoms of subsequent postpartum depression in five studies (OR=2.19, 95% CI 1.39-3.45 p=0.000) although there was substantial heterogeneity. There was some evidence of a bi-directional relationship between recent IPV and hard drug use, and marijuana use although studies were limited. There was no evidence of an association between recent IPV and alcohol use or sexually transmitted infections (STIs) although there were few studies and inconsistent measurement of alcohol and STIs.

Conclusions

Exposure to violence has significant impacts. Longitudinal studies are needed to understand the temporal relationship between recent IPV and different health issues, whilst considering the differential effects of recent versus past exposure to IPV. Improved measurement will

enable an understanding of the immediate and longer-term health needs of women exposed to IPV. Health care providers and IPV organisations should be aware of the bi-directional relationship between recent IPV and depressive symptoms.

Systematic review registered on Prospero (CRD42016033372).

Strengths

- This is the first systematic review of cohort studies to measure the magnitude of the association and temporal direction between recent exposure to IPV and health outcomes.
- As the review considers a broad range of outcomes, we identified gaps in the evidence base including a need for cohort studies on recent IPV and non-communicable diseases such as cardiovascular disease hypertension and obesity, as well as posttraumatic stress disorder and anxiety disorder.

Limitations

- Due to the large number of abstracts retrieved and the limited timeframe for the review, we were not able to employ double screening of abstracts. However, two researchers conducted the review of full text papers, with a third reviewer the full texts of papers where there was uncertainty about their inclusion.
- As some studies measured the outcome variable (either IPV or the health condition) continuously, it was not possible to combine all measures of effect, which limited the number of studies in the meta-analyses.
- It was not possible to quantitatively assess publication bias, as too few studies were in the meta-analyses of each health condition.

Background

Worldwide, almost a third (30%) of all women who have been in a relationship have experienced physical and/or sexual violence by their intimate partner.[1 2] Women's lifetime exposure to IPV is associated with myriad health outcomes. Systematic reviews of longitudinal data, find that women who have been physically and/or sexually abused by their partner at some point in their life are twice as likely to have an abortion, twice as likely to suffer from depression, and in some regions are 1.5 times more likely to acquire HIV compared to women who have not experienced IPV.[2] Not surprisingly, given its high prevalence and adverse health effects, lifetime exposure to IPV is estimated to result in a high burden of disease. IPV is the second most common risk factor for disability-adjusted life years (DALY) globally in women aged 20 to 24 years.[3]

In our previous systematic reviews, we began to explore the relationships between 'ever' exposure to IPV and depressive symptoms and alcohol use, which revealed evidence of a bidirectional association. Devries et al. found evidence suggestive of an association between IPV and incident depressive symptoms (OR=1.97, 95% CI 1.56-2.48) as well as an association in the reverse direction between depressive symptoms and incident IPV (OR=1.93, 95% CI 1.51-2.48).[4] In another systematic review the authors found increased odds of alcohol use following IPV (OR=1.25, 95% CI 1.02-1.52) and increased odds of IPV following alcohol use (OR=1.27, 95% CI 1.07-1.52).[5]

Although available evidence finds important associations between IPV and a range of mental and physical health outcomes, the nature of the associations are not always clear. It is possible that exposure to IPV results in subsequent mental and physical health outcomes; that

different mental and physical health conditions increase risk of subsequent IPV; or that a bi-directional relationship is present.

Both IPV and some associated health outcomes, such as depression, anxiety and substance abuse, are chronic, episodic conditions, which can occur with varying frequency over longer time periods. Studies that measure lifetime exposure to IPV therefore hide the complexity of the relationship between IPV and mental and physical health outcomes. This is because estimates of 'ever' exposure to IPV are heterogeneous, and may include anything from past year, before the past year and more distant experiences of IPV. Recent violence may lead to more severe health outcomes, but this may be influenced by duration and severity, for example, recent violence with no prior history versus recent violence experienced as part of ongoing historical abuse.

In the current systematic review, we build on this by closely examining the issue of temporality with regard to recent exposure to IPV and a broader range of health outcomes. In this paper we aim to: (i) review what health outcomes have been examined in cohort studies of recent IPV ('recent' defined here as IPV experienced up to and including the last 12 months); (ii) quantify the magnitude of the association between IPV and different health outcomes and (iii) examine the temporal direction of IPV and health outcomes.

Methods

A systematic review protocol was registered on PROSPERO on the 18th March 2016 (CRD42016033372) and is available from http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016033372

Literature searches

We searched Medline, EMBASE and PsycINFO from the first record up to January 27, 2016 (with an updated search conducted in November 2016). Terms for IPV were adapted from a previous systematic review on the prevalence of IPV and health outcomes which was conducted for the 2010 Global Burden of Disease of IPV. [1] Controlled vocabulary terms and text words related to longitudinal studies were used for each database. In order to ensure a wide yield of studies, terms for specific health outcomes were not included. An example search strategy appears in Appendix 1. Reference list screening was undertaken for key systematic review papers. One study was included from a systematic review on IPV and perinatal mental health disorders published in 2017 which we identified whilst this paper was under review.

Inclusion criteria

- English language publications
- Longitudinal studies reporting on female participants aged 15 and over were considered. Studies were deemed longitudinal if either the exposure or the outcome was measured on at least two occasions.
- Studies where IPV was conceptualised as the independent variable, or where IPV was the dependent variable, in order to capture any evidence of bi-directional causality.
- All author definitions of recent IPV victimisation that occurred up to and including 12 months prior.
- All author definitions of women related health outcomes that were measured on at least two occasions.

A 12-month cut-off period was chosen for recent IPV as this is the most commonly used period for prevalence estimates, it is consistent with internationally recognised IPV measures,[6 7] and has been used in a number of intervention studies for IPV.[8-10]

Screening and data extraction

Records were initially screened by one reviewer (LJB) and studies not meeting the inclusion criteria were removed. Full text articles were reviewed by one reviewer (LJB) and where there was uncertainty about the inclusion of an article it was referred to the senior author (KD). The final set of full-text articles were formally appraised by two reviewers (LJB and MR). Data were extracted and entered into an Excel spreadsheet by one reviewer (LJB). The study selection process including the number of studies abstracts and full texts screened with reasons for exclusion is summarised in the flowchart in Figure 1.

Quality appraisal

The quality of each effect estimate was appraised and presented in Table 1 which correspond to the major relevant domains of potential bias in quality assessment tools. Consideration was given to whether definitions of IPV and health outcomes were based on valid, reliable measures. We considered whether studies controlled for potential confounders for two reasons. IPV and the health outcomes of interest commonly occur episodically over a period of time, and episodes of either that are incident over the study period may be a continuation of previous IPV or health outcomes. Therefore, we examined whether studies adjusted for time one levels (i.e. at the beginning of the study period) of the outcome variable. Additionally, IPV and the health outcomes of interest are associated with demographic characteristics and other risk factors that may explain the association between them such as childhood sexual abuse. Due to the complexity of the potential causal pathways between IPV

and the health outcomes, we did not specify a minimum set of confounders that should be adjusted for. Additionally, it has been noted that it is not always appropriate to adjust for baseline levels of an outcome variable in longitudinal studies. When exposures are associated with baseline health status, bias can arise if change in health status preceded baseline assessment or if the dependent variable measurement is unreliable or unstable.[11] However, we recorded whether key variables were adjusted for and examined the results in the light of these adjustments. Information was also extracted in relation to mode of administration of surveys, length of follow-up number of waves and attrition rates.

Data Analysis

Analyses were conducted by LJB and KD using Stata 14.0. Study characteristics and quality are summarised descriptively. Studies reported a range of effect estimates (e.g. odds ratios, relative risks and correlation coefficients). Adjusted odds ratios (ORs) were extracted directly from the publications with the exception of one unadjusted OR which was calculated for a study on perceived stress which is not one of the health outcomes included in the meta-analyses. Studies measured IPV or health outcomes in heterogeneous ways, therefore the results are summarised descriptively for each health outcome. Where there were at least two estimates, random effects meta-analysis was used to calculate the pooled ORs representing associations between IPV occurring up to and including the last 12 months and various health outcomes. Higgin's I^2 statistic, which describes the percentage of variability in point estimates that is due to heterogeneity rather than sampling error [12], was calculated. Some studies reported multiple estimates using overlapping definitions of IPV on the same sample of participants. In order to avoid double counting participants in these studies, which can lead to falsely precise pooled estimates, preference was given to one estimate using the following algorithm implemented in the following sequence: (i) those derived from multivariate

analysis (ii) where the definition of IPV closely matched that of the other studies in the meta-analysis (iii) where the reference group was unexposed to any violence and (iv) where the estimate was most precise (i.e. the smallest confidence interval). This algorithm was applied to 3 studies. Studies that provided multiple estimates, but on different sub-samples of participants were included in the meta-analysis. Studies that reported other types of estimate (e.g. correlations coefficients, betas, risk ratios) are documented separately.

Ethics Statement

All data used in this review were already in the public domain and ethical approval was not required.

Patient and public involvement

Patients and the public were not involved in this systematic review.

Table 1. Quality assessment of 36 papers reporting on 35 studies included in the review and effect estimates

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of Administration	Effect Estimate
Depressive symptoms as dependent variable									
Chuang et al. [13]; 1,420 adult women; USA	2 years; 2 waves	29.1%	Physical and/or sexual, CTS-like, last 12 months	Depression, CES-D, past week	Yes	No	IPV; age group; race; education; marital status; income (for the step 1 regression model)	Telephone interview	aOR=1.88 (1.02-3.45)
Chowdhary & Patel [39]; 1,750 adult women; India	1 year; 3 waves	-	Physical, CT-like, last 3 months	Depressive disorder, ICD-10, currently suffering	No, but analysis removes women with baseline depressive disorder	No	Age; literacy; household per capita income	Interviewer administered	aOR=0.5 (0.07-3.79)
Davidson et al. [31]; 494 adult women; Australia	2 years; 2 waves	37.4%	Physical and/or sexual, CAS, last 12 months	Major Depressive Disorder, PHQ-9, past 2 weeks	Yes	Yes	Social function; social structure; lives alone; economic disadvantage; neuroticism; child sexual abuse; child physical abuse	Self-administered	aOR=2.3 (1.03-5.12), p=0.04
Kim & Lee [43]; 3,153 adult women; Korea	4 years; 4 waves	34.2%	"Physical violence and/or threat of physical violence", last 12 months	Depression, CES-D, past week	Yes	No	Age; education; social support; household income; past year physical violence at time 1	Interviewer administered	Beta=-0.03, SE=0.01, p=0.004
Newcomb et al. [23] 113 adult women; USA	1 year; 3 waves	24.0%	Psychological and/or physical, CTS, last 6 months	Depression, CES-D, period not specified	Yes	No	Age; education; relationship status	Interviewer administered	Path coefficient=0.17, p=<0.05
Suglia et al. [25]; 1,834 adult women; USA	3 years; 3 waves	-	Physical and/or sexual, CTS-like, last 12 months	Depression, CIDI-SF, past 12 months	Yes	No	Age; ethnicity; education; marital status; economic hardship; IPV	Interviewer administered	aOR=1.09 (0.6-1.9)
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	-	Physical, CTS, last 12 months	Depression, CES-D, past week	Yes	No	Sociodemographic factors; highest level of abuse by a partner prior to wave 1; number of sexual partners between wave 1 and 2; time elapsed between wave 1 and wave 2; level of risk behaviour at wave 1 (alcohol use/illicit substance us)	Computer assisted personal and self- interview	Beta=0.18 (0.1-0.26) p<0.05

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Taft et al. [32]; 9,683 adult women; Australia	4 years; 2 waves	-	Physical and/or sexual, CTS, last 12 months	Depression, CES-D, past week	Yes	No	Depression time 1; number of children; marital status; age; education level; occupation; health insurance status; country of birth; area of residence; state of residence; Aboriginal or Torres Strait identity	Self-administered	aOR=2.12 (1.69-2.65)
Zlotnick et al. [19] 3,104 adult women; USA	5 years; 2 waves	-	Physical, CTS-like, last 12 months	Depression, CES-D, past week	Yes	No	Age	Self-administered and interviewer administered	Beta=6.96, p=0.003
Depressive symptoms – IPV as dependent variable									
Foshee et al. 2004 [24]; 1,291 adolescents; USA	4-5 years; 4-5 waves	-	Sexual dating violence, CTS like, last 12 months	Depression symptoms "Kandel and Davis", last 6 months	Yes	No	Demographics; peer environment; family environment; social norms; personal competencies; depression; problem behaviour; alcohol use	Self-administered	HR=1.35 (1.05-1.74)
Kim & Lee [43]; 3,153 adult women; Korea	4 years; 4 waves	34.2%	"Physical violence and/or threat of physical violence", last 12 months	Depression, CES-D, past week	Yes	No	Age; education; social support; household income	Interviewer administered	Beta=3.34, SE=0.61, p<0.001
Leher et al. 2006 [17]; 1,659 adolescents; USA	7 years; 3 waves	-	Physical, CTS-like, last 12 months	Depression, CES-D, past week	Yes	Yes	Age; race/ethnicity; parental education; childhood physical abuse; dating violence/forced sex	Computer assisted self- interview	aOR=1.86 (1.05-3.29)
Levendosky et al. [26] 150 adult women; USA	4 years; 5 waves	-	Physical and/or sexual, last 12 months, SVAWS	Depression, BDI, time period not specified	No	No	Unadjusted	Interviewer administered	R=0.24, p<0.05
Nduna et al. 2010 [37]; 995 women and girls; South Africa	1 year; 2 waves	22.6%	Physical and/or sexual, CTS-like (WHO), last 12 months	Depression, CES-D, past week	Yes	Yes	Socio-economic status; experiences of childhood adversity; alcohol abuse; education; study design	Interviewer administered	aOR=1.67 (1.18-2.36)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Postpartum depression as dependent variable									
Escriba-Aguir et al. [42]; 888 pregnant women; Spain	1 year; 4 waves	33.5%	Psychological, Abuse AAS, past 12 months	Postpartum depression, EPDS, past 12 months	Yes	No	Sociodemographic factors (age, marital status, education, employment status, native country); negative life events	Self-administered, interviewer administered and telephone interview	aOR=4.11 (1.23-13.73)
Plach et al. [47]; 5,681 pregnant women; United Kingdom	3.5 years; 5 waves	-	Has a partner physically hurt and/or been emotionally cruel, during pregnancy	Postnatal depression, EPDS, past 7 days (asked at 8 weeks postpartum)	Yes	No	Paternal postnatal depressive symptoms; size of child for gestational age	Self-administered	aOR=1.29 (1.02-1.63)
Kita et al. [46]; 562 adult women; Japan	1 month; 2 waves	26.7%	Physical and/or non-physical, during pregnancy, ISA	Postnatal depression, HADS, past 7 days	Yes	No	Mother to infant bonding; age, parity	Self-administered	Path coefficients: Antenatal IPV and postnatal depression=0.10 (NS); Antenatal IPV and antenatal depression=0.31; Antenatal depression and postnatal depression=0.57
Patel et al. [40]; 335 pregnant women; India	6 months; 3 waves	13.0%	"Marital violence" during pregnancy	Postnatal depression at 6 months, EPDS, past 7 days	No	No	Unadjusted	Interviewer administered	RR=2.6 (1.6-4.3) p=0.001
Tsai et al. [38]; 258 pregnant women; South Africa	3 years; 4 waves	22.6%	Physical, CTS, last 12 months	Postpartum Depression, EPDS, past 7 days	Yes	No	Intervention or control arm; age; completion of high school; household wealth; employment full time or part time; whether father or baby is with participant; HIV serostatus; high blood pressure	Interviewer administered	Coefficient=1.04 (0.61-1.47)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[b]Woolhouse et al. [33]; 1,102 pregnant women; Australia	4 years; 6 waves	18.1%	Physical and/or emotional, CAS, last 12 months	Depression in the 1st year postpartum only, EPDS, past 7 days	Yes	No	Maternal age at baseline; number of children at 4 years postpartum; IPV; relationship transitions; family income at 4 years postpartum; stressful life events/social adversity in past 12 months - this estimate for IPV in first year postpartum only	Self-administered	aOR=0.75 (0.4-1.6)
				Depression at 4 years postpartum only, EPDS, past 7 days					aOR=3.48 (2.0-6.1)
				Depression in the 1st year and at 4 years postpartum, EPDS, past 7 days					aOR=2.18 (1.2-3.8)
Rogathi et al. [48]; 1013 pregnant women; Tanzania	14 months; 4 waves	4.6%	Physical, sexual, emotional, WHO survey, during pregnancy	Postpartum depression up to 40 days post-delivery, EPDS, past 7 days	No, as not significant in bivariate test	No	Age; reported history of depression; reported history of hypertension; HIV/AIDS diagnosis; emotional support; number of pregnancies; exposure to at least one type of IPV	Interviewer administered and telephone interview	aOR=2.51 (1.67-3.76)
Valentine et al. [30]; 210 pregnant women; USA	1 year; 4 waves	-	Physical, sexual, psychological, AAS, during or within 12 months or current pregnancy	Postpartum depression, BDI, time period not specified	Yes	No	Recent IPV; remote IPV; social support	Interviewer administered and telephone interview	aOR=5.38 (2.21-13.08)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Postpartum depression – IPV as dependent variable									
Tsai et al. [38]; 958 pregnant women; South Africa	3 years; 4 waves	22.6%	Physical, CTS, last 12 months	Postpartum Depression, EPDS, past 7 days	Yes	No	Intervention or control arm; age at baseline; completion of high school; household wealth; employment full time or part time; whether father or baby is with participant; HIV serostatus; high blood pressure	Interviewer administered	Beta=0.054 (0.030-0.079)
Suicide attempts as dependent variable									
Chowdhary & Patel [39]; 8,750 adult women; India	1 year; 3 waves	-	Verbal, CTS-like, last 3 months	Single question, ever attempted suicide	Yes	No	Age; literacy; household per capita income	Interviewer administered	aOR=2.84 (0.55-14.73)
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	-	Verbal, threats, physical, CTS, last 12 months	Single question, ever attempted suicide	Yes	No	Sociodemographic factors; highest level of abuse by a partner prior to wave 1; number of sexual partners between wave 1 and 2; time elapsed between wave 1 and wave 2; level of risk behaviour at wave 1 (alcohol use/illicit substance us)	Computer assisted self- interview	Beta=0.12 (0.02-0.22)
Perceived stress as dependent variable									
Salzaar et al. [44]; 398 adults; Nicaragua	3 years; 2 waves	16.7%	Emotional, physical, sexual, WHO Survey, last 12 months	Perceived emotional distress, SRQ,	No	No	None	Interviewer administered	OR=4.59 (2.5-8.45) calculated
Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	9.0%	Verbal aggression, CTS, last 12 months Physical aggression, CTS, last 12 months	Perceived Stress, Cohen et al. 1983 a 14-item measure, past 6 months	Yes	No	Race; have a child/pregnant; time 1 marital satisfaction; time 1 verbal aggression	Self-administered at time 1 and interviewer administered or telephone interview at time 2	Beta=0.18; p<0.001 Beta=0.11; p<0.05
Study, Participants,	**Length of Follow-up;**	**Attrition at Last Wave**	**IPV Measure and Timeframe**	**Health Outcome**	**Adjusted for Time 1**	**Adjusted for CSA**	**Other Variables Adjusted For**	**Mode of administration**	**Effect Estimate**

Country	Number of Waves			Measure and Timeframe	Dependent Variable[a]				
General anxiety as dependent variable									
Suglia et al. [25];1,834 adult women; USA	3 years; 3 waves	-	Physical and/or sexual, CTS-like, past 12 months	Single question, asking if they had a period of 6 months or more when they felt worried, tense or anxious	Yes	No	Age; ethnicity; education; marital status; economic hardship; IPV	Interviewer administered	aOR=1.95 (1-3.8)
Self-perceived health status as dependent variable									
Escriba-Aguir et al. [42]; 888 pregnant women; Spain	1 year; 4 waves	33.5%	Psychological, Abuse AAS, past 12 months	Respondents asked to report their general health as: very good; good; fair; poor; very poor	Yes	No	Sociodemographic factors (age, marital status, education, employment status, native country); negative life events	Self-administered, interviewer administered and telephone interview	aOR=4.32 (1.58-11.87)
Hard drug use (cocaine, crack, heroin) as dependent variable									
Algeria et al. [41]; 452 adult women; Puerto Rico	3 years; 3 waves	-	Physical and/or psychological, CTS, last 12 months	Hard core drug use, self-report of crack or cocaine, heroin, past 12 months	Yes	No	Education; employment; very severe partner violence; alcohol use in last year	Computer assisted personal interview	aOR=2.02 (1.04-3.91)
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Cocaine use once a week or more, last 6 months	No	Yes	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=2.10 (0.82-5.5)
Hard drug use (cocaine, crack, heroin) – IPV as dependent variable									
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Crack use once a week or more, last 6 months	No	Yes	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=1.6 (0.84-3.0)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, injurious, sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Hard drug use (cocaine, crack or heroin), last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support	Interviewer administered	RR=1.6 (1.08-2.36)
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	-	Minor violence from same partner, CTS, last 12 months Severe violence from same partner, CTS, last 12 months	Hard drug use, past year	Yes	No	Race; age; cohabiting; married; time 1 psychological aggression; marijuana use	Computer assisted self-interview, and self-administered postal survey	aOR=2.41 (1.36-4.26) aOR=2.87 (1.39-5.92)
Marijuana use as dependent variable									
El-Bassel et al. [21]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use once a week or more, last 6 months	No	Yes	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=2.4 (0.92-6.2)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use, last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support; baseline IPV	Interviewer administered	RR=1.14 (0.81-1.6)
Nowotny & Graves [16] 2,959 adolescents; USA	6 years; 2 waves	-	Sexual, CTS-like, last 12 months	Marijuana use (any), last 12 months	Yes	No	Age; married; education; employment; personal income	Computer assisted personal and self-interview	aOR=1.4 (0.97-2.08)
Marijuana use – IPV as dependent variable									
El-Bassel et al. [22]; 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Marijuana use once a week or more, last 6 months	No	No	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=4.5 (2.4-8.4)
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves		Physical, injurious, sexual, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", Hard drug use (cocaine, crack or heroin), last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support	Interviewer administered	RR=0.94 (0.71-1.24)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[b]Testa et al. [28] 724 adult women; USA	1 year; 2 waves	-	Minor violence from same partner, CTS, last 12 months Severe violence from same partner, CTS, last 12 months	Marijuana use, past year	Yes	No	Race; age; cohabiting; married; time 1 psychological aggression; marijuana use	Computer assisted self-interview, and self- administered postal survey	aOR=0.98 (0.59-1.64) aOR=1.78 (0.92-3.44)
Other combinations of illicit drug use and/or alcohol use as dependent variable									
Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, injurious, sexual, CTS, last 6 months Physical, CTS, last 6 months	"Drug Use and Risk Behaviour Questionnaire", any illicit drug use, last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support; baseline IPV	Interviewer administered	RR=1.15 (0.83-1.58) RR=0.9 (0.65-1.26)
Newcomb et al. [23];113 adult women; USA	1 year; 3 waves	24.0%	Psychological and/or physical, CTS, past 6 months	Participants asked if they had ever used 16 illegal drugs including cocaine, crack, heroin, marijuana and others not listed.	Yes	No	Age, education, relationship status	Interviewer administered	Path coefficient=0.18, p<0.05

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[c]Nowotny & Graves [16]; 3,959 adolescents; USA	6 years; 2 waves	-	Physical, CTS-like, last 12 months	Drug use (MDMA, inhalents, LSD, heroin, PCP or other illegal drugs), last 12 months	Yes	No	Age; married; education; employment; personal income	Computer assisted personal and self-interview	aOR=1.3 (0.8-2.15)
Roberts et al. [22]; 2,206 adolescents; USA	1 year; 2 waves	-	Physical, CTS, last 12 months	Tobacco, alcohol and/or marijuana use, last 12 months	Yes	No	Sociodemographic factors; highest level of abuse by a partner prior to wave 1; number of sexual partners between wave 1 and 2; time elapsed between wave 1 and wave 2	Computer assisted self- interview	Beta=0.16 (0.06-2.26), p<0.05
Alcohol use as dependent variable									
[b]Boden et al. [49]; 630 adult women; New Zealand	10 years; 4 waves used	-	Physical and/or sexual, CTS, last 12 months	CIDI - 1 to 2 symptoms versus none, last 12 months CIDI - 3 to 5 symptoms versus none, last 12 months CIDI - > 5 symptoms versus none, last 12 months	No	No	Unadjusted	Not reported	Population averaged IRR=1.58 (1.37-1.82) Population averaged IRR=2.5 (1.88-2.89) Population averaged IRR=3.38 (2.57-6.03)
El-Bassel et al. [21] 317 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	Binge drinking – drinking 4 or more alcoholic drinks within a 6-hour period) once a week or more in the past 6 months	No	No	Socio-demographics; history of trauma (childhood sexual abuse, PTSD); psychological distress; social support; HIV risk behaviours	Interviewer administered	aOR=0.80 (0.04-17.0)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
[b]Gao et al. [35]; 636 adult women; New Zealand	2 years; 2 waves	16.9%	Verbal aggression at 24 months postpartum only, CTS, last 12 months Verbal aggression at 6 weeks and 24 months postpartum only, CTS, last 12 months Physical at 24 months postpartum only, CTS, last 12 months Physical at 6 weeks and 24 months postpartum only, CTS, last 12 months	High risk alcohol use - drank 6 or more alcoholic drinks on at least one occasion in the last 12 months	No	No	Age; education; ethnicity; duration living in New Zealand; marital status; household income; whether born in New Zealand; cultural orientation; composite measures of verbal and physical violence	Interviewer administered	aOR=2.68 (0.57–12.62) aOR=3.14 (0.71-13.92) aOR=1.24 (0.69-2.23) aOR=1.49 (0.78-2.84)
[c]Gilbert et al. [14]; 185 adult women; USA	1 year; 3 waves	23.2%	Physical, CTS, last 12 months	"Drug Use and Risk Behaviour Questionnaire", Binge drinking, last 6 months	Yes	Yes	Socio-demographics (age, ethnicity, employment, marital status); homelessness; incarceration; childhood sexual abuse, psychological distress; active or avoidant coping; partner illicit drug use; partner binge drinking; financial dependency; sexual relationship power scale; perceived community support; baseline IPV	Interviewer administered	RR=1.4 (0.97-2.02)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Keiley et al. [15]; 195 couples; USA	2.5 years; 2 waves	-	Physical, CTS, last 12 months Verbal, CTS, last 12 months	ADS and MAST, last 12 months	Yes	No	Socio-economic status; race; wife's reports of their own anxiety and depression; wife's reports of their own physical and verbal aggression towards husband; wife's reports of their husband's physical and verbal aggression towards them	Self-administered and interviewer administered	Slope=0.011 Quadratic=0.001 NS Slope=-0.009 Quadratic=-0.006 NS
Nowotny & Graves [16]; 2,959 adolescents; USA	6 years; 2 waves	-	Threats, minor violence, CTS-like, last 12 months	Binge drinking: drinking five or more drinks during a single occasion at least two to three times a month in the past year	Yes	No	Age; married; education; employment; personal income	Computer assisted personal and self-interview	aOR=1.0 (0.71-1.43)
Testa et al. 2001 [27]; 494 adult women; USA	2 years; 2 waves	9.0%	Verbal aggression, CTS, last 12 months Physical aggression, CTS, last 12 months	Alcohol consumption, average daily volume. Heavy drinking index, 6+ drinks single occasion and drinking to intoxication (continuous), last 12 months	Yes	No	Race; have a child/pregnant; time 1 marital satisfaction; time 1 verbal aggression	Self-complete questionnaire at time 1 and in-person/telephone interview and self-complete questionnaire at time 2	Beta=-0.4; NS Beta=0.09; p<0.05

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Zlotnick et al. [19]; 2,905 adult women; USA	5 years; 2 waves	-	Physical, CTS-like, last 12 months	National Survey of Alcohol and Drug Abuse Questions. Four items coded on a 6-point scale ranging from 0 (abstinent) to 3 (high moderate use) to 5 (binge drinking) past 30 days	No	No	Unadjusted	Self-administered and interviewer administered	IPV: Weighted mean score=1.45 (SE=0.19) No IPV: Weighted mean score=0.87 (SE=0.06) NS
Alcohol use – IPV as dependent variable									
Marsh-Buzy et al. [29]; 73 school students; USA	4 months, 2 waves	31.1%	Physical and/or sexual, CTS, past 4 months	Alcohol use – quantity/frequency measure, past 4 months	Yes	No	None	Self-administered	aOR=3.94; p=0.04
Testa et al. 2003 [28];724 adult women; USA	1 year; 2 waves	-	Severe violence from same partner, CTS, last 12 months Minor violence from same partner, CTS, last 12 months	Heavy episodic drinking in past 12 months consisted of mean response to two questions on frequency of consuming 5 or more drinks in a single day and frequency of drinking until intoxicated	Yes	No	Race; age; cohabiting; married; time 1 psychological aggression; marijuana use; hard drug use	Computer assisted self-interview, and self- administered postal survey	aOR=1.0 (0.71-1.4) aOR=1.2 (0.93-1.56)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
HIV infection as dependent variable									
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, last 6 months	HIV positive status	Yes	No	Age; ethnicity; education; drug and alcohol use; baseline HIV risk behaviours	Interviewer administered	aOR=0.21 (0.03-1.6)
Jewkes et al. [36] 1,099 women and girls; South Africa	2 years; 3 waves	12.5%	Physical and/or sexual, WHO Survey, last 12 months	HIV infection assessed with blood tests at all three waves	Yes	No	Age; study treatment group; stratum; person years of exposure to HIV (years from baseline to last negative HIV test), herpes simplex virus at basline	Interviewer administered	IRR=1.51 (1.04-2.21)
Sexually transmitted infection as dependent variable									
Chowdhary & Patel [40]; 1,750 adult women; India	1 year; 3 waves	-	Physical, CTS-like, last 3 months	STI (chlamydia, gonorrhoea or trichomoniasis) biological testing, past 3 months	No, but removes women who had STI at baseline	No	Age; literacy; household per capita income	Interviewer administered	aOR=1.88 (0.64-5.53)
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, CTS, last 6 months	STI infection at wave 3	Yes	No	Age; ethnicity; education; drug and alcohol use; baseline HIV risk behaviours	Interviewer administered	aOR=0.88 (0.53-1.5)
Wilson et al. [45]; 389 adult women; Kenya	Up to 2 years; unclear	-	Physical and/or sexual, WHO, last 12 months	STI at quarterly examination, Presence of gonorrhoeae, chlamydia trachomstis, or trichomonas vaginalis detected by nucleic acid amplification test	No	No	Age; baseline alcohol use level; lifetime history of sexual violence since age of 15 by someone other than the index partner	Interviewer administered	aRR=0.88 (0.57-1.37)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Sexual risk behaviour as dependent variable									
El-Bassel et al. [20] 405 adult women; USA	1 year; 3 waves	24.0%	Physical and/or sexual, last 6 months	Unprotected anal sex Condom use consistency Condom request consistency Multiple concurrent partners	Yes	No	Age; ethnicity; education; drug and alcohol use; baseline HIV risk behaviours	Interviewer administered	aOR=1.8 (0.58-5.5) aOR=0.41 (0.24-0.71) aOR=0.42 (0.22-0.82) aOR=3.1 (0.89-11.0)
Teitelman et al. [50]; 2,629 adolescents; USA	7 years; 2 waves Is it 2 waves	-	Verbal and/or physical, CTS, last 12 months	HIV risk (condom use), last 12 months	Yes	No	Age; race/ethnicity; family income	Computer assisted personal and self-interview	aOR=1.59 (1.16-2.18)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Wilson et al. [45]; 389 adult women; Kenya	Up to 2 years; unclear	-	Physical and/or sexual, WHO, last 12 months	Unprotected anal and/or vaginal sex, past week	No	No	Age; baseline alcohol use level; lifetime history of sexual violence since age of 15 by someone other than the index partner	Interviewer administered	aRR=1.91 (1.32-2.78)
				100% condom use, past week					aRR=0.90 (0.82-0.99)
				2 or more sexual partners, past week					aRR=0.96 (0.76-1.21)
				3 or more sex acts, past week					aRR=1.0 (0.79-1.26)
				Semen detection by prostate specific antigen test PSA as a biomarker of unprotected sex					aRR=1.54 (1.17-2.04)
				No sex in the past week					aRR=0.67 (0.54-0.83)

Study, Participants, Country	Length of Follow-up; Number of Waves	Attrition at Last Wave	IPV Measure and Timeframe	Health Outcome Measure and Timeframe	Adjusted for Time 1 Dependent Variable[a]	Adjusted for CSA	Other Variables Adjusted For	Mode of administration	Effect Estimate
Gynaecological problems as dependent variable									
[c]Chowdhary & Patel [39]; 1,750 adult women; India	1 year; 3 waves	-	Physical, CTS-like, last 3 months	Abnormal vaginal discharge, last 3 months	No, but removes women who had condition at baseline	No	Age; literacy; household per capita income	Interviewer administered	aOR=1.06 (0.44-2.58)
			Sexual, CTS-like, last 3 months	Dysuria, last 3 months					aOR=1.57 (0.6-4.14)
			Physical, CTS-like, last 3 months	Lower abdominal pain, last 3 months					aOR=1.2 (0.63-2.32)
			Physical, CTS-like, last 3 months	Dyspareunia, last 3 months					aOR=2.15 (0.8-5.82)

[a] Refers to the dependent variable

[b] Estimates are mutually exclusive as based on different sub-samples

[c]More than one estimate reported in the study, but preference given to one estimate using the following algorithm: estimate derived from multivariate analysis; the definition of IPV closely matches that of other studies in the health outcome group; where the reference group was unexposed to any violence; where the estimate was most precise

NS, Not statistically significant

CSA, Childhood sexual abuse

AAS, Abuse Assessment Screen; ADS, Alcohol Dependence Scale; BDI, Beck Depression Inventory; CAS, Composite Abuse Scale; CES-D, Center for Epidemiological Studies-Depression; CIDI-SF, Composite International Diagnostic Interview-Short Form; CTS, Conflict Tactics Scale; HADS, Hospital Anxiety and Depression Scale; ISA, Index of Spouse Abuse; MAST, Michigan Alcoholism Screening Test; PHQ-9, Patient Health Questionnaire; SRQ, Self-Report Questionnaire; SVAWS, Severity of Violence Against Women Scale

Results

Study characteristics

Thirty-five separate cohort studies described in 36 articles published between 2002 and 2017 with 48,863 participants met the inclusion criteria and contained 174 effect estimates of association between IPV and health outcomes. Eighteen articles were from the USA,[13-30] three from Australia,[31-33] two from New Zealand,[34 35] three from South Africa,[36-38] two from India,[39 40] one from Puerto Rico,[41] one from Spain,[42] one from Korea,[43] one from Nicaragua,[44] one from Kenya,[45] one from Japan,[46] one from the UK,[47] and one from Tanzania.[48] Amongst the 35 cohort studies, 11 were household surveys,[13 19 27 28 32 35 39 43 44 47 49] 14 sampled participants from clinical settings,[14 20 21 23 25 26 30 31 33 {Rogathi, 2017 #4192 40 42 45 46] seven from schools,[16 17 22 24 29 36 50] and three from the local community.[15 38 41] Some studies were based on sub-populations of women including one study (reported in two papers) of women receiving methadone maintenance treatment,[20 21] women attending a clinic with depressive symptoms at baseline,[31] HIV-positive female sex workers,[45] and eight studies of pregnant women.[30 33 38 40 42 46-48] Six studies focussed on adolescents[16-18 22 24 29] and one (reported in two papers) included women and young girls.[36 37]

Table 2 presents the different health outcomes measured in the studies, the number of studies that measure each health condition, the overall number of estimates that contribute to each health condition, and the number of estimates that contribute to the meta-analysis.

Table 2: Health outcomes/health risk behaviours measured in the 35 studies and number of estimates

Health outcome	Number of studies and estimates, refs	Number of estimates in the meta-analysis
Depression	13 studies; [13 17 19 22-26 31 32 37 39 43] 13 estimates	7
Postpartum depression	8 studies; [30 33 38 40 42 46-48] 11 estimates	7
Suicide attempts	2 studies; [22 39] 2 estimates	NA
Perceived stress	2 studies; [27 44] 3 estimates	NA
General anxiety	1 study; [25] 1 estimate	NA
Self-perceived health status	1 study; [42] 1 estimate	NA
Hard drug use	4 studies; [14 21 28 41] 6 estimates	5
Marijuana use	4 studies; [14 16 21 28] 7 estimates	5
Other combinations of illicit drug/alcohol use	4 studies; [14 16 22 23] 5 estimates	NA
Alcohol use	10 studies; [14-16 19 21 27 29 35 49] 18 estimates	9
HIV infection	2 studies; [20 36] 3 estimates	NA
STIs	3 studies; [20 39 45] 2 estimates	NA
Sexual risk behaviours	3 studies; [18 20 45] 8 estimates	NA
Abnormal vaginal discharge	1 study; [39] 3 estimates	NA
Dysuria	1 study; [39] 3 estimates	NA
Lower abdominal pain	1 study; [39] 3 estimates	NA
Dyspareunia	1 study; [39] 3 estimates	NA

NA- Not applicable as study estimates were continuous and could not be included in a meta-analysis

Table 1 summarises quality issues in relation to the 36 papers reporting on 35 separate cohort studies included in the review. All but three of the 35 cohort studies used recognised, validated IPV instruments or used items that were taken from validated instruments.[40 43 47] All, but nine studies assessed for IPV that occurred in the last 12 months; one measured IPV in the last three months,[39] two in the last six months,[20 21 23] one in the last four months,[29] four measured IPV that occurred during pregnancy,[40 46-48] and one measure IPV during or within 12 months of pregnancy.[30] Most of the studies assessed for physical and/or sexual violence from a partner, with some also including threats, emotional or verbal abuse. The attrition rate was reported or calculated in 19 studies and ranged from 4.6%[48] to 37.4%.[31] The length of follow-up ranged from one month[46] to ten years[49] and the number of waves ranged from two (multiple studies) to six.[33] The smallest sample size was 73 adolescents[29] and the largest was 1,303 adult women[48]. Table 1 presents all study estimates grouped by health outcome.

IPV and depressive symptoms

Thirteen studies examined the relationship between recent IPV and depressive symptoms[13 17 19 22-26 31 32 37 39 43] of which one examined the association in both directions.[43] Of these, nine studies provided nine estimates of association between IPV and subsequent depressive symptoms.[13 19 22 23 25 31 32 39 43] Eight of these estimates showed a positive direction of association between experience of IPV and subsequent depressive symptoms.[9 13 19 22 23 31 32 39] Of the nine estimates of the association between IPV and subsequent depression, all but two reached statistical significance.[25 39] Five studies provided five estimates of association between depression and subsequent IPV, all of which showed a positive and statistically significant relationship.[17 24 26 37 43]

We were able to include seven estimates reporting binary IPV measures and binary depressive symptoms or disorder measures in the meta-analysis. For IPV and subsequent depressive symptoms or disorder, the pooled OR from five estimates[13 25 31 32 39] was 1.76 (95% CI 1.26-2.44, I^2 = 37.5% p=0.172). Two estimates[17 37] were included in the meta-analysis of the relationship between depressive symptoms and subsequent IPV, resulting in a pooled OR of 1.72 (95% CI 1.28-2.31, I^2 = 0.0%, p=0.752). One study, not included in the meta-analyses examined the bi-directional relationship between IPV and depression.[43] A Korean study of married women found that IPV at Wave 1 was positively associated with the depression level at Wave 1 (Beta=0.030, SE=0.03, p<0.001), but negatively associated with the growth rate of depression over the study period (Beta=-0.03, SE=0.01, p=0.004). IPV experienced at Wave 4 was associated with a larger growth rate of depression in the model (Beta=3.34, SE=0.61, p<0.001) and the experience of IPV at Wave 1 (Beta=0.68, SE=0.11, p<0.001). See Figure 2.

Depression measurement: Of the nine studies that measured IPV and subsequent depressive symptoms, one measured depressive symptoms occurring in the past 12 months,[25] one in the last two weeks,[31] five in the last week,[13 19 22 32 43] one "current",[39] and one did not specify a time period.[23] Of the five studies that measured depressive symptoms and subsequent IPV, three measured depressive symptoms in the past week,[17 37 43] one in the past six months,[24] and one did not specify a time period.[26]

All but one of the studies used screening questionnaires that measured depressive symptoms as opposed to diagnostic tools. Of the 13 studies, eight used the Center for Epidemiologic Studies Depression Scale (CES-D),[13 17 19 22 23 32 37 43] one study used the WHO ICD-10,[39] one used the Composite International Diagnostic Interview-Short Form (CIDI-SF),[25] one used the Patient Health Questionnaire (PHQ),[31] one used the Beck Depression Inventory (BDI),[26] and one used a scale from Kandel and Davies.[24]

Common risk factors/confounding: Of the nine studies that measured IPV and subsequent depressive symptoms and disorder, all but one controlled for time one levels of depression. Chowdhary & Patel[39] excluded women with baseline depressive disorder in their analysis, but this may have resulted in the exclusion of cases of IPV that preceded depressive symptoms at baseline and the remaining cases may not have been representative of women experiencing IPV. All, but one of the five studies that measured depressive symptoms and later IPV, controlled for time one levels of IPV.[26] Of the 13 studies, all but 2 controlled for socio-demographic factors.[26 39] Other confounders were not comprehensively controlled for. Two studies controlled for childhood physical and/or sexual abuse[17 31] and two for alcohol use,[24 37] of which one also controlled for childhood adversity which measured emotional and physical neglect, and physical and sexual abuse.[37] There were no discernible differences in effect

estimates regardless of which confounders were adjusted for and studies found similar directions and varying magnitudes of association.

IPV and postpartum depressive symptoms

Eight studies provided eleven estimates of association between IPV and subsequent postpartum depressive symptoms.[30 33 38 40 42 46-48] All eleven estimates showed a positive direction of association between IPV and subsequent postpartum depressive symptoms, with all but one of the estimates reaching statistical significance.[46] Seven estimates from three studies were included in the meta-analysis of the relationship between IPV and subsequent postpartum depression,[33 47 42 30 48] resulting in a pooled OR of 2.19 (95% CI 1.39-3.45). This was heterogeneous (I^2 = 79.8%, p=0.000). One of the studies examined the bi-directional relationship and found that depression symptom severity was associated with a greater risk of subsequent IPV.[38] Each five point difference in the Edinburgh Postnatal Depression Scale was associated with a 0.9 to 2.3 point difference in subsequent IPV risk (Beta=0.054; 95% CI 0.030-0.079).

Postpartum depression measurement: Of the eight studies that measured IPV and subsequent depressive symptoms, one measured depressive symptoms occurring in the past 12 months,[42] six studies measured depressive symptoms in the last week,[33 38 40 46 47 48] and one study did not specify the time period.[30] One study measured postpartum depression in the last week and subsequent IPV [38]. Of the eight studies, six used the Edinburgh Postnatal Depression Scale (EPDS),[33 38 40 42 47 48] one used the Hospital Anxiety and Depression Scale (HADS),[46] and one used the Beck Depression Inventory (BDI).[30]

Common risk factors/confounding: Six of the eight studies that examined IPV and subsequent postpartum depression controlled for time one levels of depressive symptoms.[33 38 42 46 47 30] One study did not control for time one levels of depressive symptoms as it was not significant in the bivariate analysis.[48] Five studies controlled for socio-demographic factors.[33 38 42 46 48] One study controlled for HIV serostatus[38] and one controlled for HIV/AIDS diagnosis.[48]

IPV and alcohol use

Ten studies examined the relationship between recent IPV and alcohol use. Of these, eight studies provided 15 estimates of association between IPV and subsequent alcohol use.[14-16 19 21 27 35 49] All, but one of these 15 estimates showed a positive direction of association between IPV and subsequent alcohol use,[15] with two studies providing five estimates which reached statistical significance.[27 49] Two studies[28 29] provided three estimates showing a positive direction of association between alcohol use and subsequent IPV, of which one was statistically significant.[29]

For IPV and later alcohol use, the pooled OR from six estimates provided by three studies[16 21 35] was 1.19 (95% CI 0.91-1.55, I^2 = 0.0%, p=0.523). Three estimates from two studies[28 29] were included in the meta-analysis of the relationship between alcohol use and subsequent IPV, resulting in a pooled OR of 1.11 (95% CI 0.91-1.35, I^2 = 0.0%, p=0.672).

Alcohol use measurement: Of the eight studies that measured IPV and subsequent alcohol use, five measured alcohol use in the last 12 months,[15 16 27 35 49] two in the last six months,[21 14] and one in the last 30 days.[19] Of the two studies that measured alcohol use and subsequent IPV, one measured alcohol use in the last 12 months[28] and one in the last four months.[29]

Alcohol consumption was measured in a variety of ways. Of the 10 studies, one assessed alcohol abuse or dependence using the CIDI-SF,[49] four measured binge drinking which was based on the number of alcoholic drinks consumed on one occasion,[14 16 21 35] three measured heavy drinking which was assessed using a combined quantity-frequency measure,[27-29] one used the Alcohol Dependence Scale (ADS) and the Michigan Alcohol Screening Test (MAST),[15] and one used the National Survey of Alcohol and Drug Abuse (NSDUH).[19]

Common risk factors/confounding: Of the eight studies that measured IPV and subsequent alcohol use, only four adjusted for time one levels of alcohol use.[14-16 27] Both studies that examined the association between alcohol use and subsequent IPV adjusted for time one levels of IPV.[28 29] Of the 10 studies, 7 controlled for socio-demographic factors.[14-16 21 27 28 35] Two studies adjusted for a history of trauma. El-Bassel[21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert[14] also controlled for childhood sexual abuse as well as psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power. Regardless of the confounders controlled for, all but one study found a positive direction of association and reported varying magnitudes of association.

IPV and hard drug use (crack, cocaine, heroin)

Four studies examined the relationship between recent IPV and hard drug use,[14 21 28 41] of which one reported an association in both directions.[21] Two studies provided two estimates of IPV and subsequent hard drug use, both of which showed a positive direction of association although only one was statistically significant.[21 41] The pooled OR from these studies was 2.05 (95% CI 1.19-3.52, I^2 = 0.0%, p=0.948). Three studies provided four estimates of hard drug use and subsequent IPV, which showed a positive direction of association and three of

these were statistically significant.[14 21 28] Three of these estimates were included in the meta-analysis, resulting in a pooled OR of 2.20 (95% CI 1.52-3.17, I^2 = 0.0%, p=0.455).

Hard drug use measurement: Of the two studies that measured IPV and subsequent hard drug use, one study measured drug use in the last 12 months[41] and the other in the last 6 months.[21] Of the three studies that measured hard drug use and subsequent IPV, one assessed use in the last 12 months[28] and two in the last six months.[14 21] Of the four studies, two used the Drug Use and Risk Behaviour Questionnaire[14 21] and two asked about use of specific hard drugs including crack, cocaine and heroin.[28 41] Of the latter, one of the studies used two methods for assessing hard drug use at each wave including self-report information only and combined self-report and toxicological information.[41]

Common risk factors/confounding: Of the two studies that measured IPV and subsequent hard drug use, one controlled for time one levels of hard drug use [41]. Of the three studies that measured hard drug use and subsequent IPV, two controlled for time one levels of IPV.[14 28] All four studies controlled for socio-demographic factors. El-Bassel[21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert[14] controlled for childhood sexual abuse, psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power.

IPV and marijuana use

Four studies examined the relationship between recent IPV and marijuana use,[14 16 21 28] of which two studies reported an association in both directions.[14 21] Three studies provided three estimates of IPV and subsequent marijuana use, all showing a positive direction of

association, although none were statistically significant.[14 16 21] Two of these studies were included in the meta-analysis resulting in a pooled OR of 1.52 (95% CI 1.04-2.24, I^2 = 5.4%, p=0.304). Three studies provided four estimates of marijuana use and subsequent IPV[14 21 28] of which one showed a positive and statistically significant relationship. Three of these estimates were included in the meta-analysis, resulting in a pooled OR of 1.96 (95% CI 0.8-4.83). This was heterogeneous (I^2 = 85.4%, p=0.001).

Marijuana use measurement: Of the four studies, two measured marijuana use in the last 12 months [16 28] and two in the last six months.[14 21] All studies used self-report information to assess for marijuana use.

Common risk factors/confounding: Of the three studies that measured IPV and subsequent marijuana use, two controlled for time levels of marijuana use.[14 16] Of the three studies that measured marijuana use and subsequent IPV, two controlled for time levels of IPV.[14 28] All the studies controlled for socio-demographic factors. El-Bassel[21] controlled for childhood sexual abuse, post-traumatic stress disorder, multiple concurrent partners and frequency of condom use. Gilbert[14] controlled for childhood sexual abuse, psychological distress, coping strategies, the partner's illicit drug use and binge drinking and sexual relationship power.

IPV and STIs (excluding HIV)

Three studies provided three estimates of the association between recent IPV and subsequent STIs[20 39 45] of which one showed a positive and statistically significant relationship.[39] The meta-analysis of two of these studies[20 39] resulted in a pooled OR of 1.10 (95% CI 0.56-2.18, I^2 = 35.5%, p=0.214).

STI measurement: One study assessed for STIs (chlamydia, gonorrhoea or trichomoniasis) within the last three months using biological measures,[39] another relied on self-report to assess for STIs at the last wave[20] and the third study assessed women quarterly for gonorrhoeae, chlamydia or trichomoniasis.[45]

Common risk factors/confounding: All the studies controlled for socio-demographic factors. El-Bassel's study[21] of women attending a methadone maintenance clinic adjusted for time one HIV risk factors (i.e. frequency of condom use, frequency of requesting condom use, having unprotected anal sex, exchanging sex for drugs, being HIV positive and having had an STI), as well as drug and alcohol use. Chowdhary & Patel[39] removed women with an STI at time one from the analysis. However, this would likely have introduced bias in the resulting cases, as it would have excluded women with IPV that preceded the acquisition of an STI at baseline. Wilson's[45] study of HIV positive sex workers did not control for time one sexual risk behaviours, although it did control for a lifetime history of sexual violence since the age of 15 by someone other than the index partner. Figure 3 presents the forest plots for alcohol use, hard drug use, marijuana use and STIs.

Discussion

Summary of main findings

Our review identified cohort studies that examined the relationship between recent IPV (i.e. IPV occurring up to and including the last 12 months) and depression, postpartum depression, alcohol use, hard drug use, marijuana use and STIs. Although a few other health or health related outcomes were identified (i.e. sexual risk behaviours, HIV infection, general anxiety, perceived stress and gynaecological problems) these could not be included in a meta-analysis because there was only one estimate. We found evidence consistent with a bi-directional relationship between recent IPV and depressive symptoms. Recent IPV was also associated

with increased symptoms of postpartum depression. There was some evidence of a bi-directional relationship between recent IPV and hard drug use, and IPV and subsequent marijuana use although there were a limited number of studies. There was no evidence of an association between recent IPV and alcohol or STIs although the evidence was weak with few studies and inconsistent measurement of alcohol and STIs.

Although the search strategy did not limit the types of health outcomes identified, the review found no cohort studies for recent IPV exposure and non-communicable diseases such as cardiovascular disease, hypertension and obesity. Nor did we find longitudinal evidence for recent experience of IPV and posttraumatic stress disorder or anxiety disorder. There is limited evidence from cross-sectional data that lifetime IPV increases the risk of cardiovascular disease.[51] Cohort studies measuring past history of IPV have reported an association with increased body mass index,[52] increased risk for cardiovascular disease[53] and hypertension.[54] Physiological mechanisms may explain the association between IPV and some adverse health outcomes through complex neural, neuroendocrine and immune responses to acute and chronic stress. For example, sustained and acute elevated stress levels have been linked to cardiovascular disease, hypertension, gastrointestinal disorders and chronic pain. When exposed to prolonged or acute stress, areas of the brain (e.g. hippocampus, amyglada and prefrontal cortex) undergo structural changes that can impact on mental and cognitive functioning, which can lead to mental disorders.[55]

We found evidence consistent with a bi-directional relationship between recent experience of IPV and depressive symptoms. The magnitude of the association in either direction is similar to that reported in our previous review of 'ever' IPV and depressive symptoms[4] although there were fewer estimates in our meta-analysis of recent IPV and depressive symptoms.

All the studies on postpartum depressive symptoms conceptualised IPV as the dependent variable and there was evidence that recent experience of IPV or IPV during pregnancy increased symptoms of subsequent postpartum depression although there was substantial heterogeneity. The magnitude of the association was slightly lower (OR=2.19, 95% CI 1.39-3.45) compared to Howard et al.[56] who reported a three-fold increase in the levels of depressive symptoms in the postnatal period after having experienced IPV during pregnancy (OR=3.1, 95% CI 2.7-3.6). However, the authors state that study heterogeneity and lack of data on baseline symptoms prevented conclusions on temporality. In addition, we excluded one study that was included in the Howard et al review as it measures postnatal depressive symptoms using the Edinburgh Postnatal Depression Scale (EPDS) at the final wave, but assesses common mental health disorders during pregnancy with the Self-Reporting Questionnaire (SRQ-20).[57] A recently published systematic review explored studies of IPV during pregnancy and perinatal mental disorders in low and middle income countries. However, most of the studies were cross-sectional and consider partner violence experienced during pregnancy. Furthermore, estimates were not pooled in a meta-analysis.[58]

There was no evidence of an association between recent IPV and alcohol use in either direction. This might be because there were fewer estimates in the meta-analysis of recent IPV and measurement of problematic alcohol use was conceptualised in a number of different ways for example, binge drinking, heavy episodic drinking and high risk alcohol use, which may have diluted the effect. None of the estimates in the meta-analysis measured alcohol use disorder. Furthermore, few estimates in the meta-analysis controlled for time one levels of IPV or alcohol use, and none included the perpetrator's alcohol use which may be related to IPV and/or the woman's drinking behaviour. This finding is in contrast to our previous review of 'ever' IPV and alcohol use which did find evidence consistent with a bi-directional

relationship.[5] Although the pooled estimates in both reviews are based studies that assess binge drinking, the Devries review includes estimates of IPV that occurred in the distant past (i.e. before the last 12 months).

Our review found evidence consistent with a bi-directional relationship between recent IPV and hard drug use. However, this finding should be treated with caution as there were very few studies overall, and one of the studies was based on a sample of women attending a methadone maintenance clinic. For marijuana use, there were few studies, but the evidence suggests that IPV predicts subsequent marijuana use. Pooled estimates did not support that marijuana use predicts subsequent IPV, although estimates were heterogeneous. The evidence for recent IPV and STI infection was in conflicting directions and there were only two estimates. Our review adds to previous systematic reviews as it focuses on longitudinal studies that measure recent experiences of IPV. Furthermore it includes a broader range of health or health related outcomes and explores bi-directionality. The review also highlights that longitudinal studies on recent IPV are lacking for important health outcomes that are known to be associated with partner violence.

Limitations of the review

To our knowledge, this is the first systematic review of cohort studies to measure the magnitude of the association between recent exposure to IPV and health outcomes. Although we conducted an extensive search of the global literature, the review has a number of limitations. Due to the large number of abstracts retrieved and the limited timeframe for the review, we were not able to employ double screening of abstracts. Citation tracking was not undertaken although we conducted reference list screening of key systematic review papers. However, two researchers reviewed the final set of included papers. One researcher was

responsible for extracting data from included papers. As some studies measured the outcome variable (either IPV or the health condition) continuously, it was not possible to combine all measures of effect, which limited the number of studies in the meta-analyses. However, we comment on the direction of the association of studies that were not included in the meta-analysis in the results section for each health condition. It was not possible to quantitatively assess publication bias as too few studies were in the meta-analyses of each health condition.

Sources of bias and limitations of included studies

One of the main limitations of the included studies relates to the lack of consistency in controlling for key potential confounders. With regard to studies on depression, hard drug use and marijuana use, most controlled for time one levels of the health condition or IPV (where IPV was the dependent variable). Far fewer of the estimates on IPV and later alcohol use and IPV and STI controlled for time one levels of the health outcome.

With regard to the studies on depressive symptoms, only two controlled for early childhood trauma (i.e. childhood sexual and/or physical abuse) and two controlled for alcohol use, even though both are known to increase the risk for depression.[59 60] This makes it difficult to rule them out as potential contributors to the causation of the outcomes. Nevertheless, we found that studies showed a positive direction of association, regardless of which variables were adjusted for, and there was no clear pattern of differing magnitude of association that indicated the relationship between IPV and depressive symptoms were not likely to be entirely accounted for by shared risk factors.

Little is known about the potential causal mechanisms between depression and subsequent IPV. However, women who are depressed may experience symptoms (e.g. lethargy and

withdrawal) that impact their capacity for engaging in self-care behaviours including help-seeking and contact with health care providers that could enable them to extricate themselves from the relationship. It is also plausible that earlier, perhaps unmeasured experiences of violence, such as childhood sexual abuse and trauma are causing depression and later IPV, or that depression is mediating the relationship between childhood sexual abuse and later IPV. A path analysis with cross-sectional data supports this hypothesis [60], but few longitudinal studies have explored these relationships.

Only two studies on alcohol use controlled for childhood sexual abuse and one controlled for the partner's level of alcohol use, both of which are potential causes of women's alcohol use. It has been suggested that women who drink heavily are more likely to have a partner who drinks heavily, which can increase their risk of IPV because heavy alcohol use by men is associated with IPV perpetration.[61] This can occur because people tend to choose a partner with similar drinking patterns to themselves or through the influence of their partner's drinking patterns and expectations.[62] Research also suggests that the partner's or the woman's drinking may fuel conflict in the relationship. A nationally representative study from the US found that couples with similar drinking patterns (e.g. both abstinent or both binge drinkers) were less likely to experience IPV in their relationship compared to those with discordant drinking habits.[63] This implies that relationship conflict may result in IPV, as opposed to alcohol use alone because high alcohol use would be more predictive than discordant use. Alcohol use was measured in a variety of ways with most assessing binge drinking or heavy drinking and only two studies measuring alcohol dependence. Although heavy alcohol consumption increases the risk for disease, injury and premature death[64 65] the adverse consequences may vary considerably between people who sporadically drink heavily and those who develop an alcohol use disorder. Although the evidence points to a bi-directional

relationship between IPV and hard drug use and IPV and marijuana use there were few estimates. Women may self-medicate with alcohol, tobacco or drugs in an attempt to cope with the trauma and stress of living in an abusive relationship, which in themselves are important risk factors for poor health. However, alcohol or substance abuse by the abuser or the woman has also been identified as a trigger to violent episodes or a factor that contributes to more severe violence.[66] The evidence for the association between recent IPV and STIs is uncertain.

It was not possible to examine whether the duration or severity of the violence influenced the relationship between IPV and health. Studies conceptualised violence as physical, sexual, verbal, or emotional (or psychological), with most using a combination of types of violence. Only one study provided estimates of minor and severe violence. Studies reported the time frame in which the violence occurred, but not the duration.

The majority of the studies were from high income countries, most notably the USA and only seven studies were from middle income countries where is it known that the prevalence of past year IPV is higher. Six of the studies were of adolescents, again mostly in high income countries, where these were likely to be dating relationships with no cohabitation. One study included young girls and women. Experiences of IPV in adult and adolescent relationships may be qualitatively different, in that there is a lower likelihood of experiencing systematic and chronic violence in dating relationships.[67] About a third of the studies were drawn from clinical settings, schools or were taken from sub-populations and therefore subject to bias (e.g. HIV positive sex workers, women with depressive symptoms and women on methadone maintenance). More population-based cohort studies are needed in order to generalise the findings. Most studies measured physical violence and some modelled exposure to physical

and sexual and other forms of violence separately. However, other forms of violence (e.g. emotional abuse, threats) may also associated with some of the health outcomes. Most studies constructed the reference categories for IPV as binary opposites, meaning that some participants in the reference group may have been exposed to other forms of IPV that were not measured or modelled. This can bias the effect estimates towards the null and underestimate the magnitude of the association between recent IPV and health outcomes. Some studies included only women who were in a relationship for all waves of data collection. However, research shows that the prevalence of IPV is higher among women who are no longer with abuser compared to those currently in a relationship[68] and excluding these women may dilute the association between IPV and health outcomes.

Implications

The evidence on the association between exposure to IPV and mental and physical health outcomes has important implications for the delivery of interventions and services. IPV against women has received increasing attention by public health experts globally.[2] The results of this review indicates that health care providers and specialist IPV organisations should be aware of the bidirectional relationship between recent IPV and depression. Women with depression may be at risk of IPV, including IPV that is ongoing and services, particularly health care, should be trained to enquire about IPV experiences and respond and refer appropriately. Little is known about what pattern of exposure to IPV is more strongly associated with different health outcomes. In order to establish these connections, longitudinal studies of IPV and health are needed that distinguish recent violence with no prior history, from recent violence that is part of ongoing abuse, and historical violence that no longer occurs. Other factors that are known to mediate the relationship such as the duration and severity of IPV, childhood physical and sexual abuse, poverty related stress and

risk behaviours such as alcohol and substance abuse should be carefully considered in analyses.

Figure 1: Flow of studies through review

Figure 2: Forest plot estimates of the association between IPV and depression

Figure 3: Forest plot estimates of the association between IPV and alcohol use, hard drug use, marijuana use and STIs

Declarations

Ethics approval

Not applicable

Consent for publication

Not applicable

Availability of data and material

All data generated or analysed during this study are included in this published article [and its supplementary files].

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Conceived and designed the study: LJB KD. Data collection: LJB. Analysed the data: LJB, MR, KD. Wrote the first draft of the manuscript: LJB. Contributed to the writing of the manuscript: LJB CW KD MR. Agreed with manuscript results and conclusions: LJB CW KD MR.

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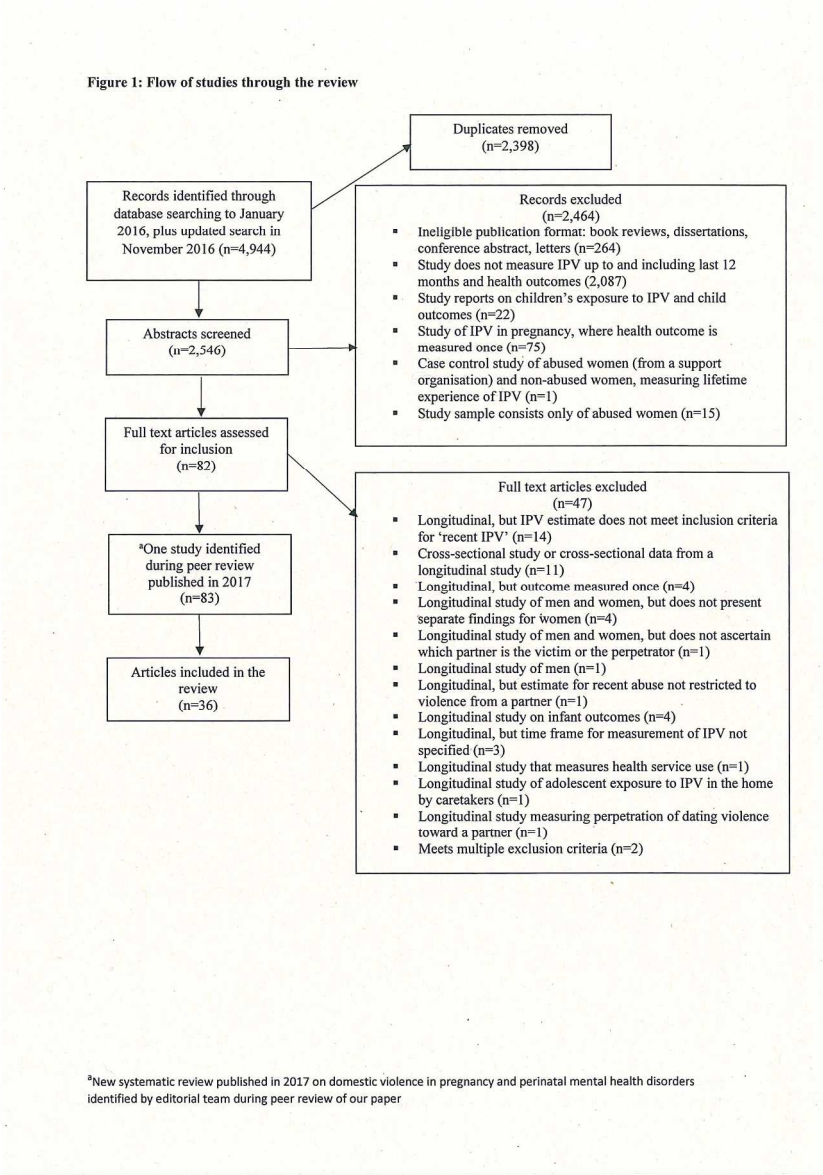
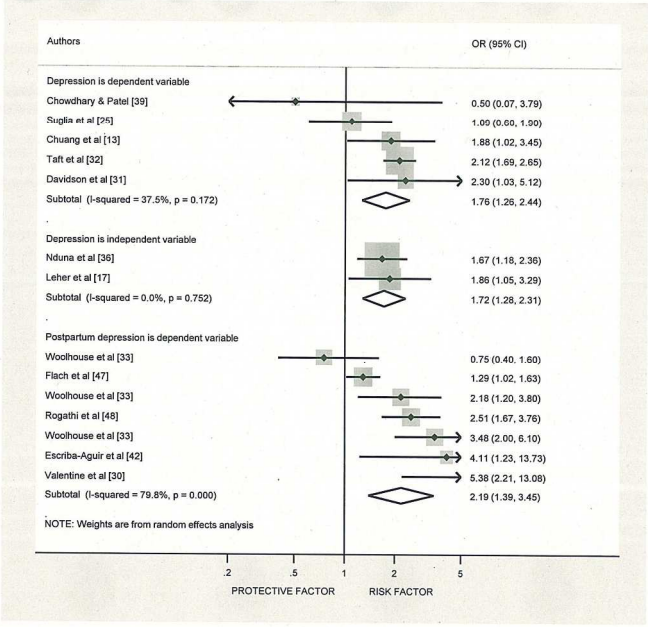


Figure 1 Flow of studies through the review

209x296mm (300 x 300 DPI)

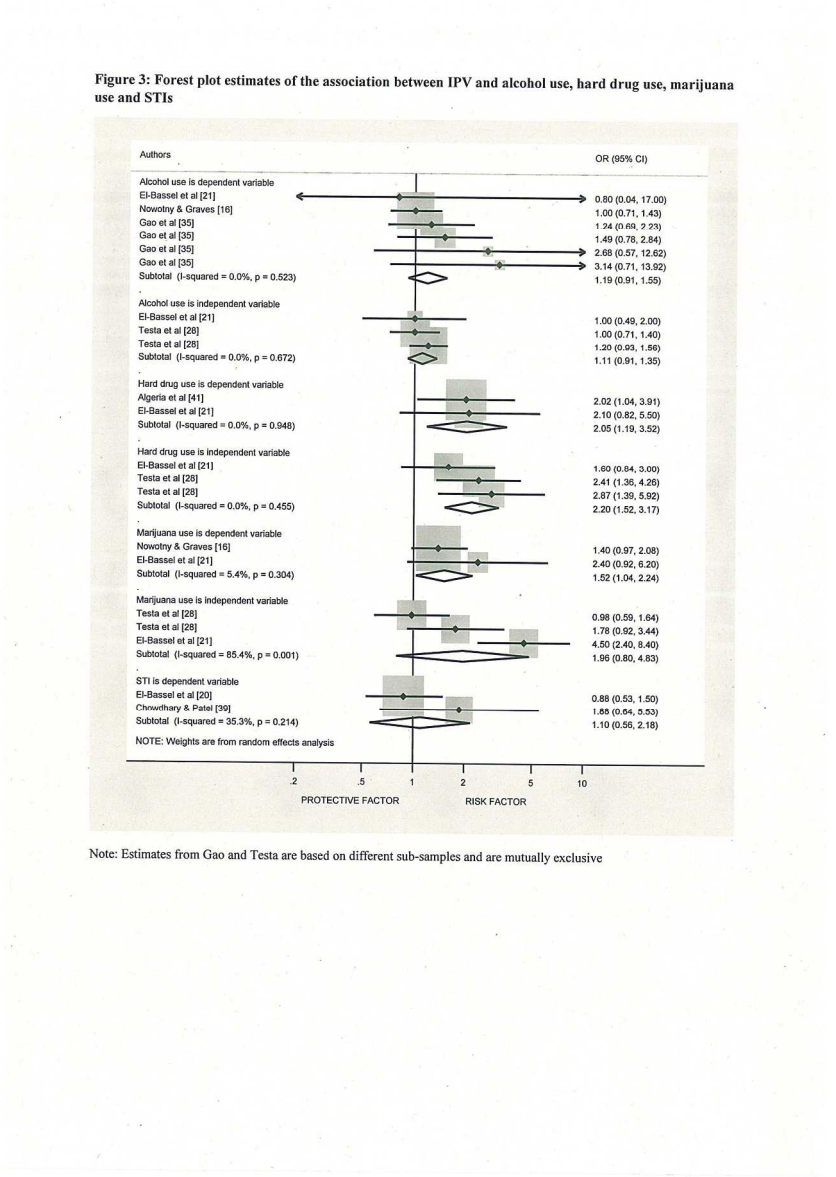
Figure 2: Forest plot estimates of the association between IPV and depression



Notes: Woolhouse estimates are based on different sub-samples and are mutually exclusive.
Meta-analysis with depression as the dependent variable was also undertaken excluding the Chowdhary study, but it did not materially change the overall pooled estimate (OR=1.83; 95% CI 1.35-2.49; I^2 = 35.1%, p=0.202)

Figure 2 Forest plot estimates of the association between IPV and depression

209x296mm (300 x 300 DPI)



Note: Estimates from Gao and Testa are based on different sub-samples and are mutually exclusive

Figure 3 Forest plot estimates of the association between IPV and alcohol use, hard drug use, marijuana use and STIs

209x296mm (300 x 300 DPI)

Appendix 1

Search Strategy from Medline

1. domestic violence/ or spouse abuse/
2. Battered Women/
3. (spous* abuse or battered wom*n or intimate partner violence or intimate partner abuse or dating violence or domestic abuse).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
4. (intimate adj4 partner adj4 violence).tw.
5. (intimate adj4 partner adj4 abuse).tw.
6. ((partner or relationship or wom$n or domestic or spous*) adj4 (abus* or violen* victimi* or batter*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier]
7. Rape/
8. sexual violence.tw.
9. sexual abuse.tw.
10. rape.tw.
11. cohort studies/ or follow-up studies/ or longitudinal studies/ or "national longitudinal study of adolescent health"/ or prospective studies/
12. longitudinal stud*.tw.
13. cohort stud*.tw.
14. panel stud*.tw.
15. follow up stud*.tw.
16. prospective stud*.tw.
17. longitudinal analysis.tw.
18. (longitudinal adj3 analysis).tw.
19. cohort analysis.tw.
20. (cohort adj3 analysis).tw.
21. panel analysis.tw.
22. (panel adj3 analysis).tw.
23. time series.tw.
24. (longitudinal adj3 stud*).tw.
25. (cohort adj3 stud*).tw.
26. (panel adj3 stud*).tw.
27. (follow up adj3 stud*).tw.
28. (prospective adj3 stud*).tw.
29. letter.pt.

30. editorial.pt.

31. comment.pt.

32. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10

33. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28

34. 29 or 30 or 31

35. 33 not 34

36. 32 and 35 (2,536)

MOOSE Checklist for Meta-analyses of Observational Studies

Item No	Recommendation	Reported on Page No
Reporting of background should include		
1	Problem definition	5
2	Hypothesis statement	NA
3	Description of study outcome(s)	6
4	Type of exposure or intervention used	5
5	Type of study designs used	5
6	Study population	5
Reporting of search strategy should include		
7	Qualifications of searchers (eg, librarians and investigators)	
8	Search strategy, including time period included in the synthesis and key words	6
9	Effort to include all available studies, including contact with authors	6
10	Databases and registries searched	6
11	Search software used, name and version, including special features used (eg, explosion)	6
12	Use of hand searching (eg, reference lists of obtained articles)	6
13	List of citations located and those excluded, including justification	27 and see flow chart 1 figure
14	Method of addressing articles published in languages other than English	NA see exclusion page 6
15	Method of handling abstracts and unpublished studies	7
16	Description of any contact with authors	NA
Reporting of methods should include		
17	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	NA
18	Rationale for the selection and coding of data (eg, sound clinical principles or convenience)	7-9
19	Documentation of how data were classified and coded (eg, multiple raters, blinding and interrater reliability)	7-9
20	Assessment of confounding (eg, comparability of cases and controls in studies where appropriate)	7-9
21	Assessment of study quality, including blinding of quality assessors, stratification or regression on possible predictors of study results	7-9
22	Assessment of heterogeneity	7-9
23	Description of statistical methods (eg, complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated	8
24	Provision of appropriate tables and graphics	10-26,28
Reporting of results should include		
25	Graphic summarizing individual study estimates and overall estimate	Figures 2 and 3
26	Table giving descriptive information for each study included	10-26
27	Results of sensitivity testing (eg, subgroup analysis)	NA see 40

28	Indication of statistical uncertainty of findings	29-36

Item No	Recommendation	Reported on Page No
Reporting of discussion should include		
29	Quantitative assessment of bias (eg, publication bias)	39 - 40
30	Justification for exclusion (eg, exclusion of non-English language citations)	39
31	Assessment of quality of included studies	40 - 43
Reporting of conclusions should include		
32	Consideration of alternative explanations for observed results	37 - 39
33	Generalization of the conclusions (ie, appropriate for the data presented and within the domain of the literature review)	37 - 39
34	Guidelines for future research	43-44
35	Disclosure of funding source	45

From: Stroup DF, Berlin JA, Morton SC, et al, for the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) Group. Meta-analysis of Observational Studies in Epidemiology. A Proposal for Reporting. *JAMA*. 2000;283(15):2008-2012. doi: 10.1001/jama.283.15.2008.

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