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Review Article

Violence against women increases cancer diagnoses: Results from a meta-analytic review

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ABSTRACT

The purpose of this project was to assess the magnitude of the relationship between violence against women and cancer; to identify the exposures and cancers for which this relationship was particularly robust; to identify the effect of violence exposure on cancer screening. We conducted a meta-analysis of 36 studies to determine the relationship between violence against women and cancer outcomes, including screening, in 2017. Results from this review provide evidence of a significant, positive relationship between violence and cancer diagnoses, particularly for cervical cancer. Women who were victims of intimate partner violence and sexual abuse were more likely to be diagnosed with cancer compared with non-victims. Violence against women did not appear to be related to cancer screening practices and routine clinical service utilization; however, violence was associated with greater odds of abnormal pap test results. Victims of intimate partner violence and women who suffered physical abuse were more likely to have abnormal pap test results. In conclusion, use of screening tools for violence against women in clinical settings may improve the breadth and quality of research on violence against women and cancer. Investigators should consider how to creatively apply case-control and retrospective cohort designs to investigate the complex mechanisms and moderators of the relationship between violence against women and cancer.

1. Background

Cancer remains the second leading cause of death for United States (U.S.) women (Centers for Disease Control and Prevention, 2017). Projected estimates suggest that 843,820 new cases of cancer will be diagnosed among U.S. women; these incident diagnoses are expected to cause 281,400 deaths (Siegel et al., 2016). Of these, 246,660 cases of breast cancer were expected to cause 40,450 deaths, and nearly thirteen thousand cases of cervical cancer were expected to cause 4120 deaths in 2016 (Siegel et al., 2016). Low rates of healthcare utilization and screening are well-established drivers of cancer mortality (Berry et al., 2005; Last, 1998; Youlden et al., 2012), particularly among minorities and women of lower socio-economic position (Nelson, 2002).

For 100 years, researchers have studied the relationship between traumatic exposures, and more commonly intimate partner violence, and cancer incidence (Phelps, 1910). Research findings have been mixed. Hindin found women who were victims of any type of intimate partner violence were more than twice as likely to have abnormal pap smear results, 60% more likely to have cervical dysplasia and 4.5 times more likely to have cervical cancer, than women with no intimate partner violence exposure (Hindin et al., 2015). Gandhi found that women who suffered from sexual and physical abuse were 87% less likely to have pap smears than women who suffered emotional abuse (Gandhi et al., 2010). However, other studies detected no evidence of a relationship between intimate partner violence history and cancer screening (Hathaway et al., 2000; Modesitt et al., 2006).

Several mechanisms have been identified to explain the relationship between violence against women, screening, and cancer. First, screening tests, particularly breast exams, mammograms, and pap smears, may be perceived as invasive and re-traumatizing to abuse victims, especially victims of sexual abuse (Farley et al., 2002; Robohm and Buttenheim, 1997; Watson, 2016). Second, victims of violence are likely to have unhealthy coping behaviors, like drug and alcohol use (Gerber et al., 2005), sexual risk taking (Coker, 2007b), and inconsistent condom use (Coker, 2007b), which have been related to cancer incidence (Hathaway et al., 2000; Norman et al., 2012). Third, a number of biological mechanisms—primarily, stress-related—have been speculated to drive the observed elevated rates of chronic disease among women victims of violence, as children and adults exposed to violence have high levels of C-reactive protein, an inflammation

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biomarker (Broyles et al., 2012; Heath et al., 2013; Out et al., 2012).

The purpose of the present study is to quantitatively synthesize the literature on the relationship between violence exposure and cancer, including routine screening, among women. Several narrative reviews of the literature on violence and cancer (Holman et al., 2016), and violence and cancer screening, exist. These existing reviews were focused on adverse childhood experiences (ACEs), such as childhood sexual assault or neglect (Holman et al., 2016) and intimate partner violence (Coker, 2007b; Hindin et al., 2015). In this study, we seek to extend published results by comprehensively synthesizing the literature to identify whether a direct link between violence exposure, cancer screening, and cancer diagnoses exists. The goals of this study were three-fold:

1. To assess the magnitude of the relationship between violence against women and cancer.
2. To identify the exposures and cancers for which this relationship was particularly robust.
3. To identify the effect of violence exposure on cancer screening.

2. Methods

2.1. Criteria for inclusion and exclusion of studies in the review

Studies investigating the relationship between violence, victimization, or abuse and cancer or cancer screening were included. Violence and victimization exposure, defined as firsthand experiences of assault, child abuse or neglect, intimate partner violence, physical/sexual/emotional abuse at any point during the life-course, stalking, or firsthand witnessing of family violence were eligible for inclusion. Studies of exposure to neighborhood violence or living in a high crime area were not sufficient for inclusion. Many studies included ACEs summary scores, which include—but are not limited to—violence and victimization. These effect sizes were coded, and sensitivity analyses were conducted to examine whether inclusion of ACEs studies caused variable results.

Cancer included self-reported diagnoses or abnormal test results (for pap tests only) at any point during the life-course and cases abstracted from diagnostic records. Cancer screening included self-reported screening compliance with recommended guidelines (at the time of data collection) or lifetime screening uptake.

All eligible studies were coded, regardless of the study design. Eligible studies included samples of women in industrialized countries, and only studies published in English or with an English translation. Studies must have included a direct exposure measure of firsthand abuse, victimization, or witnessed violence in childhood or adulthood. An outcome measure of cancer diagnosis, cancer history, abnormal test result, or screening must have been provided. The study had to provide adequate data for calculating an effect size if one was not provided (i.e., means and standard deviations, *t*-tests, *F*-tests, *p*-values, etc.). The time frame was not restricted, and both published and unpublished reports were considered. The search was conducted between March and May 2017. This study was exempt from IRB review because no primary data were collected.

2.2. Search strategy for identification of relevant studies

Several strategies were used to search the literature for published and unpublished manuscripts: (1) A keyword search across online databases (PubMed, EBSCOHost, Ovid/PsychInfo, ProQuest, Scopus, Web of Knowledge); (2) The reference lists of previous reviews and eligible studies; (3) a search of the first 40 pages of Google Scholar (after 40 pages, results became increasingly irrelevant); (4) communication with experts in the field. The following keywords were used:

(Violen* or abuse or neglect or victim* or assault or trauma or stalking) AND (cancer or malignan* or tumor*).

Full-text versions of each study were requested from the authors' library. If the journals were not available at the university library, the Interlibrary Loan System (ILL) was used to request the document from other institutions. When ILL was not successful in obtaining full-text copies, the author searched the Internet extensively and contacted the author directly on academic social networking sites. Using this process, only two manuscripts were not successfully obtained (Rose, 2006; Bosch, 2017).

2.3. Details of study coding categories

All eligible studies were coded on a variety of criteria such as reference information (publication year), sample, country, outcomes and exposure measurement, study design and response rates, sample size; including effect sizes. Each study was coded by author JMG and independently verified by author KKJ, a researcher with meta-analytic coding experience. All discrepancies were reconciled before the coding phase was completed.

2.4. Analytic procedures

Because all outcomes were dichotomous, pooled odds ratios were calculated to standardize effect sizes for this quantitative review. The main source of information for calculating pooled odds was the adjusted odds ratio, but in situations where odds ratios and confidence intervals were not provided, relative risk or incidence rate ratios, *f*-values, *p*-values, or proportions were used to calculate the effect sizes (Lipsey and Wilson, 2001). All analyses were conducted using Comprehensive Meta-Analysis software version 3.0 (Biostat, n.d.). Although a random effect model was hypothesized a priori, both random and fixed effect models were fit to test the assumption that effect sizes were drawn from the same distribution (Cochrane's Q statistic). Kendall's test and Egger's test were used to identify evidence of publication bias. Two sets of effect sizes are reported in this project: 1) an overall pooled effect size per study across domain of measurement and source of information (e.g., cancer overall, violence exposure overall); and, 2) stratified effect sizes by exposure and outcome type (e.g., child abuse, cervical cancer screening, cancer diagnosis, etc.). In > 95% of cases, analyses at the study-level (e.g., mean effect size for each study) and analyses at the effect size level (e.g., all effect sizes for each study are considered independent of one another) produced the same result; therefore, pooled mean effect sizes at the study level are reported to avoid violating the assumption of statistical independence.

3. Results

The electronic database search resulted in 24,637 hits; eight additional studies were identified as potentially relevant through examination of review articles' reference lists (see Fig. 1). After duplicates were removed, titles and abstracts of 13,062 studies were screened for relevancy. Ninety-seven studies were identified as having potentially relevant titles and abstracts. Two studies could not be located, and the authors did not respond to requests for full-text manuscripts. The 95 full-text manuscripts were examined and 36 were identified as eligible.

and had sufficient information to quantitatively synthesize (e.g., an effect size and error term) effect sizes, thus were included in this review. Of the 36 studies, only two were not peer-reviewed (these two studies are denoted by ** in the reference list). A description of included studies is available in Table 1.

3.1. Violence against women exposure and cancer diagnoses

Appendix A includes a funnel plot depicting effect sizes and z-test results for each of the 16 studies examining the relationship between violence against women and cancer diagnoses. No evidence of publication bias was detected.

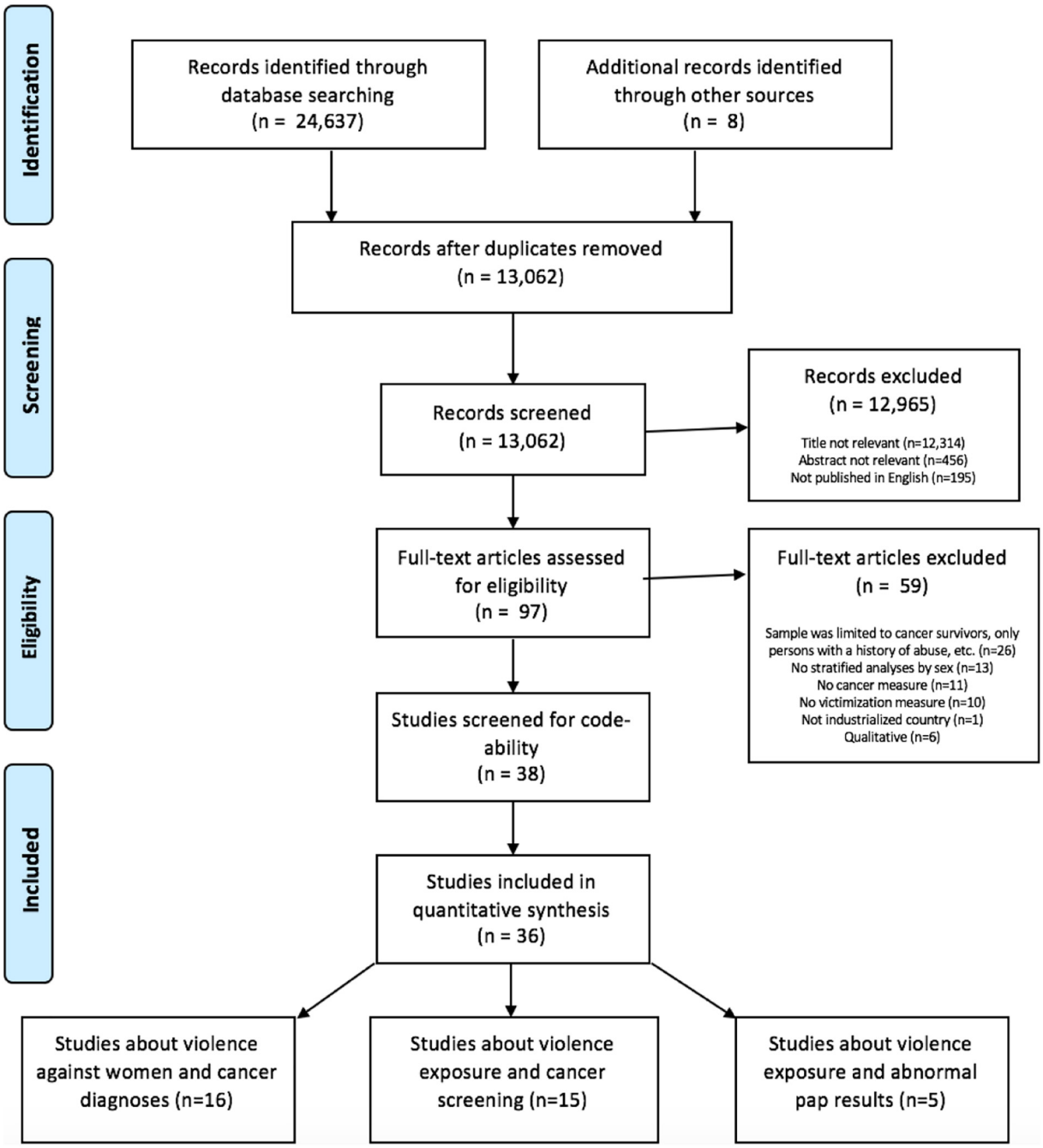

Fig. 1. PRISMA Flowchart.

Fig. 2[1] presents the relationship between violence against women and cancer diagnoses. A significant relationship was observed between violence against women and cancer overall (including ACEs exposures; n = 16; pooled OR 1.69; 95% CI 1.29–2.21). The relationship between violence against women and cancer diagnoses held for cervical cancer (n = 8; pooled OR = 2.54; 95% CI 1.71–3.77; Fig. 3) but not breast cancer (n = 3; pooled OR = 1.08; 95% CI 0.65–1.77) or bowel/colorectal cancer (n = 2; pooled OR = 0.94; 95% CI 0.78–1.13).

Stratified analyses were conducted to identify the exposures for which the relationship between violence against women and cancer was most robust. Across life-course stages, evidence suggests that victimization during adolescence (n = 1; OR = 4.23; 95% CI 1.08–16.59) or childhood (n = 3; pooled OR 2.16; 95% CI 1.39–3.35) increases the odds of cancer diagnosis. Women victims of intimate partner violence were also more likely to be diagnosed with cancers (n = 8; pooled OR 2.02; 95% CI 1.22–3.36). Neither physical violence (n = 8; pooled OR 1.50; 95% CI 0.91–2.48) nor psychological violence (n = 2; pooled OR 0.94; 95% CI 0.69–1.27) was associated with cancer diagnoses. Any lifetime sexual abuse, however, was associated with elevated odds of cancer diagnoses (n = 7; pooled OR 2.38; 95% CI 1.44–3.93).

Because violence against women was related to cervical cancer, stratified analyses were conducted to identify the risk factors associated with cervical cancer. Sexual abuse in adolescence was associated with greater odds of cervical cancer diagnosis (n = 1; OR 4.18; 95% CI 2.27–7.70). Victimization from multiple forms of violence against

[1] In Figs. 2 and 4, 'combined' means that multiple exposures and/or outcomes were pooled within-study to generate a single, overall effect size.

Table 1
Description of included studies.

Author's names	Year published or completed (for theses/dissertations)	N	Analytic strategy	Summary of results
Alcala, Mitchell, Keim-Malpass	2017	1527	Bivariate and multivariate models	• Odds of ever receiving a Papanicolaou (pap) test increased among women living households in which adults treated each other violently • Physical and sexual abuse was associated with decreased odds of receiving a recent pap test
Bear	2014	3652	• Descriptive analyses • Bivariate and multivariate regression models	• Approximately 60% of adults in Allegheny County, Pennsylvania reported at least one adverse childhood event • Childhood adversity disparities were determined by gender, race, socioeconomic status, unemployment status, and disability status • Those who experienced ACEs were significantly more likely to report mammogram and pap test non-compliance
Bergmark, Avall-Lundqvist, Dickman, Steineck, Henningsohn	2005	332	• Relative risk • Mantel-Haenszel method	• Among women who reported having a history of cervical cancer, 18% reported a history of sexual abuse in comparison to 15% of the control group • In regards to severe abuse, 5% of women with a history of cervical cancer reported severe abuse in comparison to 1.5% of controls
Brown, Weitzen, Lapane	2013	30,182	• Prevalence • *p*-Value • Multivariable logistic regression models	• 1 in 4 women reported a history of lifetime intimate partner violence (IPV) • IPV victims were two times as likely to have had an HIV test than those who did not report a history of IPV
Cadman, Waller, Ashdown-Barr, Szarewski	2012	124	• Descriptive analyses • Fisher's exact test	• 21% of participants reported physical pain or tension during cervical smear tests • 15% of participants reported parallels between the cervical smear tests and previous experiences, reporting that it was “exactly like it used to happen when I was abused” • No significant differences in ever attending pap smear according to physical or emotional abuse, or neglect, ritual abuse or spiritual abuse.
Canady, Naus, Babcock	2010	412	• Descriptive analyses • Multivariate analysis of variance (MANOVA)	• Breast cancer survivors (BCS) and cancer-free controls (CFC) reported low rates of physical and psychological abuse • Both groups reported different patterns of physical abuse overtime but not for psychological abuse • At each time point, the BCS group reported lower rates of both physical and psychological abuse
Coker, Sanderson, Fadden, Pirisi	2000	1152	• Descriptive analyses • Unconditional polytomous multivariate logistic regression • Proposed method by Zhang and Yu	• Ever experiencing IPV was strongly associated with cervical cancer than with dysplasia • In comparison to controls, women with cervical cancer reported higher rates of experiencing more frequent physical and sexual assaults, more IPV-related injuries, and were in violent relationships longer
Coker, Smith, Bethea, King, McKeown	2000	1095	• Descriptive analyses • Unconditional multivariate logistic regression • Proposed method by Zhang and Yu	• Approximately 54% of the women surveyed reported ever experiencing any type of partner violence • Approximately 14% of the 54% of women who experienced any type of partner violence reported psychological IPV without physical IPV • Psychological IPV was associated with a number of adverse health outcomes including sexually transmitted infections (aRR = 1.82), chronic pelvic pain (aRR = 1.72), and chronic pain (aRR = 1.91) • Women who reported experiencing psychological IPV were significantly more likely to report poor physical and mental health
Coker, Hopenhayn, DeSimone, Bush, Crofford	2009	4732	• Descriptive analyses • Chi-square tests • t-tests • Multivariate logistic regression	• After adjusting for confounding factors, violence against women (VAW) was associated with increased prevalence of invasive cervical cancer (aOR = 2.6, 95%CI 1.7–3.9) • Invasive cervical cancer was significantly associated with IPV (aOR = 2.7, 95% CI 1.8–4.0), adult exposure to forced sex (aOR = 2.6, 95% CI 1.6–4.3), and child exposure to sexual abuse (aOR = 2.4, 95% CI 1.4–4.0)
Farley, Minkoff, Barkan	2001	615	• Bivariate analyses • Multiple regression models • Logistic regression	• Of the 602 participants who responded to the domestic violence question, approximately 24% reported a history of domestic violence • Women with no mammography (MAMMO NO) more often reported domestic violence ($p = 0.001$), having witnessed a physical assault ($p = 0.001$), threat of physical assault ($p = 0.01$), motor vehicle accidents ($p = 0.3$) and sexual assault after age thirteen ($p = 0.45$)
Farley, Golding, Minkoff	2002	736	• Descriptive analyses	

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Table 1 (*continued*)

Author's names	Year published or completed (for theses/dissertations)	N	Analytic strategy	Summary of results
			• Contingency tables • Bivariate models • Chi-square test • Hierarchical logistic regression model	• Women in this study were less likely to have had a pap screening if they had been raped before age 18 ($p = 0.05$) and also if they had encountered other sexual assaults before age 18 ($p = 0.009$) • Hierarchical logistic regression models determined that childhood sexual abuse, but not other traumatic events, was associated with lower odds of screening when controlling for clinic location, demographic characteristics, attitudes, and PTSD
Fernandez	2007	360	• Descriptive analyses • Pearson chi-square test • Multiple logistic regression	• Total IPV, low levels of social support from relatives, and depression were significant predictors of non-compliance to cervical cancer screening • Women who experienced IPV, depression, and lacked social support from relatives were less likely to get an annual pap smear • Women who had experienced IPV were approximately one and a half times more likely to being non-compliant to annual cervical cancer screening in comparison to women who did not experience IPV
Gandhi, Rovi, Vega, Johnson, Ferrante, Chen	2010	382	• Descriptive analyses • Chi-square tests • Logistic regression model • Multivariate analyses	• The prevalence of IPV among the 382 adult women was 16.5% • In comparison to victims of emotional abuse, women aged 40–74 who were victims of physical and/or sexual abuse were associated with 87% decreased odds of being up to date with pap smears (OR = 0.13, 95% CI 0.02–0.86) and 84% decreased odd of being up to date with mammography exams (OR = 0.16, 95% CI 0.03–0.99)
Hathaway, Mucci, Silverman, Brooks, Mathews, Pavlos	2000	2043	• Descriptive analyses • Mantel-Haenzel risk ratios	• Among the 2043 women in this study, 6.3% reported intimate partner abuse (IPA) in the past year • In comparison to other women, women who reported experiencing IPA were more likely to report depression, anxiety, sleep problems, suicidal ideation, disabilities, smoking, unwanted pregnancy, HIV, testing, and condom use • Women who reported IPA were less likely to have health insurance • There was no significant difference in victims healthcare utilization (e.g., having seen a doctor in the last year), having a paper smear in the past 2 years, or having a clinical breast exam in the last 2 years
Jayasinghe, Sasongko, Lim, Grover, Tabrizi, Moore, Donath, Garland	2016	187	• Descriptive analyses • Chi-square test • Fisher's exact test • Wilcoxon rank-sum test • Multivariable regression model	• The prevalence of childhood sexual abuse among cases was approximately 27% • Participants who experienced unwanted sexual encounters were significantly more likely to experience high-risk exposures associated with cervical cancer • Regression analysis indicated that genital contact childhood sexual abuse was an independent risk factor for cervical cancer at a young age (OR = 4.7, 95% CI 1.0–22.6)
John, Johnson, Kukreja, Found, Lindow	2004	820	• Descriptive analyses • Chi-square test	• 21% of the study sample indicated a history of physical abuse and approximately 4% had experienced physical violence in the past year • A significant association was determined between pap smear abnormality and history of domestic violence ($p < 0.01$) • Women with a history of domestic violence also reported significantly higher consultation visits
Kelly-Irving, Lepage, Dedieu, Lacey, Cable, Bartley, Blane, Grosclaude, Lang, Delpierre	2013	6138	• Descriptive analyses • Multivariate logistic regression models • Bivariate crosstabulation	• 5.4% of women reported having two or more adverse childhood experiences (ACEs) • Bivariate analysis determined a significant association between ACEs and cancer • Among women who had two or more ACEs the odds of having a cancer before the age of 50 increased by twofold in comparison to women with no ACEs ($p < 0.001$)
Larsen, Hilden, Skovlund, Lidegaard	2016	12,505	• Cochran-mantel-Haenszel test • Sensitivity analysis	• Women with a history of sexual assault had a significantly higher incidence of somatic disorders in comparison to the control group • The rate ratio of cervical cancer increased significantly after sexual assault • Women with a history of sexual assault had significantly higher visits to a general practitioner before and after the assault in comparison to the control group
Leeners, Stiller, Block, Gorres, Imthurn, Rath	2007	255	• Descriptive analyses • Student t test • Wilcoxon test • Chi-square test • Fisher's exact test	• Women who were exposed to childhood sexual abuse (CSA) were more often to perceive gynecologic examinations as anxiety-provoking • Women who were exposed to CSA were also likely to seek out more treatment for acute gynecologic problems • Approximately 45% of women who experienced CSA had memories of the original abuse during gynecologic consultation
Lemon, Verhoek-Oftedahl, Donnelly	2002	1561	• Descriptive (univariate) analyses	

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Table 1 (*continued*)

Author's names	Year published or completed (for theses/dissertations)	N	Analytic strategy	Summary of results
			• Bivariate contingency tables • Multivariable multinomial logistic regression	• Among the 1561 women the prevalence of physical IPV was 4.1% and the prevalence of psychological IPV was 4.5% • Physical IPV was associated with receiving regular pap smears (OR = 2.39, 95% CI 1.01–5.70), current smoker (OR = 2.07, 95% CI 1.03–4.18), and high-risk alcohol use (OR = 4.85, 95% CI 2.02–11.60) • A significant association was determined between psychological IPV and high-risk alcohol use (OR = 3.22, 95% CI 1.46–7.09)
Loxton, Powers, Schofield, Hussain, Hosking	2009	7312	• Two-tailed *t*-tests • Multivariable logistic regression models	• When compared to women who had not experienced partner violence, women who had experienced partner violence at least eight years earlier were more likely to report inadequate cervical cancer screening (OR = 1.42, 95% CI 1.21–1.66) • Partner violence was independently associated with inadequate pap test (OR = 1.20, 95% CI 1.01–1.42) after adjusting for education, income management, marital status, general practitioner visits, chronic conditions, and depression • When adjusted for access to general practitioner of choice the association between partner violence and inadequate pap test was no longer significant (OR = 1.18, 95% CI 0.99–1.40)
Loxton, Schofield, Hussain, Mishra	2006	14,100	• Descriptive analyses • Logistic regression • Multivariate logistic regression	• Women who were single, divorced, separated, or widowed had more than three and a half times the odds of having ever experienced domestic violence than women who were currently living in a married or de facto relationship (unadjusted OR = 3.60, 95% CI 3.26–3.98) • In comparison to women who have not had cervical cancer, women who had been diagnosed with cervical cancer had more than twice the odds of ever having experienced domestic violence
Morton, Schafer, Ferraro	2012	1347	• Logistic regression models • Wald's chi-square test	• Women who were physically abused by their mother (OR = 2.21, $p < 0.05$) and were also frequently emotionally or physically abused by either parent had increased risk of cancer (OR = 2.18, $p < 0.01$)
Norman, Means-Christensen, Craske, Sherbourne, Roy-Byrne, Stein	2006	421	• Frequencies and descriptive statistics • Logistic regression analysis	• A significant association was identified among women who had experienced sexual trauma and cancer (OR = 5.21, 95% CI 1.31–20.74) • No significant association was determined between women who had experienced any trauma and cancer and also among women who had experienced assaultive trauma and cancer
Olesen, Butterworth, Jacomb, Tait	2012	2095	• Descriptive analyses • Stata multiple imputation • Logistic regression models • Population Attributable risk	• Experiencing sexual abuse in childhood was associated significantly with lower rates of cervical cancer screening in adulthood • Lifetime rape, sexual molestation, and childhood physical abuse were not associated with screening in adulthood
Philyaw	2014	23,830	• Descriptive analyses • Chi-square tests • *t*-Tests • Multivariate probit models • Model estimation	• History of childhood abuse selectively effects adult preventive service utilization • While women with a history of childhood abuse were approximately four percentage points less likely to have received a timely breast cancer screening ($p < 0.05$) the results were not significantly different from adults without a history of childhood abuse • Women with a history of childhood abuse were approximately nine percentage points less likely than women with no childhood abuse history to receive a timely breast cancer screening ($p < 0.01$)
Quinlivan, Petersen, Davy, Evans	2004	498	• Descriptive analyses • Mantel-Haenszel chi-square test • Fisher exact test • Wilcoxon rank sum test • Mixed model analysis of variance	• Teenagers with an abnormal pap smear were more likely to have a history of exposure to domestic violence (OR = 7.10, 95% CI 2.76–18.53)
Ramaswamy, Kelly, Koblitz, Kimminau, Engelman	2011	204	• Descriptive analyses • Bivariate analyses • Multiple logistic regression models • Chi-square omnibus test of model coefficients • Nagelkerke R^2	• Women with a history of physical abuse were more likely to report abnormal pap histories
Springs, Friedrich	1992	511	• Descriptive analyses	• Approximately 22% of the study sample were sexually abused women

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Table 1 (*continued*)

Author's names	Year published or completed (for theses/dissertations)	N	Analytic strategy	Summary of results
			• Chi-square tests • *t*-Tests	• Sexually abused women reported more medical problems, greater levels of somatization, and more health risk behaviors in comparison to nonabused women • The current age of the participant ($p < 0.001$) and sexual abuse ($p = 0.02$) were significantly associated to frequency of pap smears • Older women with history of sexual abuse scheduled pap smears less often the other women in the study
Stein, Barrett-Connor	2000	829	• Frequencies • Logistic regression models	• Among the women in this study, it was determined that a history of sexual assault was associated with an increased risk of breast cancer (OR = 2.21, 95% CI 1.12–4.33) • A dose-response effect was observed and determined that the 23 women who experienced repeated sexual assault were approximately four times more likely than women without sexual assault histories to have breast cancer (age-adjusted OR = 3.94, 95% CI = 1.37–11.33)
Tello, Jenckes, Gaver, Anderson, Moore, Chander	2010	200	• Descriptive analyses • Chi-square test • Nonparametric Wilcoxon rank sum test • Multivariable logistic regression	• 69% of 200 women missed at least one gynecology appointment and 22% had no pap test in the past year • 26% of 200 women reported IPV, 30% of women who missed a gynecology appointment in the past year also reported IPV, 23% of women who reported no pap test in the past year also reported IPV, and 28% who reported having missed or no pap test also reported IPV • Regression models determined that moderate and severe depressive symptoms and substance use in the past month were associated with missing a gynecology appointment in the past year (OR: 2.3, 95% CI 1.0–5.3)
Thananowan, Vongsirimas	2016	532	• Descriptive analyses • Structural equation modeling • Pearson's correlation analyses	• Positive significant association between IPV and stress, depressive symptoms, and cervical cancer • Negative significant association between IPV and social support and self-esteem
Vos, Astbury, Piers, Magnus, Heenan, Stanley, Walker, Webster	2006	14,739	• Frequencies • Comparative risk assessment methods • Multinomial logistic regression	• For the women in this study, regardless of age, IPV was the cause of 2.9% of the overall disease and injury burden • IPV was associated with 7.9% of the overall disease burden among women ages 18–44 and was determined as a larger health risk than traditional risk factors (i.e. tobacco use) • 73% of substance abuse was attributed to poor mental health and 22% of disease burden was attributed to IPV
Watson-Johnson, Townsend, Basile, Richardson	2012	35,048	• Descriptive analyses • Chi-square tests • Multivariate logistic regression models	• Sexual violence (SV) victimization was significantly associated with mammography screening for women in this study ($p = 0.002$) • Women who reported SV victimization were less likely to have healthcare insurance, a personal doctor or healthcare provider, and to have received regular checkups in the past 1–12 months
Wise, Palmer, Boggs, Adams-Campbell, Rosenberg	2011	35,728	• Cox regression models • Multivariable regression models • Two-sided *t*-tests	• Slight positive association between abuse in adulthood and breast cancer (IRR = 1.18, 95% CI = 1.03–1.34) • Findings suggest an increased risk of breast cancer among African-American women who reported physical abuse as an adult • Multivariable analyses showed that abuse in adulthood was stronger for women with less education

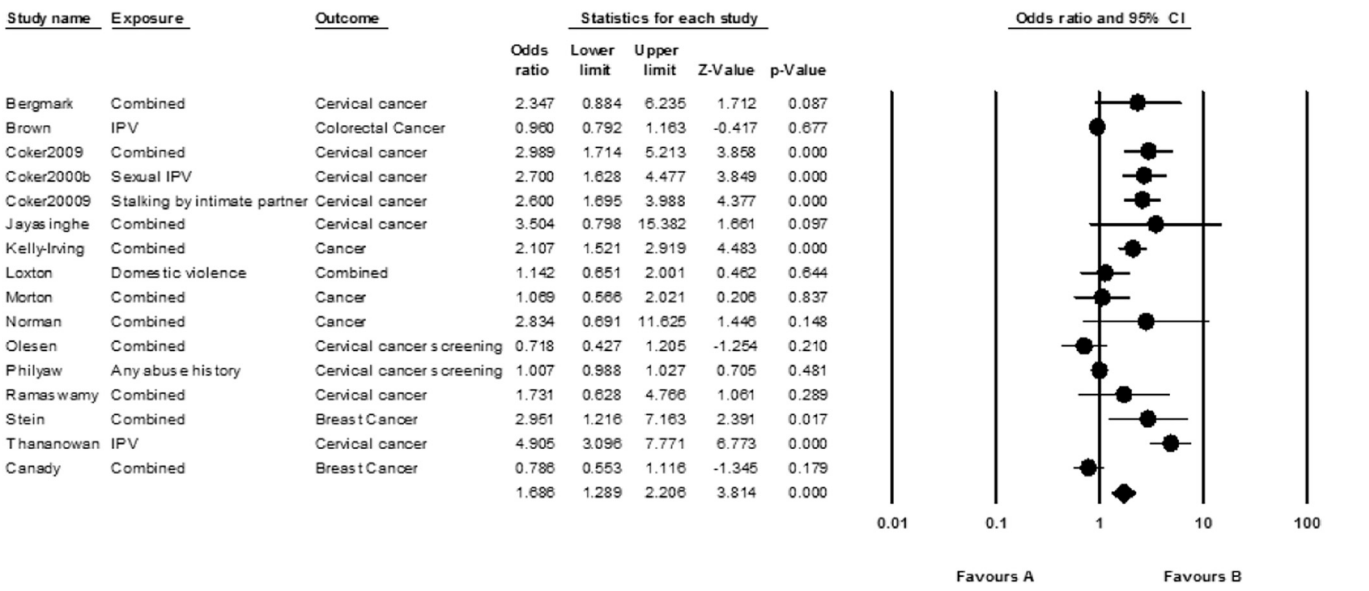

Fig. 2. Pooled effect size between violence against women and cancer diagnoses, N = 16.

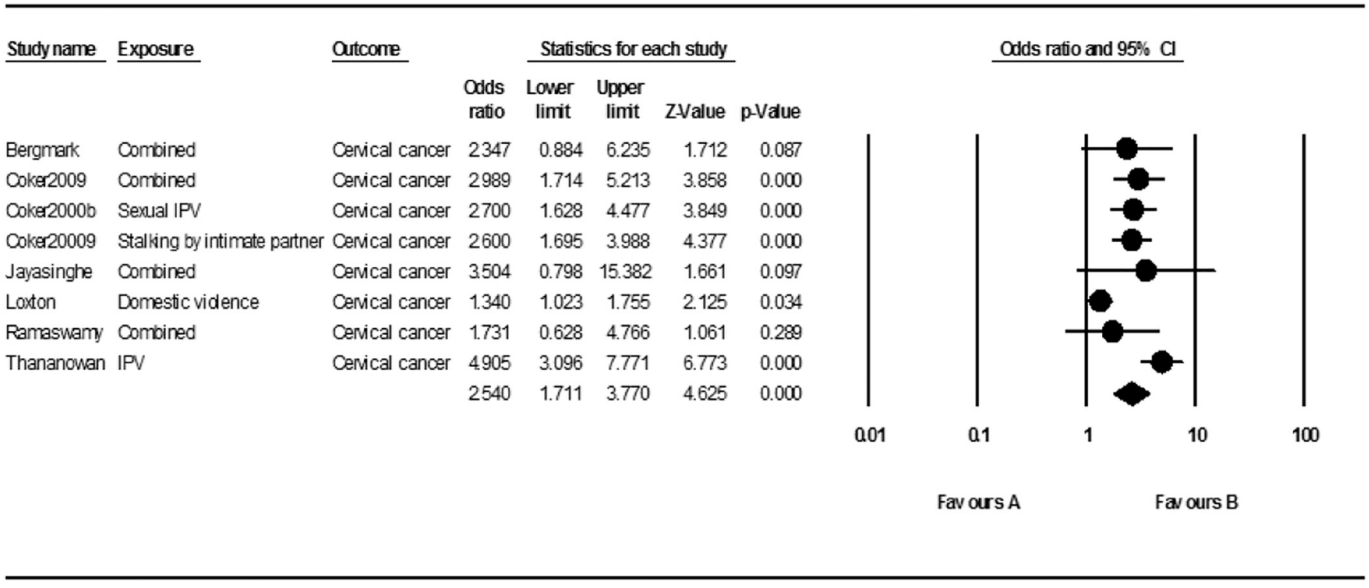

Fig. 3. Pooled effect size between violence against women and cervical cancer diagnoses, N = 8.

women (e.g., history of both physical and sexual abuse) was associated with greater odds of cervical cancer diagnoses (n = 1; OR 5.06; 95% CI 2.42–10.58). Childhood sexual abuse was not significantly associated with cervical cancer diagnoses (n = 3; pooled OR 1.70; 95% CI 0.78–3.71).

3.2. Violence exposure and cancer screening

No significant relationship between violence against women and cancer screening was detected (n = 15; pooled OR 0.98; 95% CI 0.90–1.05); therefore, stratified analyses for screening outcomes were conducted to identify differences across cancer screening types. No significant relationships between violence against women and mammogram uptake (n = 5; pooled OR 0.96; 95% CI 0.88–1.05), pap smear uptake (n = 9; pooled OR 0.91; 95% CI 0.77–1.06), or use of routine clinical care (n = 4; pooled OR 1.22; 95% CI 0.92–1.61) were identified. No evidence of publication bias was detected (Appendix A).

3.3. Violence exposure and abnormal pap results

A significant relationship between violence exposure and abnormal pap test results (n = 5; see Fig. 4; pooled OR 1.91; 95% CI 1.15–3.17) was identified. When stratified by type of violence exposure, intimate partner violence was identified as a risk factor for abnormal pap test

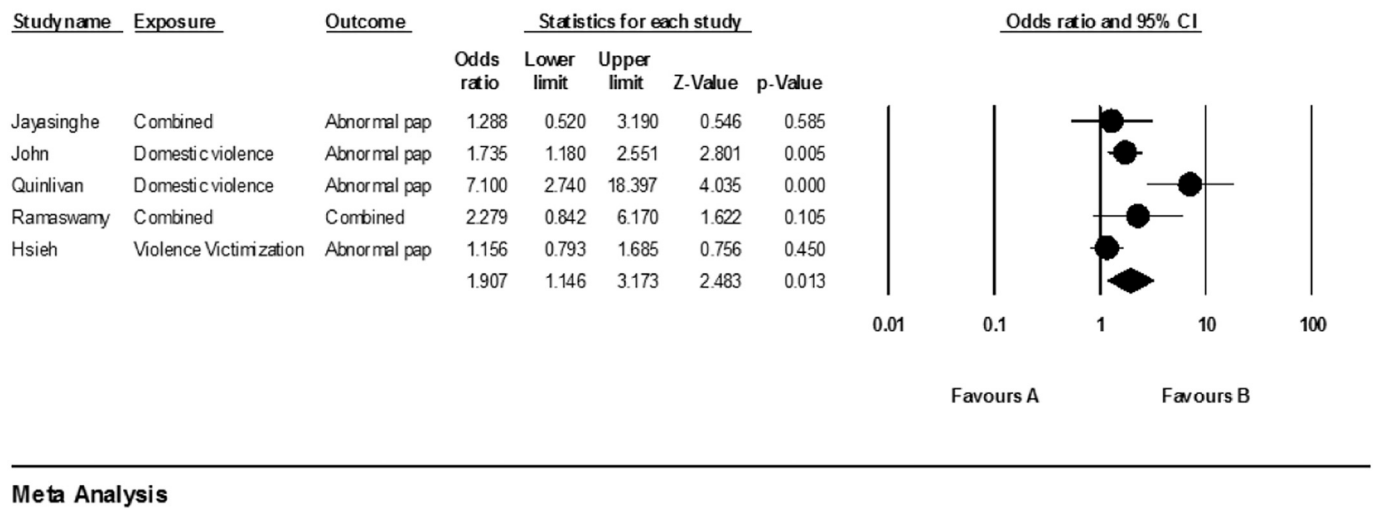

Fig. 4. Pooled effect size between violence against women and abnormal pap test results, N = 5.

results (n = 3; pooled OR 2.74; 95% CI 1.18–6.36). Lifetime physical abuse was associated with abnormal pap test results (n = 1; pooled OR 5.67; 95% CI 1.45–22.21). Childhood victimization, childhood sexual abuse victimization, or sexual abuse at any developmental period was not significantly associated with abnormal pap test results. No evidence of publication bias was detected (Appendix A).

4. Discussion

Results from this quantitative synthesis provide evidence of a significant relationship between violence and cancer diagnoses, particularly, cervical cancer. Women who were victims of intimate partner violence and sexual abuse were more likely to be diagnosed with cancer. Violence against women did not appear to be related to cancer screening practices and routine clinical service utilization; however, violence was associated with greater odds of abnormal pap test results. Victims of intimate partner violence and women who suffered physical abuse were more likely to have abnormal pap test results.

Although an overall relationship between violence against women and cancer exists, it appears that the most robust relationship was related to cervical cancer. There are several possible explanations for this finding. First, it is possible that women victims of violence are more likely to exhibit risky sexual behavior (or risk behavior generally) than women who are never victims of violence (Coker et al., 2009). If the high-risk sexual behavior preceded victimization, violence against women is spurious in its association with cancer. Second, it is possible that women victims experience more physical health problems than women who are not victims of violence (Coker et al., 2000b; John et al., 2004). These adverse health consequences may be a function of psychological stress that occurs in the aftermath of the victimization (Chen et al., 2003; Cohen et al., 1998; Coker et al., 2000a; Goodkin et al., 1993), or symptoms of a sexually transmitted infection (Coker et al., 2009; Coker et al., 2000a). Violent intimate partners, for example, may be more likely than partners who are not violent to refuse barrier methods for contraception, which in turn increase the partner's risk for sexually transmitted infections, including human papilloma virus and therefore, cervical cancer (Ann L. Coker, 2007a; World Health Organization, 2005). Although there is great speculation about the drivers of this relationship, future studies must examine this issue in greater depth.

Results from this study also identified sexual abuse, rather than physical or psychological abuse, as associated with abnormal pap test results and cancer diagnoses. There are two possible explanations for this finding. First, sexual abuse may be intrinsically related to cervical cancer and human papilloma virus through contact (potentially during the sexual abuse) with an infected partner. This mechanism would be a logical consequence of sexual abuse. Second, if physical, sexual, or psychological abuse impact cancer diagnoses, they may do so more indirectly through increased stress or symptoms of post-traumatic stress disorder (Cohen et al., 1998; Coker et al., 2000b). Future studies should examine whether the effects of violence against women are universal, or if certain types of violence have greater impacts on physical health, including cancer, than other forms of violence.

Results from this meta-analysis support several conclusions identified by Hindin and colleagues particularly, that the relationship between intimate partner violence and cancer was robust (Hindin et al., 2015). Hindin speculated that the relationship between intimate partner violence and cervical cancer was mediated through cervical cancer risk factors, including high-risk sexual behavior, smoking, and psychosocial stress. The extant literature is limited in that most studies included in this review were focused on cervical cancer (e.g., only two studies of colorectal and breast cancer were identified); therefore, cervical cancer may be driving the broad association between violence against women and cancer identified in this study. Notably, our results also suggested that the relationship between violence exposure and cancer was constant regardless of when victimization occurred during the life-course. Therefore, it is conceivable that the mechanisms driving the relationship between victimization and cancer may be similar for childhood and adult victims of violence against women.

It is important to note that violence against women was most closely associated with cancer diagnoses (particularly for cervical cancer) and abnormal pap test results, rather than screening. Although this was contrary to our hypothesis, there are several reasons why this finding may have emerged. The first potential explanation is the inconsistent operationalization of screening constructs in the extant literature. Screening outcomes ranged from lifetime mammogram or pap smear testing, to pap smear or mammogram uptake in the previous year, or compliance with current screening recommendations. This variation in screening outcomes may reduce the precision of effects detected when effect estimates are pooled across studies. Given the limited number of studies focused on violence against women, breast exams or mammograms, sensitivity analyses or stratification of these outcome measures was not possible. Alternatively, it is possible that women victims of abuse are adequately screened, but a higher level of sexual risk behavior increases their likelihood of developing cancer. Women who were never screened for cancer are at high risk for mortality from the disease

due to the late stage of diagnosis.(Sant et al., 2009) Many of these late-stage diagnoses and cancer-related deaths would not have been eligible for studies included in this review, as most studies were limited to cancer survivors or women living with cancer rather than retrospective chart reviews.

4.1. Gaps in the extant literature

Five substantive gaps in the literature were identified during this project. First, only seven studies examined non-cervical cancer screening outcomes (Brown et al., 2013; Gandhi et al., 2010; Hathaway et al., 2000; Jayasinghe et al., 2016; Lemon et al., 2002; Philyaw, 2014; Watson-Johnson et al., 2012). Of these seven, five used data gathered from the Behavioral Risk Factor Surveillance System (Brown et al., 2013; Gandhi et al., 2010; Hathaway et al., 2000; Philyaw, 2014; Watson-Johnson et al., 2012). Although these studies did not overlap in study years or states, this reliance on a single database using self-reported measures limits our knowledge on the relationship between violence against women and cancer screening.

Second, only five studies were designed to examine the temporality of the relationship between violence against women and incident cancer (or cancer screening) (Coker et al., 2000b; Hsieh et al., 2017; Jayasinghe et al., 2016; Larsen et al., 2016; Wise et al., 2011). For instance, findings from Coker and colleagues suggest 86% of intimate partner violence occurs before18 years of age (Coker et al., 2002). Therefore, the impact of victimization in young adulthood may be more readily detectable for cervical cancer and pap tests, as cervical cancer risk is highest between ages 25 and 35 (Schiffman et al., 2007), plateauing by age 45–50 (Bosch and de Sanjosé, 2003). However, breast cancer incidence peaks between the ages of 50 and 64 (Siegel et al., 2013). According to the American Cancer Society, routine screening should not begin for women in the general population until age 45 (although at-risk women may be screened at 40) (Oeffinger et al., 2015). Therefore, it is conceivable that the negative effects of violence against women dissipate or resolve before women are at-risk for breast cancer or eligible for mammography screening. Alternatively, the observed relationship between violence against women, abnormal pap test results, and cervical cancer, may be a function of general high-risk behavior that occurs in early adulthood. Additional research is needed in this area to identify the factors driving these differences.

Third, many studies did not distinguish the type of violence against women. This occurred most often in studies of intimate partner violence, which was not deconstructed by abuse type (e.g., physical, psychological or sexual). These decisions to pool all forms of violence together may have been a practical decision due to limited sample sizes insufficient to sustain stratified analyses. Researchers must creatively leverage case-control designs or retrospective cohort studies of large, existing databases, to sample a sufficient number of women experiencing various forms of violence.

Fourth, only three studies included in this study examined whether the screening or cancer outcomes varied depending upon the relationship of the perpetrator to the victim (excluding studies of intimate partner violence, in which the perpetrator was presumably an intimate partner) (Coker et al., 2009; Farley et al., 2004; Morton et al., 2012). Morton and colleagues found that odds of cancer were greater when the victim's mother perpetrated physical abuse (Morton et al., 2012). Similarly, Coker found that the odds of cervical cancer diagnosis were higher among victims of sexual assault when someone other than an intimate partner perpetrated the assault (Coker et al., 2009). From this small number of studies, it appears that the nature of the relationship between the victim and the perpetrator could impact the health outcomes experienced by the victim. Although conclusions based upon three studies are premature, this additional layer of complexity should be further investigated.

Finally, the duration of exposure to violence against women was largely omitted as a variable from studies in the literature. This is likely a function of common measures, such as the Conflict Tactics Scale, which measure the frequency of victimization according to specific acts that occurred over the past year. For instance, it is unclear whether exposure to sexual assault repeatedly in childhood causes greater health-related harm in adolescence and adulthood when compared to women who were victimized during a single incident several decades prior. Investigators might consider expanding existing assessments to investigate whether the dose of violence against women differentially impacts cancer outcomes.

5. Conclusions

5.1. Limitations

The results of this meta-analytic review should be interpreted considering the following. First, most studies were cross-sectional in nature and relied on retrospective data; therefore, causal inference is not possible. The research designs and methodologies used in studies included in this quantitative review were homogeneous in nature, and this precluded examination of methodological rigor or study quality in this review. Study effect sizes were weighted according to their respective sample sizes, as effect sizes drawn from studies with larger analytic samples were more precise; although, not necessarily more valid. To address this limitation in the future, this review will be updated when more objective measures of cancer diagnoses and cancer screening have been published in the literature.

Second, effect sizes were extracted from multivariate models in the original manuscript; therefore, we assumed that the authors appropriately modeled the original data when coding effect sizes in this study. Because studies on some forms of cancer (particularly, ovarian, breast and colorectal cancers) were not identified –or were identified in small numbers—results generated wide confidence intervals. Additional studies are necessary to broaden the literature base and on the relationship between victimization and cancers other than cervical cancer.

In summary, this meta-analytic review identified a relationship between violence against women and cancer generally; this relationship also held for cervical cancers specifically. Victims of intimate partner violence and sexual abuse had greater odds of cancer diagnoses. Sexual abuse in adolescence and victimization from multiple forms of violence against women (e.g., both physical and sexual abuse, or physical, sexual and emotional abuse) was associated with greater odds of cervical cancer diagnoses. No relationship between exposure to violence against women and screening was detected. However, violence exposure appears to increase the likelihood of abnormal pap test results. Although an examination of all possible explanations for the relationship between violence against women and cancer was beyond the scope of this study, future studies should be designed to examine whether these apparent relationships between intimate partner violence and sexual risk are causal in nature (Coker, 2007a), or whether this relationship is spurious. Similarly, studies should be designed to prospectively examine whether the apparent relationship between violence against women and cancer (including abnormal pap test results) is an artifact of general high-risk behavior, or whether violence and victimization histories spur risky behavior.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2018.07.008.

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