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ORIGINAL PAPER

Psychosocial Syndemic Correlates of Sexual Compulsivity Among Men Who Have Sex with Men: A Meta-Analysis

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Abstract Efforts have been made to better understand sexual compulsivity by examining salient psychosocial syndemic correlates, though examination of such factors has yielded inconclusive results. Given that research on sexual compulsivity has predominately involved men who have sex with men (MSM), the aims of the current study were to establish the mean effect sizes of seven psychosocial syndemic indicators with sexual compulsivity, to determine if the effect varied as a function of the type of psychosocial syndemic, and investigate the potential moderating effects using MSM samples. A total of 95 studies were included for analyses among the psychosocial syndemic indicators of interest (i.e., depression, anxiety, alcohol use, drug use, intimate partner violence, childhood sexual abuse, and sexual risk behavior). Results revealed a medium mean effect size of sexual compulsivity, the strength of which was significantly moderated by type of psychosocial syndemic indicator. Significant mean effect sizes for all syndemic indicators on sexual compulsivity were found, with depression and anxiety having the strongest relationships; significant moderating effects were found and are discussed. Findings highlight clinical considerations regarding sexual compulsivity and its role within the HIV syndemic framework among MSM.

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Introduction

Sex is a basic human physiological need (Maslow, 1943), and sexuality plays a role in overall quality of life and well-being (Davison, Bell, LaChina, Holden, & Davis, 2009; McCabe & Cummins, 1998), but for some individuals, sexual behavior can become out of control and lead to impairment in social, occupational, or other types of functioning. Historically, out-of-control sexual behavior has been given many labels, including nymphomania, satyriasis, hypersexuality, sexual addiction, sexual impulsivity, and sexual compulsivity (Rinehart & McCabe, 1997). More recently, out-of-control sexual behavior has been conceptualized using sexual addiction, sexual impulsivity, and sexual compulsivity models.

The central features of the sexual addiction model are that sexual behavior is used to regulate negative affect, that sexual activity escalates and progresses as a result of tolerance, that individuals become unable to control the behavior, and that there are negative psychosocial consequences (Kafka, 2010). The sexual impulsivity model proposes that out-of-control sexual behavior be understood as an impulse control disorder whereby there is a failure to resist a sexual impulse, that the sexual act is preceded by an increasing sense of tension and followed by temporary pleasure, gratification, or relief from a negative emotional state, immediately followed by a distress resulting from the sexual act (Barth & Kinder, 1987). According to the sexual compulsivity model, individuals experience intrusive sexual thoughts and engage in repetitive sexual acts to reduce anxiety and other negative affect such as depression and shame (Black, Kehrberg, Flumerfelt, & Schlosser,

1997; Coleman, 1987, 1990). Despite the various terminology for, and conceptual models of, out-of-control sexual behavior, a growing body of literature has focused on sexual compulsivity characterized by an increase in the frequency or intensity of sexual thoughts and behaviors that are difficult to control and are associated with subjective distress or impairment in important life domains (Black, 2000; Kafka & Prentky, 1994; Kalichman & Rompa, 1995).

Estimates of the prevalence of sexual compulsivity in the general population in the U.S. range from 3 to 6% (Kuzma & Black, 2008), with severity of sexual compulsivity being greater among men than women (Dodge, Reece, Cole, & Sandfort, 2004; Reid, Dhuffar, Parhami, & Fong, 2012). Just over half of all individuals with sexual compulsivity report onset prior to age 18, while 30% report age of onset between the ages of 18–25, and 16% after age 25 (Reid et al., 2012). Sexual compulsivity is associated with a greater frequency of partnered, solo, and public sexual activity (Dodge et al., 2004). Individuals with sexual compulsivity report a wide range of negative consequences resulting from sexual activity, including negative impact on mental health (reported by 94% of individuals), emotionally hurting a loved one (88%), interference with ability to experience healthy sex (78%), unwanted financial loss (53%), contracting a sexually transmitted infection (39%), ending a romantic relationship (39%), loss of a job (17%), and legal problems (17%; Reid et al., 2012a). The lifetime prevalence of mood, anxiety, and substance use disorders is elevated among individuals with sexual compulsivity relative to the general population (Black, 2000).

Sexual compulsivity is more prevalent among men who have sex with men (MSM) than among the general population. Prevalence estimates based on an established cutoff score on the Sexual Compulsivity Scale (SCS; Kalichman & Rompa, 1995) range from 19 to 30% in community samples (Kelly, Bimbi, Nanin, Izienicki, & Parsons, 2009; Parsons, Grov, & Golub, 2012), and 51% in a sample of highly sexually active MSM, defined as self-reporting at least nine different male sex partners within the past 90 days (Parsons, Rendina, Moody, Ventuneac, & Grov, 2015). Qualitative research has identified several triggers for sexually compulsive behavior among MSM, including relationship turmoil, personal and societal catastrophes, drug and pornography use, and specific places and people (Parsons, Kelly, Bimbi, Muench, & Morgenstern, 2007). The origin of sexual compulsivity among MSM has been explored via qualitative interviews, with common themes include negative affect, low self-esteem, the need for validation and affection, stress release, relationship issues, availability of sex partners, childhood sexual abuse, parental issues, and genetics, hormones, or other biological factors (Parsons et al., 2008).

Sexual compulsivity has been associated with depression, substance use, intimate partner violence, and childhood sexual abuse among MSM (Carrico et al., 2012; Herrick et al., 2013; Parsons et al., 2012), as well as with several sexual risk behaviors, including condomless anal intercourse (CAI), sex under the influence of club drugs, identifying as a barebacker, temptation for condomless sex, and number of recent sex partners (Grov, Parsons, & Bimbi, 2010b; Kalichman & Rompa, 1995). Furthermore, sexual compulsivity has been identified as one component of the HIV syndemic framework for MSM, whereby it interacts with other commonly occurring psychosocial problems for MSM such as depression, anxiety, childhood sexual abuse, intimate partner violence, and substance use to increase HIV risk (Parsons et al., 2012, 2015). Sexual compulsivity is therefore not only associated with individual and interpersonal distress, but is also a public health concern for MSM.

Although there are no diagnostic criteria for sexual compulsivity officially endorsed by either the American Psychiatric Association (APA) or World Health Organization (WHO), *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013) field trials resulted in a working operational definition and diagnostic criteria for hypersexual disorder, which includes recurrent and intense sexual fantasies, sexual urges, or sexual behaviors associated with four of the five following behavioral criteria: excessive time is consumed by sexual fantasies and urges, and by planning for and engaging in sexual behavior; repetitive engagement in sexual fantasies, urges, and behavior in response to dysphoric mood states; repetitive engagement in sexual fantasies, urges, and behavior in response to stressful life events; repetitive but unsuccessful efforts to control or significantly reduce these sexual fantasies, urges, and behavior; and repetitive engagement in sexual behavior while disregarding the risk for physical or emotional harm to self or others (Reid et al., 2012a).

Several assessment tools have been developed for measuring sexual compulsivity, and hypersexual disorder, including the Sexual Compulsivity Scale (SCS; Kalichman & Rompa, 1995), the Compulsive Sexual Behavior Inventory (CSBI; Coleman, Miner, Ohlerking, & Raymond, 2001), the Hypersexual Behavior Inventory (HBI; Reid, Garos, & Carpenter, 2011), and the Hypersexual Disorder Screening Inventory (HDSI; American Psychiatric Association, 2010). However, while these assessment tools provide a useful starting point for examining sexual compulsivity, the definitions and underlying etiology vary by tool, making it difficult to know exactly what is being measured. Furthermore, the operational definitions of sexual compulsivity and hypersexual disorder are overlapping, yet distinct, further complicating interpretation and comparison of findings across studies. While both constructs are characterized by frequent and intense sexual fantasies, urges, and behaviors, and impairment in social, occupational, or other important areas of functioning, the distinguishing feature of hypersexual disorder is clinically significant distress or impair-

ment resulting from the sexual fantasies, urges, or behavior (Kafka, 2010; Parsons, Rendina, Ventuneac, Moody, & Grov, 2016). Emerging evidence supports the idea that sexual compulsivity and hypersexuality are overlapping, yet distinct constructs, and that among MSM, the presence of both sexual compulsivity and hypersexuality is associated with greater frequency of CAI acts than either sexual compulsivity or hypersexuality alone (Parsons et al., 2016).

Similarly, the presence of both sexual compulsivity and hypersexuality is associated with a greater number of co-occurring psychosocial factors among MSM than the presence of either one alone (Parsons et al., 2015), also known as co-occurring HIV syndemics. A syndemic involves at least two or more other psychosocial problems, which work synergistically to exacerbate a disease (e.g., HIV), or disease risk (e.g., CAI) in a population (Singer, 2010; Wilson et al., 2014). Syndemic theory has been applied to HIV risk among MSM: current research has investigated the HIV syndemic framework, focusing on risk factors of HIV working concurrently with other psychosocial syndemic indicators of HIV, increasing the risk of contracting and transmitting HIV infection. These frequently studied syndemic indicators include depression, anxiety, alcohol use, substance use, intimate partner violence, childhood sexual abuse, and sexual risk behavior.

The growing body of literature on sexual compulsivity among MSM highlights its role in the HIV syndemic including its association with other co-occurring psychosocial syndemic indicators and its impact on sexual risk behavior. However, past investigations of these associations have yielded inconsistent results. Moreover, moderating variables between other psychosocial syndemic indicators and sexual compulsivity have complicated these findings further. Thus, a more nuanced understanding of these relationships and moderators in the HIV syndemic, and implementation of interventions designed to reduce HIV transmission and improve the mental and physical well-being of MSM, may improve the treatment and prevention of sexual compulsivity and other psychosocial syndemic indicators. Therefore, the aims of this study are to: (1) explore extant literature to reveal what psychosocial syndemic indicators are significantly associated with sexual compulsivity among MSM; (2) establish the mean effect size of each psychosocial syndemic indicator with sexual compulsivity; and (3) determine if this effect varies as a function of the type of psychosocial syndemic.

Method

Study Collection

Multiple study collection strategies were implemented to maximize qualifying data for analyses, including published articles, dissertations, and unpublished work, to account for a potential file drawer effects. First, in January 2016, studies were collected from two computer-based electronic databases (*Web of Science*, and *PubMed*). Studies were also collected using the research electronic reference system *EBSCOhost;* this reference system allows for the search of multiple databases sponsored by *EBSCOhost*. The databases searched within the *EBSCOhost* reference system were: *PsycINFO*; *Academic Search Premier*; *AgeLine*; *CINAHL Plus*; *EBSCOhost eBOOK collection*; *LGBT Life*; *Information Science & Technology Abstracts*; *MEDLINE*; *PsycARTICLES*; and *PsycCRITQUES*. Studies were also located using *ProQuest Research Library*, an additional database with a specified search for dissertations, allowing for a broader search for dissertation results that may not have appeared in the other databases containing only published literature. Key search terms for study collection can be found in Table 1. All syndemic indicator article searches had the same Criterion A and Criterion B terms, whereas Criterion C search terms were tailored to each psychosocial syndemic indicator being studied (i.e., depression, anxiety, alcohol use, substance use, intimate partner violence, childhood sexual abuse, and sexual risk behavior). Each factor had a set of search results; however, these results contained redundant studies from among the three reference systems. Efforts were made to eliminate all redundant search results, leaving a unique set of publications and dissertations for the next steps of study selection. Table 2 presents this study collection and selection process for each indicator measured following Preferred Reporting Items for Systematic Reviews and Meta-Analyses, or PRISMA, guidelines.

Secondly, e-mails were sent to selected listservs (i.e., Sexnet and SSSSTalk) requesting unpublished/in-press data relevant to the current study. One researcher provided unpublished data from two studies, one of which was in progress. Lastly, individual researchers who have previously published work pertaining to sexual compulsivity among MSM were solicited for any unpublished or in-press data. This strategy yielded one unpublished manuscript; however, this study did not meet inclusion criteria for the current study.

Inclusion and Exclusion Criteria

Studies included for analysis must have been published in English to avoid translation issues. There was no restriction on ethnicity of participants or on publication year. The meta-analysis included studies with samples of MSM and/or gay/bisexual identifying men of at least 18 years of age, at least one measure of the syndemic indicators, and a cross-sectional design. Given that there are salient developmental differences between adults and children, combining studies across these varied developmental stages could obscure results.

Studies were excluded if they did not include a measure of sexual compulsivity. We referred to Hook, Hook, Davis, Worthington, and Penberthy (2010) to assess the validity and reliability of measures of sexual compulsivity for study inclusion. For

measures not included in this review, we examined the reported psychometrics in the original scale development publications (e.g., Hypersexual Behavior Inventory; Reid et al., 2011). Although structured clinical interviews such as the Hypersexual Disorder Diagnostic Clinical Interview (HDDCI; Reid et al., 2012a) and the Diagnostic Interview for Sexual Compulsivity (DISC; Parsons et al., 2007) have been developed, they are not yet widely used and have not been psychometrically validated. The few studies which measured sexual compulsivity through structured clinical interviews were dropped from analysis; however, as the use of these interviews becomes more widespread, including such studies in future research may be worthwhile. Case studies were also excluded from analysis. Further, if an effect size could not be computed and the author could not provide the effect size for the syndemic indicators, the study was dropped from final analyses.

Study Selection and Coding

Table 2 reflects the final number of studies for each psychosocial syndemic indicator that were evaluated for inclusion. A coding scheme was developed to indicate all relevant information from a study, including potential moderating variables and statistical information for effect size calculations. Moderators considered were mean age of sample, sample race majority (>50%), proportion of sample that is HIV positive, publication year, sample sexual orientation majority (>50%), and sexual compulsivity scale used.

Following the removal of studies that did not meet inclusion criteria, two independent coders utilized the established coding scheme to record details of each study. Once studies were coded independently, coders met to determine consistency, resulting in a percentage of agreement of 99.29%, a commonly reported index of coding reliability (Lipsey & Wilson, 2001). The few discrepancies between coders were resolved by mutual agreement or, if necessary, input by the third author, with final total percentage of agreement of 100%.

If a particular primary study measured more than one syndemic indicator, each indicator was coded individually. This plan was implemented to allow for researchers to analyze all effect sizes available for inclusion into the meta-analysis rather than to only code effect size estimates in the search results for a particular indicator. For example, Parsons et al. (2012) assessed five syndemic indicators, but this publication was only included in the search results for four indicators. This article was then coded for each of the indicators assessed in the publication (e.g., depression, anxiety, etc.), regardless of whether it appeared in search results for the indicator or not.

If a particular project or sample was utilized in more than one study (e.g., Project SPIN; Grov, 2007), all studies using this particular sample were closely reviewed to determine which syndemic indicator effect sizes could be reported. The study using the particular sample that was recorded first by coders was given preference; all other studies reporting effect sizes on the same sample were dropped from analysis. However, in the case that a study reported an additional syndemic indicator that was not included in the preferred study, only this unique syndemic indicator was coded along with the subsequent study information. For example, the first study that was coded using the Project SPIN sample was included, while subsequent studies using that sample were not. However, another sample, using the Project SPIN sample, described a syndemic indicator that was not reported in the primary study, so only this particular effect size was coded. This process was employed to prevent redundant effect sizes from being included in analyses.

All effect size estimates were reported as Pearson's coefficients or Spearman's correlations (used only for count variables). Based on the recommendations of Lipsey and Wilson (2001), correlations were calculated from studies that reported statistics as chi-square tests, *t* tests, odds ratios, and frequency tables. In the event an author did not provide statistics that could not be converted into a correlation, or if authors reportedly measured a syndemic indicator but did not report the statistical results, authors were contacted to request these effect sizes. Authors who no longer had access to the data or did not respond to the inquiry resulted in the effect size(s) being excluded from final analyses.

All coded studies reported measures used to quantify each syndemic indicator and the variable of sexual compulsivity. Though most syndemic indicators used common measures, sexual risk included a wide range of definitions as operationalized by primary study authors, and, therefore, a variety of measures of sexual risk were presented in this meta-analysis. To address this issue, we defined sexual risk as involving CAI, either receptive or insertive, with casual partners. Therefore, some studies were dropped from analysis for sexual risk measures that did not meet this definition, such as frequency of condomless oral sex acts, or the number of sexual partners within the last month (CAI unspecified). While other measures and definitions may accurately measure forms of sexual risk, we opted to narrow the scope to a specific behavior that can be addressed in prevention efforts by measuring a common and frequently studied behavior associated with increased risk of HIV transmission.

Regarding coding of potential moderating variables, if year of data collection was not available, the date of publication was coded. In the event that more than one valid measure of sexual compulsivity was measured, preference was given to the Sexual Compulsivity Scale (SCS) developed by Kalichman et al. (1994), as it is the most frequently used psychometric measure of sexual compulsivity (Parsons et al., 2012). If the SCS was not utilized in the study, the effect size estimates from each scale implemented were averaged together to create one effect size to report for that particular factor.

Data Analysis

Data were analyzed using mixed-effects models, which include unmeasured random effects in the distribution of effect sizes as well as the sample error (Lipsey & Wilson, 2001). Mixed-effects models assume the variability in the distribution of effect sizes is the result of between-study differences, participant-level sample error, and an additional random component. Furthermore, within mixed-effects models, it is assumed the impact of moderator variables is systematic. The maximum likelihood model method was utilized in all statistical analyses.

When using mixed-effects models, the process begins by first testing the average effect size and homogeneity of a given association between two variables; in this study, this was between the psychosocial syndemic indicators and sexual compulsivity. The presence of a moderator effect indicates that systematic variance affects the relationship (mean effect sizes) between two variables differently at different levels of the moderator variable. The remaining variance after accounting sample error and moderator variables is then added to estimates of the average effect sizes.

As the test of homogeneity was conducted in the presence of other psychosocial variables, an investigation analyzing each indicator alone for potential moderators was warranted. Mean age of sample, proportion of sample that is HIV positive, and publication year were treated as continuous variables and tested via the meta-analysis equivalent of regression analysis. Sample race majority, sample orientation majority, and sexual compulsivity scale used were dichotomous variables and were tested via the meta-analysis equivalent of analysis of variance (ANOVA).

Investigation into sexual compulsivity scale used as a potential moderator only considered studies which utilized one of the following scales: the Sexual Compulsivity Scale (SCS), the Compulsive Sexual Behavior Inventory (CSBI), or the Hypersexual Behavior Inventory (HBI). Studies that used other valid measures of sexual compulsivity were excluded from this analysis due to insufficient number of studies using other scales for statistical comparison.

All statistics were transformed using Fisher's z tests, and inverse variance weights were used to weight each effect size (Lipsey & Wilson, 2001). The interpretation of effect sizes were $\leq$.10 for a small effect, .11–.39 for a medium effect, and $\geq$.40 for a large effect (Lipsey & Wilson, 2001). Statistical analyses were conducted via SPSS v24 and utilized meta-analysis macro-programs developed by Wilson (2005). Furthermore, to investigate the "file-drawer effect" and its impact on findings, a weighted fixed-effect fail-safe number ($N+$) was calculated (Rosenberg, 2005). This N indicates the number of null primary studies that would need to be included to reduce the effect size to nonsignificant levels. Adequately large N ($>5n+10$) indicates that the probability of such a number of these null studies existing is trivial.

Results

A total of 95 effect size estimates from 36 different studies were included for analysis to determine the relationship between psychosocial syndemic indicators and sexual compulsivity. First, all mean effect sizes within each indicator were analyzed independently of other indicators to locate outliers. Outliers were identified as effect sizes not within ± 1.5 multiplied by the interquartile range from the first and third quartiles for each syndemic indicator; box-and-whisker plots were also analyzed. Seven outliers were detected: three within anxiety, one within intimate partner violence, two within childhood sexual abuse, and one within sexual risk behavior. As analyses excluding outliers did not substantially alter the mean effect size for these four factors, outliers were retained in all statistical analyses.

Across all indicators, there was a statistically significant medium effect size ($r = .16$, SE = .01, 95% CI .14, .17, $z = 16.56$, $p < .01$). Calculations indicated a robust fixed fail-safe $N+ = 128{,}955$ (Robust $N > 485$). Additionally, there was also a significant between-groups effect ($Q_{\text{Between}} = 114.71$, $p < .01$); thus, it was necessary to interpret the mean effect size of sexual compulsivity within each psychosocial syndemic indicator, as type of indicator significantly moderated the strength of the effect size. Forest plots are included (Figs. 1, 2, 3, 4, 5, 6, 7) in the Appendix to visually show the weight and influence of each study in determining the overall effect size for each indicator.

Depression and Sexual Compulsivity

Twenty-one effect size parameters ($n = 30{,}448$) were included to assess the relationship between depressive symptoms and sexual compulsivity. A statistically significant medium effect size was found: $r = .32$, SE = .02, 95% CI .28, .36, $z = 14.82$, $p < .01$ (see Fig. 1); $Q_{\text{Depression}} = 33.66$, $p = .03$. Calculations yielded a robust fixed fail-safe, $N+ = 18{,}871$ (Robust $N > 115$). Age emerged as a statistically significant moderator: $Q_{\text{Model}} = 29.68$, $p < .01$; $Q_{\text{Residual}} = 27.53$, $p = .07$; $\beta = -.72$, $z = 58.70$, $p < .01$, indicating that the positive relationship between depression and sexual compulsivity was stronger among younger participants. Additionally, results indicated a significant difference in the distribution of effect sizes as a function of sexual compulsivity scale used: $Q_{\text{Between}} = 7.86$, $p = .02$; $Q_{\text{Within}} = 19.75$, $p = .23$; $r = .33$, 95% CI .29, .37, $z = 15.49$, $p < .01$. Investigations into this difference indicated a medium effect size for studies using the SCS, which was significantly different from zero (SCS: $r = .29$, 95% CI .24, .34, $z = 11.65$, $p < .01$). Analyses also indicated large effect sizes for studies using the CSBI, and the HBI, which were significantly different from zero (CSBI: $r = .43$, 95% CI .30, .55, $z = 6.74$, $p < .01$; HBI: $r = .42$, 95% CI .32, .52, $z = 8.18$, $p < .01$). There was no statistical evidence to suggest race,

proportion of sample that was HIV positive, sexual orientation, and publication year were significant moderators.

Anxiety and Sexual Compulsivity

Nine effect sizes parameters ($n = 1553$) were included to assess the relationship between anxiety symptoms and sexual compulsivity. A statistically significant medium effect size was found: $r = .30$, SE = .04, 95% CI .23, .37, $z = 8.03$, $p < .01$ (see Fig. 2); $Q_{\text{Anxiety}} = 6.15$, $p = .63$. Calculations revealed a robust fixed fail-safe, $N+ = 312$ (Robust $N > 55$). No variables moderated the relationship between anxiety and sexual compulsivity. There was, however, insufficient statistical power to assess race as a moderator.

Alcohol Use and Sexual Compulsivity

Twelve effect size parameters ($n = 31{,}405$) were included to assess the relationship between alcohol use and sexual compulsivity. A statistically significant small effect size was found: $r = .07$, SE = .03, 95% CI .02, .12, $z = 2.69$, $p < .01$ (see Fig. 3); $Q_{\text{Alcohol}} = 9.74$, $p = .55$. Calculations revealed a robust fixed fail-safe, $N+ = 2315$ (Robust $N > 70$). Proportion of sample that was HIV positive was found to be a statistically significant moderator between alcohol use and sexual compulsivity: $Q_{\text{Model}} = 5.00$, $p = .03$; $Q_{\text{Residual}} = 9.80$, $p = .28$; $\beta = .58$, $z = 2.24$, $p = .03$, indicating that the positive relationship between alcohol use and sexual compulsivity was stronger among samples with higher proportions of HIV positive individuals. However, age, publication year, sexual orientation, and type of sexual compulsivity measure were not statistically significant moderators in this relationship. Race as a moderator could not be determined due to insufficient statistical power.

Substance Use and Sexual Compulsivity

Sixteen effect size parameters ($n = 33{,}534$) were included to assess the relationship between substance use and sexual compulsivity. A statistically significant small effect size was found: $r = .09$, SE = .02, 95% CI .05, .13, $z = 4.27$, $p < .01$ (see Fig. 4); $Q_{\text{Substance}} = 12.87$, $p = .61$. Calculations revealed a robust fixed fail-safe, $N+ = 2853$ (Robust $N > 90$). No potential moderators were found to be statistically significant. It should be noted, however, that race as a moderator could not be calculated due to insufficient statistical power.

Intimate Partner Violence and Sexual Compulsivity

Five effect size parameters ($n = 26{,}864$) were included to assess the relationship between intimate partner violence and sexual compulsivity. A statistically significant medium effect size was found: $r = .16$, SE = .04, 95% CI .08, .23, $z = 4.17$, $p < .01$ (see Fig. 5); $Q_{\text{IPV}} = 3.16$, $p = .53$. Calculations revealed a robust fixed fail-safe $N+ = 888$ (Robust $N > 35$). Publication year was found to be a statistically significant moderator between intimate partner violence and sexual compulsivity: $Q_{\text{Model}} = 3.90$ $p = .05$ $Q_{\text{Residual}} = 5.84$, $p = .12$; $\beta = -.63$, $z = -1.98$, $p = .04$, indicating that the positive relationship between intimate partner violence and sexual compulsivity was weaker among more recently published studies. There was no statistical evidence to suggest age, race, proportion of sample that was HIV positive, and sexual orientation were moderators; sexual compulsivity measure used could not be considered due to lack of statistical power.

Childhood Sexual Abuse and Sexual Compulsivity

Thirteen effect size parameters ($n = 29{,}895$) were included to assess the relationship between childhood sexual abuse and sexual compulsivity. A statistically significant small effect size was found: $r = .07$, SE = .03, 95% CI .02, .12, $z = 2.64$, $p < .01$ (see Fig. 6); $Q_{\text{CSA}} = 21.77$, $p = .04$. Calculations revealed a robust fixed fail-safe $N+ = 602$ (Robust $N > 75$). Publication year was found to be a statistically significant moderator between childhood sexual abuse and sexual compulsivity: $Q_{\text{Model}} = 9.03$, $p < .01$; $Q_{\text{Residual}} = 12.24$, $p = .35$; $\beta = -.65$, $z = -3.01$, $p < .01$, indicating that the positive relationship between childhood sexual abuse and sexual compulsivity was weaker among more recently published studies. Additionally, a significant difference in the distribution of effect sizes as a function of sexual compulsivity measure used was found: $Q_{\text{Between}} = 6.43$, $p = .04$; $Q_{\text{Within}} = 10.69$, $p = .22$; $r = .07$, 95% CI .01, .13, $z = 2.19$, $p = .03$. Investigations into this difference indicated a small effect size for studies using the SCS that was significantly different from zero: SCS: $r = .09$, 95% CI .01, .016, $z = 2.29$, $p = .02$. Analyses also indicated a medium effect size for studies using the CSBI were significantly different from zero CSBI: $r = .14$, 95% CI .01, .27, $z = 2.04$, $p = .04$. However, the small effect size of studies using the HBI was not found to be significantly different from zero: HBI: $r = -.10$, 95% CI $-.25$, .05, $z = -1.35$, $p = .18$. There was no statistical evidence to suggest mean age, race, proportion of sample that was HIV positive, and sexual orientation moderate this relationship.

Sexual Risk Behaviors and Sexual Compulsivity

Nineteen effect size parameters ($n = 29{,}349$) were included to assess the relationship between sexual risk behaviors and sexual compulsivity. A statistically significant medium effect size was found: $r = .13$, SE = .02, 95% CI .09, .18, $z = 6.52$, $p < .01$ (see Fig. 7); $Q_{\text{SexualRisk}} = 14.54$, $p = .69$. Calculations revealed a robust fixed fail-safe $N+ = 2574$ (Robust $N > 105$). Publication year was found to be a statistically significant moderator between sexual risk behavior and sexual compulsivity: $Q_{\text{Model}} = 6.63$, $p = .01$; $Q_{\text{Residual}} = 19.67$, $p = .29$; $\beta = -.50$,

$z = -2.58, p = .01$, indicating that the positive relationship between sexual risk behavior and sexual compulsivity was weaker among more recently published studies. Additionally, results indicated that there was a significant difference in the distribution of effect sizes as a function of sample race/ethnicity majority: $Q_{Between} = 7.55, p = .02$; $Q_{Within} = 19.26, p = .26$; $r = .13$, 95% CI .10, .16, $z = 2.19, p = .03$. It is important to note that among studies coded for sexual risk behavior, only majority White, majority Latino, and no-majority race/ethnicity samples were found (i.e., no single racial/ethnic group made up more than 50% of the sample). These results indicated there was a significant difference in the distribution of effect sizes as a function of race/ethnicity. Investigations into this difference indicated a medium effect size for White MSM that was significantly different from zero: White: $r = .13$, 95% CI .09, .17, $z = 6.76, p < .01$. Analyses also indicated a medium effect size for Latino MSM that was significantly different from zero: Latino: $r = .18$, 95% CI .12, .23, $z = 6.72$, $p < .01$. However, the small effect size of no-majority race/ethnicity samples was not found to be significantly different from zero (No-majority: $r = .06$, 95% CI −.003, .12, $z = 1.87, p = .06$). There was no statistical evidence to suggest age, proportion of sample that was HIV positive, and sexual orientation moderate this relationship. Sexual compulsivity measure used did not have enough statistical power to compare the SCS, CSBI, and the HBI, as the HBI was not utilized in any of the samples in this analysis. When SCS and CSBI were compared, there was no evidence of a moderation effect by sexual compulsivity scale used.

Discussion

This is the first known meta-analysis conducted on sexual compulsivity. The purpose of the current study was to investigate the relationships between psychosocial syndemic indicators and sexual compulsivity among MSM. Results revealed a statistically significant overall medium effect size between all syndemic indicators and sexual compulsivity. Analyses also revealed significant parameters between each syndemic indicator and sexual compulsivity; moderators were found for some of these associations; however, tests of moderation should be interpreted with caution due to low statistical power. Results from the current study emphasize the utility in considering sexual compulsivity in the context of co-occurring psychosocial syndemic indicators.

Main Effects

Depression and anxiety displayed the strongest correlations with sexual compulsivity. These medium-sized effects are consistent with findings that those with sexual compulsivity are more likely to have both mood and anxiety disorders compared to the general population (Black, 2000). Though temporality cannot be determined due to the use of cross-sectional studies, the examined relationship between anxiety and sexual compulsivity may support the sexual compulsivity model, in so that individuals engage in sexual acts as an attempt to reduce negative affect (Black et al., 1997; Coleman, 1987, 1990). Though there has been robust literature examining the intuitive negative relationship between depression and sexual interest (Segraves, 1998), there has also been discussion regarding the minority of men who have increased sexual desire in states of high depression/anxiety. It has been suggested that there is a comorbidity between sexual compulsivity and mood disorders in which the relationship between low mood and sexual interest is not always in the same direction (Black et al., 1997); in fact, among the minority of men who experience an increase in sexual interest when experiencing anxious/depressive symptoms, the relationship was found to be moderated by age, with younger men more likely to be in this minority group (Bancroft, Janssen, Strong, & Vukadinovic, 2003). Additionally, intimate partner violence and sexual risk behaviors were also found to have medium effect sizes, though lesser than both depression and anxiety. It is surprising that sexual risk behavior did not yield a stronger relationship with sexual compulsivity considering the stable focus on the relationship between sexual compulsivity and sexual risk behaviors studied over the past two decades (Grov, Golub, Mustanski, & Parsons, 2010a); however, this may be due to our operational definition of sexual risk behavior. Alcohol use, substance use, and childhood sexual abuse were found to yield small effect sizes with sexual compulsivity.

Moderators

Age

Mean age of study samples significantly moderated the relationship between depression and sexual compulsivity. That is, there was a smaller effect size for the positive relationship between depression and sexual compulsivity among studies that reported older mean age compared to studies with younger mean age. One explanation for this finding may be due to a difference in the value placed on sex in the lives of younger MSM compared to older MSM. Sexual difficulties, including sexual compulsivity, may impact younger MSM to a greater degree given that they may invest more heavily in an identity that incorporates being sexually healthy and free of difficulties as important. Thus, younger men suffering from sexual compulsivity could produce a stronger relationship with depression, as compared to the relationship in older MSM. This is not to say the relationship between sexual compulsivity and depression among older MSM does not exist, but does to a lesser extent, as older MSM may have a sense of identity that is less heavily invested in sexual roles (Kertzner, Meyer, Frost, & Stirratt, 2009) and may be less likely to use sex to cope with depression. In other words, older MSM may have a more diversified sense

of self, which could buffer them somewhat from the effects of sexual compulsivity. Future research is needed to explore this potential relationship.

Race/Ethnicity

Race/ethnicity as a study characteristic was operationally defined as the proportional majority of the study sample (i.e., >50%). Race/ethnicity significantly moderated the relationship between sexual risk behaviors and sexual compulsivity, such that the relationship between sexual risk behaviors and sexual compulsivity was significantly positively stronger among majority White and majority Latino samples compared to No-majority samples; no study included in this meta-analysis measured a predominately African-American sample. Though both effect sizes for majority White ($r = .13$) and majority Latino ($r = .18$) samples were medium in size, the effect size for Latino-majority samples is higher. One explanation for this finding, although speculative in nature, may be because Latino MSM, and other people of color, experience excess stressors, specifically related to their sexual minority and ethnic minority statuses (Balsam, Molina, Beadnell, Simoni, & Walters, 2011; Meyer, 2010). Latino MSM with elevated sexual compulsivity may have less psychological resources (which may be depleted relative to White MSM, given the additional stressors felt by their dual minority identity) to inhibit sexual behaviors, which may explain a stronger relationship between sexual compulsivity and sexual risk behaviors among Latino MSM. Moreover, an additional caveat to interpreting these results is that given the operational definition of what constitutes a sample's racial/ethnic characteristic, the racial/ethnic composition of samples was heterogeneous. Future research should investigate the relationship between race/ethnicity, sexual risk behaviors, and sexual compulsivity using homogenous racial/ethnic groups, particularly among African-American MSM.

HIV Status

HIV status significantly moderated the relationship between alcohol use and sexual compulsivity, such that samples with a higher proportion of HIV positive MSM had significantly larger effect sizes than samples with lower proportions of HIV positive individuals. Of note, samples analyzed were heterogeneous such that, for example, a sample with a majority of individuals reporting a positive HIV status would still contain HIV negative individuals. Nonetheless, the findings from this meta-analysis could be attributed to the stigma that accompanies an HIV diagnosis: experiences of stigma due to ones seropositive status have been previously linked with depression, self-esteem, and other negative psychosocial health outcomes (Dowshen, Binns, & Garofalo, 2009; Vanable, Carey, Blair, & Littlewood, 2006). Additionally, alcohol use has been found to pay a role in sexual scripts among HIV positive MSM (Parsons et al., 2004); that is, consumption of alcohol is part of certain environmental contexts that may lead to frequent opportunities for sex, such as bars, sex clubs, or bathhouses (Parsons et al., 2004). Therefore, HIV positive MSM may use alcohol to cope with distress from their dual identities (sexual minority identity and HIV positive identity), as well as engage in drinking behaviors strongly associated with the opportunities and environments to engage in (potentially risky) sexual behavior. Future research should investigate the relationships between HIV status, alcohol use, and sexual compulsivity using homogenous groups of HIV positive and HIV negative individuals.

Publication Year

Publication year significantly moderated the relationships between intimate partner violence, childhood sexual abuse, sexual risk behaviors, and sexual compulsivity. In more recent studies, the relationships between sexual compulsivity and these indicators were attenuated compared to older studies. One possible explanation for these findings may be due to the fact that more recent studies were conducted during a comparatively more hospitable sociocultural environment for MSM. As such, the associations between sexual compulsivity and the above-mentioned syndemic indicators may be attenuated over time as MSM have encountered less psychosocial stressors, compared to studies that were conducted in the 1990s and early 2000s. Indeed, in the U.S., positive societal attitudes toward same-sex sexual behavior have increased from the 1970s to the 2010s (Twenge, Sherman, & Wells, 2016), and explicit and implicit preferences for heterosexual individuals over gay men and lesbian women notably decreased from 2006 to 2013 (Westgate, Riskind, & Nosek, 2015). Participants in earlier samples may have had less psychological resources due to a more hostile sociocultural environment and subsequent stressors; thus, sexual compulsivity in such a context may have produced stronger effects with the syndemic indicators. The suggestion of such a cohort effect should be investigated further.

Sexual Compulsivity Scale

The type of sexual compulsivity scale used in analyses moderated the relationship between depression and sexual compulsivity. Specifically, samples that utilized either the CSBI or HBI reported significantly larger effect sizes than those using the SCS ($r = .43; .42; .29$, respectively). This moderating effect may be explained by the CBSI and the HBI tapping into more pathological components of sexual compulsivity compared to the SCS. For example, the CSBI and HBI both include items that address distress and impairment as a result of an individual's sexual behaviors, whereas the SCS includes comparably benign items regarding distress and impairment.

Additionally, the type of sexual compulsivity scale also moderated the relationship between childhood sexual abuse

and sexual compulsivity. Samples that utilized either the SCS or CSBI reported significantly larger, positive associations between childhood sexual abuse and sexual compulsivity, but not among samples that used the HBI. This may be explained by items on the CSBI that assess both childhood sexual abuse and intimate partner violence. While there was insufficient statistical power to investigate sexual compulsivity scale used as a potential moderator between intimate partner violence and sexual compulsivity, we suspect use of the CSBI would moderate the relationship between IPV and sexual compulsivity as well. Regarding the studies that used the HBI to measure sexual compulsivity, there are some aspects of these studies (e.g., proportion of bisexual men), which may impact the relationship between sexual compulsivity and childhood sexual abuse using the HBI. Further investigation into the relationship between sexual compulsivity scale and childhood sexual abuse is necessary.

Sexual Orientation

There was no evidence to suggest that sexual orientation moderated the relationships between any psychosocial indicator studied and sexual compulsivity. Though these results can only extend to the population utilized in this meta-analysis (MSM), it should be considered that all participants in the primary studies included in this meta-analysis endorsed sex with men. However, these findings may also be the result of few primary studies that included a heterogeneous sample of sexual minority identities (i.e., MSM, gay, bisexual) and a breakdown of effects by these identities, which would be useful to fully assess group differences. Furthermore, though heterosexual men were not studied in this meta-analysis, it may be reasonable to assume similar patterns found in this study may occur among all men. Further research should be conducted using a mixed sample of both MSM and men who do not have sex with men to determine if sexual partner choice moderates the relationship between any of the studied psychosocial indicators and sexual compulsivity.

Limitations and Clinical Considerations

The current study is not without limitations. First, there were an insufficient number of studies that utilized a longitudinal design to include in the meta-analysis; the studies that did include a measure of problematic sexual behavior did not meet other inclusion criteria for this study. Therefore, the reported results are unable to indicate directionality among variables given that all studies were required to utilize a cross-sectional design. Future investigations are encouraged to utilize a longitudinal design to aid in determining temporality. Second, varying author-operationalized definitions of substance use made this indicator difficult to measure. Indeed, some authors specified substances for analyses (e.g., cocaine, methamphetamines), whereas others measured global, non-specific substance use. Furthermore, authors differed in their definitions regarding usage duration and frequency when inquiring about recent substance use. Collectively, these variations created substantial heterogeneity, which may have obscured findings. A third limitation was the lack of statistical power to assess the moderating role of race/ethnicity. This may indicate a lack of diversity and a paucity of research on sexual compulsivity among MSM. Fourth, HIV status and race/ethnicity coding was operationally defined as proportional majority, and not homogeneous samples. Therefore, subgroup comparisons (e.g., HIV positive MSM vs. HIV negative MSM) could not be assessed within moderation analyses.

Though the rates of sexual compulsivity in community and clinical samples could not be compared due to a lack of statistical power, the current examination may still help to inform clinical practice regarding treatment of sexual compulsivity. Until such a comparison can be investigated, clinicians treating MSM may wish to address the comorbid symptomatology of sexual compulsivity, specifically, depression and anxiety. Treatment of these two common disorders could perhaps reduce one's probability of developing sexual compulsivity, or diminish the driving forces of sexual compulsivity, regardless of which theorized model for sexual compulsivity one prescribes to. Clinicians may also implement behavioral strategies to relieve or reduce depressive and anxious affect as a result from suffering from sexual compulsivity. Until further investigations can offer evidence regarding directionality of comorbid depressive and anxious symptomatology and sexual compulsivity, clinicians would be advised to address this comorbidity. Furthermore, this meta-analysis indicates sexual compulsivity is associated with seven known psychosocial syndemic correlates of HIV contraction, supporting past findings that sexual compulsivity should be considered part of the HIV syndemic framework (Parsons et al., 2012). Therefore, sexual compulsivity should continue to be a target factor to be considered in syndemic-based HIV treatment and prevention efforts among MSM.

While this meta-analysis may aid in the comprehension of sexual compulsivity as a psychosocial construct, more research must be conducted on this topic. Foremost, researchers and clinicians would most benefit from further investigation into which theoretical model of sexual compulsivity best fits this psychosocial impairment. From there, a proper name of this psychological condition can be applied, eliminating the confusion and uncertainty created from the many names and theories. However, it is possible that sexual compulsivity may not prescribe to a single model, but be comprised of several overlapping, but distinct, components captured by a combination of theories. Future research may investigate this hypothesis via examination of items and factor loadings among the more widely administered measures of sexual compulsivity. Furthermore, future considerations should be made surrounding the lack of a consistent scale in the investigation into sexual compulsiv-

ity. Such inconsistency of implementation has led to muddled speculation surrounding sexual compulsivity, as many of the measures used capture similar, but varying aspects of sexual compulsivity. Researchers may also want to include questionnaires pertaining to each of the psychosocial syndemic indicators analyzed in this meta-analysis, especially among investigations using a longitudinal study design. Additionally, examining other populations beyond MSM would lead to a deeper comprehension into sexual compulsivity. Nonetheless, these results should aid in the beginnings of these endeavors to ultimately better understand sexual compulsivity as a whole and treat those suffering from this clinical phenomenon.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Human and Animal Rights This article does not contain any studies with human participants performed by any of the authors.

Appendix

See Tables 1 and 2 and Figs. 1, 2, 3, 4, 5, 6, and 7.

Table 1 Study search terms

Criterion A: sexual compulsivity	Sexual compulsivity; hypersexual disorder; compulsive sexual behavior; sexual addiction; sexual impulsivity; impulsive sexual behavior; problematic hypersexuality; highly sexually active; sexual sensation seeking	
Criterion B: MSM	Men who have sex with men; gay men; bisexual men; sexual minority men; GBMSM; MSM; homosexuality; homosexual men	
Criterion C: syndemic indicator	Depression	Depression; negative affect; distress; psychological well-being; depressive symptoms
	Anxiety	Anxiety; agitation; uneasiness; fearful; distress; negative affect; worry; psychological well-being; tension
	Alcohol use	Alcohol; alcohol use; intoxication; drinking; binge drinking
	Substance use	Drugs; club drugs; polydrug use; polydrug abuse; substance use/abuse; polysubstance use; polysubstance abuse; drug addiction; addiction
	Intimate partner violence	Intimate partner violence; domestic violence; IPV; partner violence; partner abuse
	Childhood sexual abuse	Childhood sexual abuse; CSA
	Sexual risk	Sexual risk; high-risk sexual behavior; HIV risk; sexual risk taking; unsafe sex; HIV transmission risk; unprotected sex; condomless sex; anal sex; anal intercourse

Table 2 Qualifying article totals: PRISMA flowchart in table form (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009)

	Depression	Anxiety	Alcohol use	Substance use	Intimate partner violence	Childhood sexual abuse	Sexual risk
Records identified through database searching	277	240	251	822	81	43	1450
Additional records identified through other sources	+1	+1	+0	+0	+0	+2	+0
Duplicates eliminated	−75	−30	−59	−404	−15	−15	−267
Records after duplicates removed/records screened	203	211	192	418	66	30	1183
Records excluded	−152	−162	−130	−327	−39	−6	−1079
After screening total	51	49	62	91	27	24	104
Full-text articles excluded, with reasons	−30	−40	−50	−75	−22	−11	−85
Effects coded/included in qualitative synthesis	21	9	12	16	5	13	19

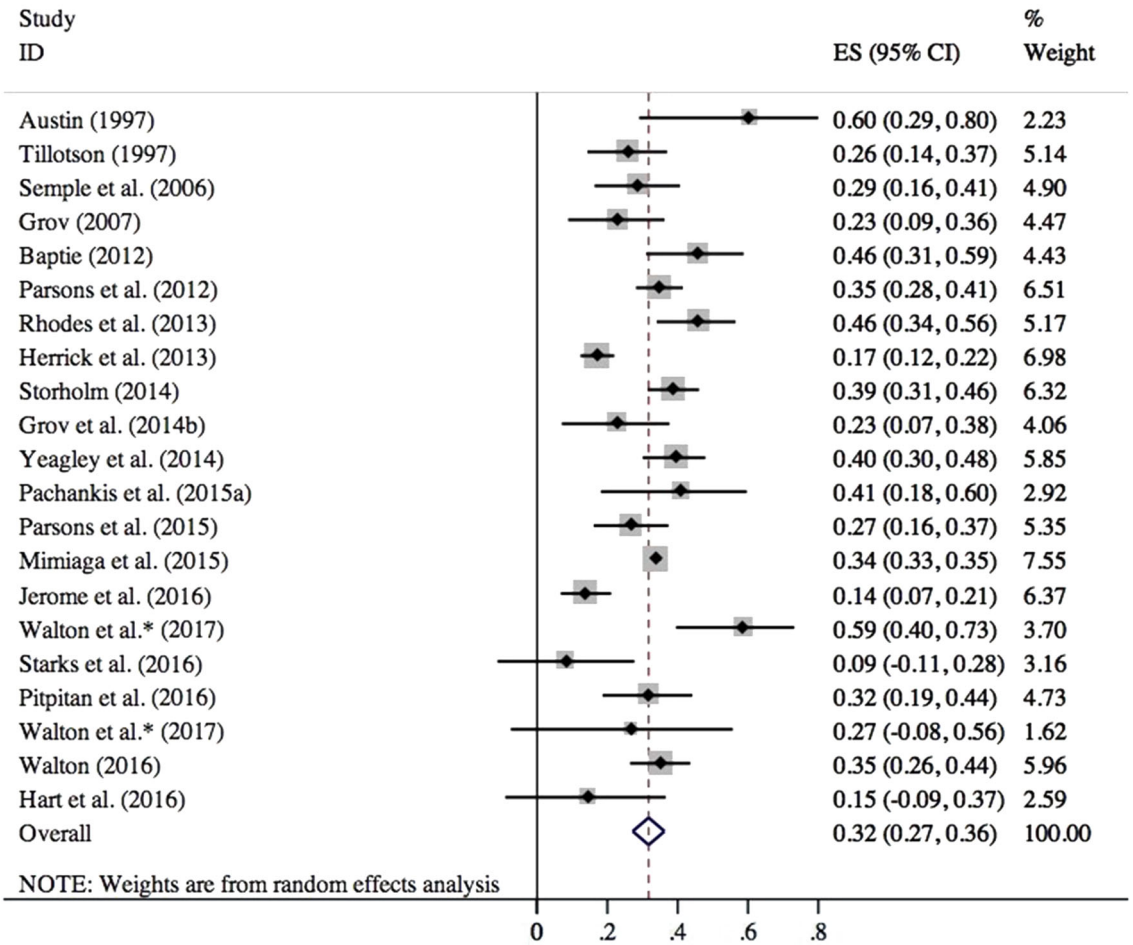

Fig. 1 Depression forest plot. The *solid line* denotes the "line of null effect"; the *dashed line* indicates the overall mean effect size as it relates to the individual studies; the *horizontal lines* indicate the 95% confidence intervals for each study in the analysis; the *bottom diamond* indicates the 95% confidence interval for the overall mean effect size. *From Walton, Cantor, and Lykins (2017)

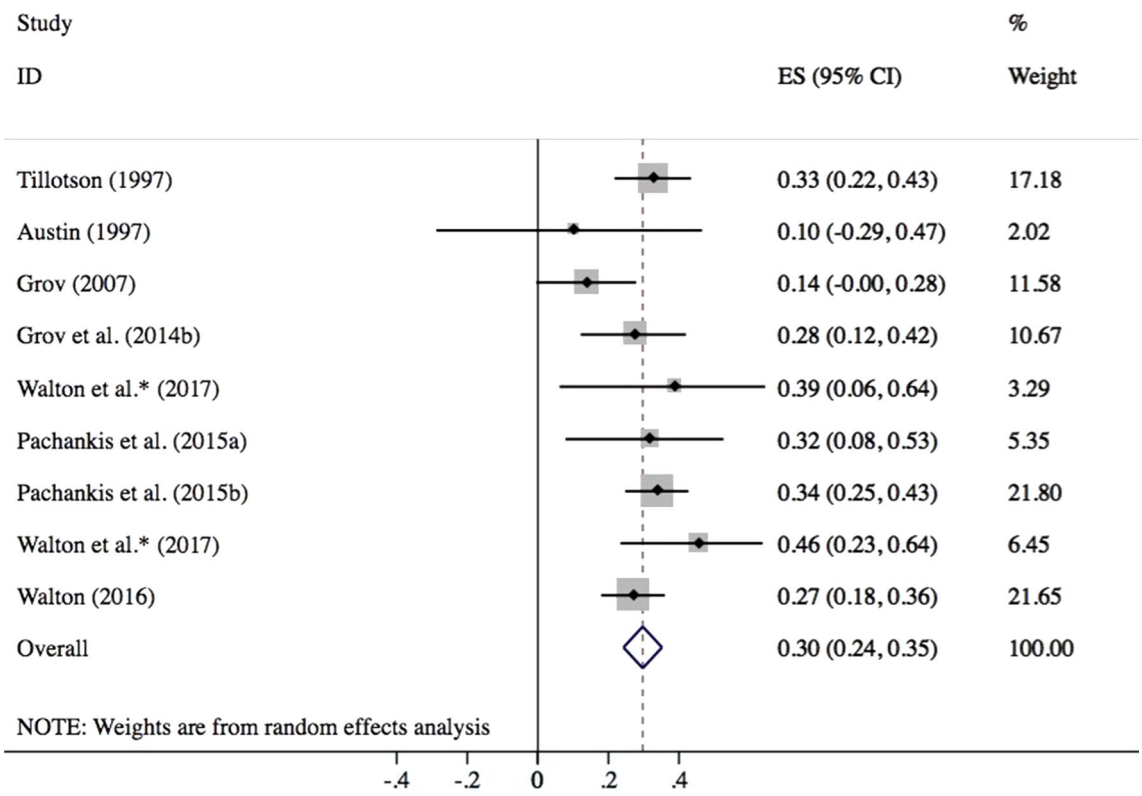

Fig. 2 Anxiety forest plot. The *solid line denotes* the "line of null effect"; the *dashed line* indicates the overall mean effect size as it relates to the individual studies; the *horizontal lines* indicate the 95% confidence intervals for each study in the analysis; the *bottom diamond* indicates the 95% confidence interval for the overall mean effect size. *From Walton, Cantor, & Lykins (2015)

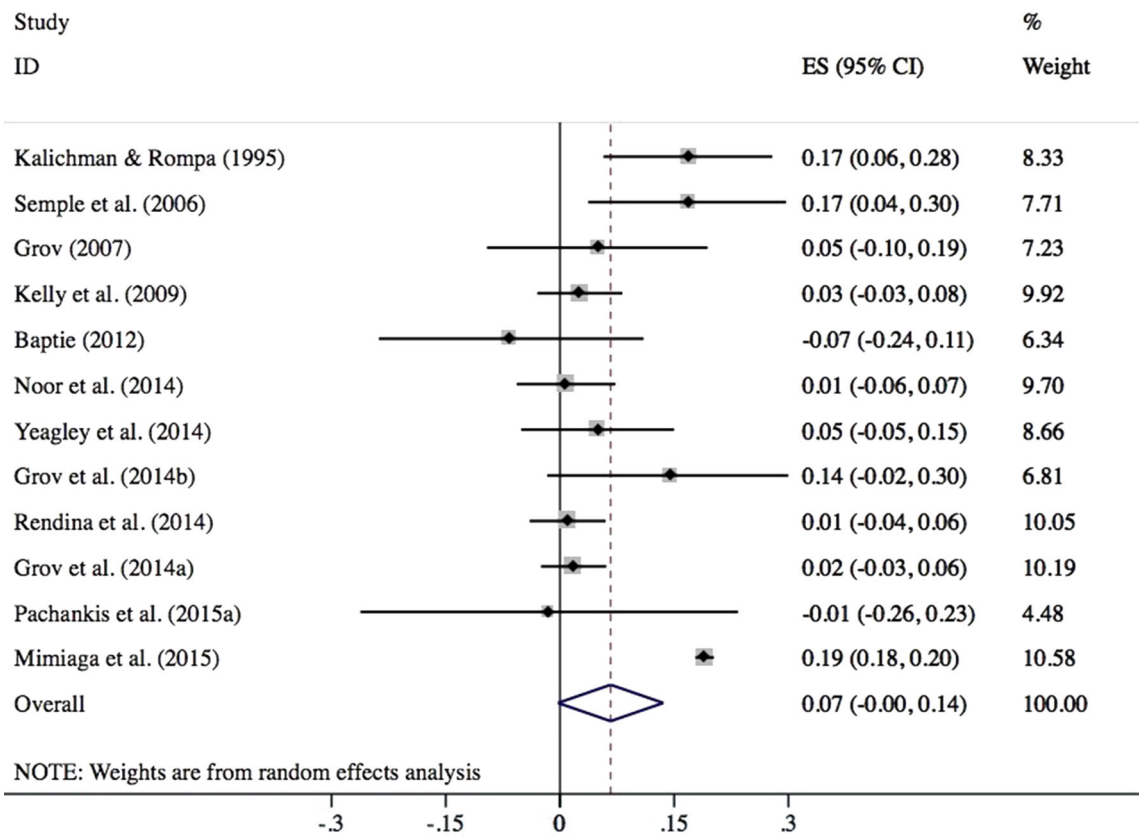

Fig. 3 Alcohol use forest plot. The *solid line* denotes the "line of null effect"; the *dashed line* indicates the overall mean effect size as it relates to the individual studies; the *horizontal lines* indicate the 95% confidence intervals for each study in the analysis; the *bottom diamond* indicates the 95% confidence interval for the overall mean effect size

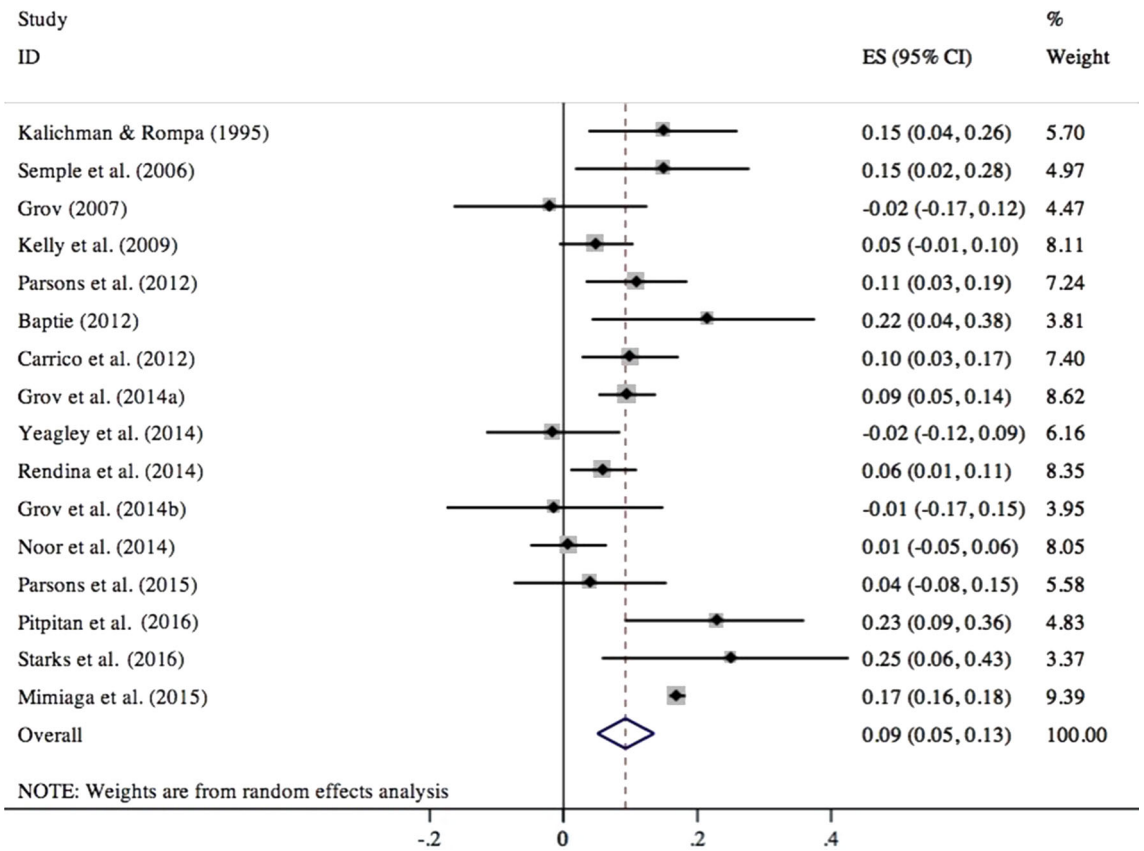

Fig. 4 Substance use forest plot. The *solid line* denotes the "line of null effect"; the *dashed line* indicates the overall mean effect size as it relates to the individual studies; the *horizontal lines* indicate the 95% confidence intervals for each study in the analysis; the *bottom diamond* indicates the 95% confidence interval for the overall mean effect size

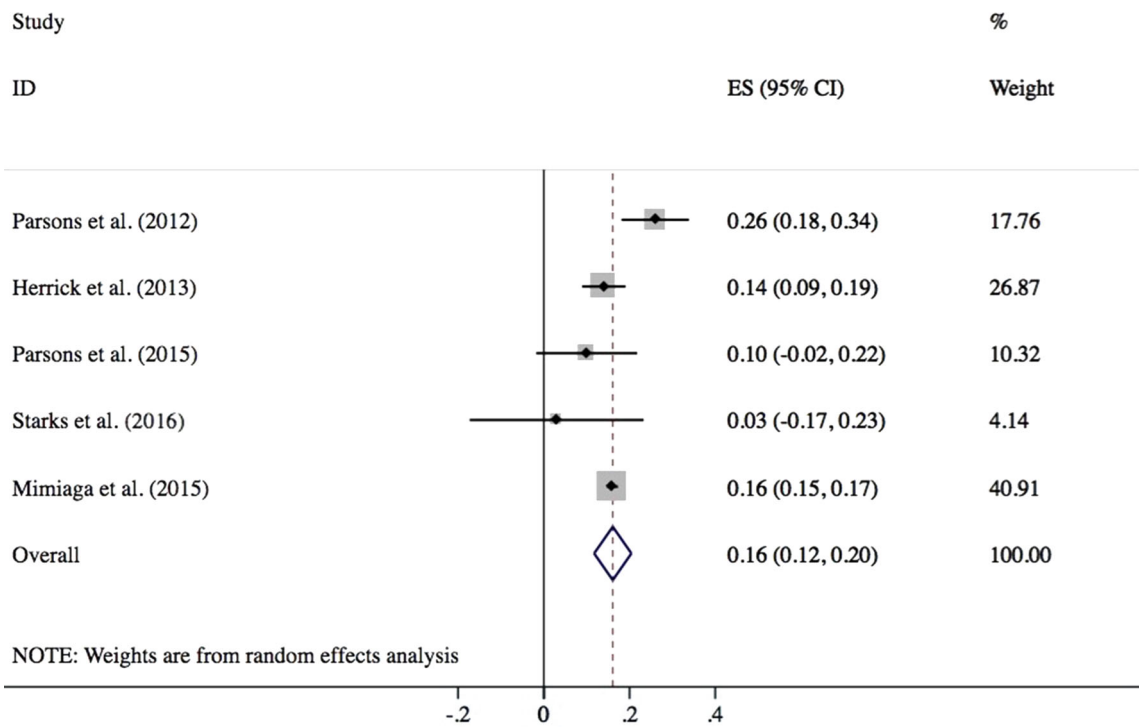

Fig. 5 Intimate partner violence forest plot. The *solid line* denotes the "line of null effect"; the *dashed line* indicates the overall mean effect size as it relates to the individual studies; the *horizontal lines* indicate the 95% confidence intervals for each study in the analysis; the *bottom diamond* indicates the 95% confidence interval for the overall mean effect size

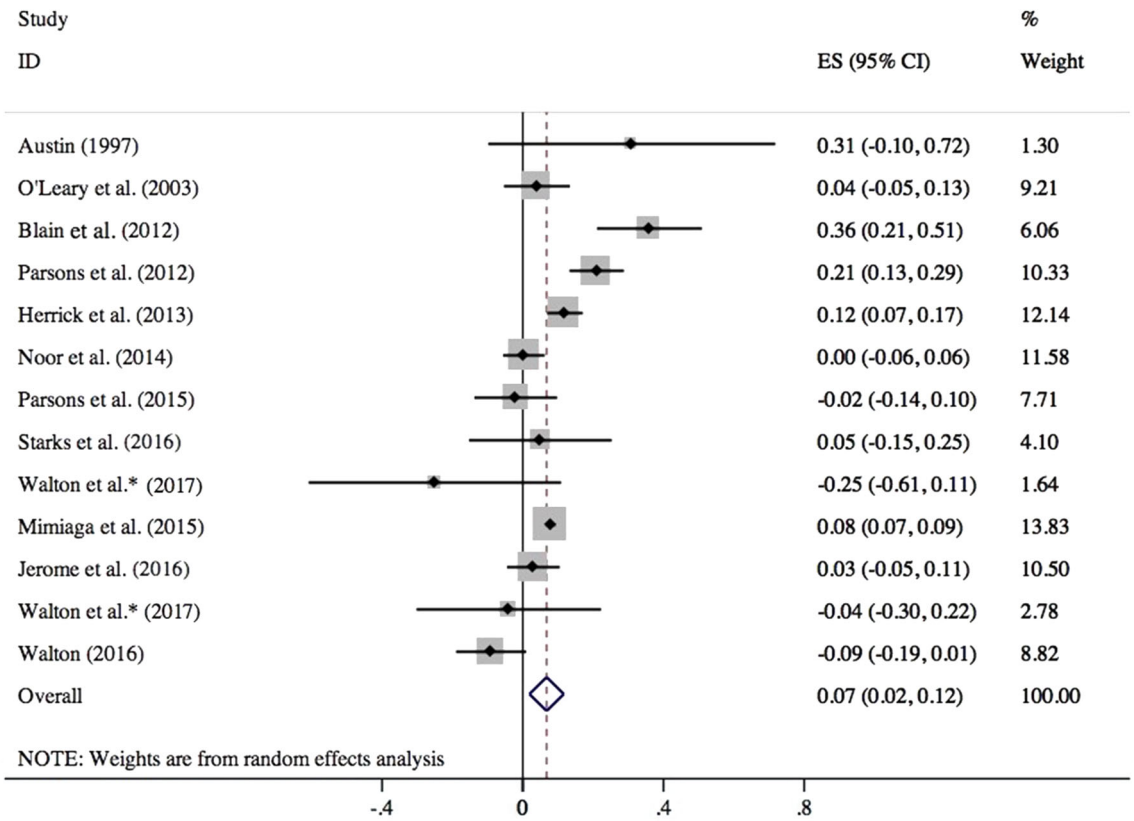

Fig. 6 Childhood sexual abuse forest plot. The *solid line* denotes the "line of null effect"; the *dashed line* indicates the overall mean effect size as it relates to the individual studies; the *horizontal lines* indicate the 95% confidence intervals for each study in the analysis; the *bottom diamond* indicates the 95% confidence interval for the overall mean effect size. *From Walton, Cantor, and Lykins (2017)

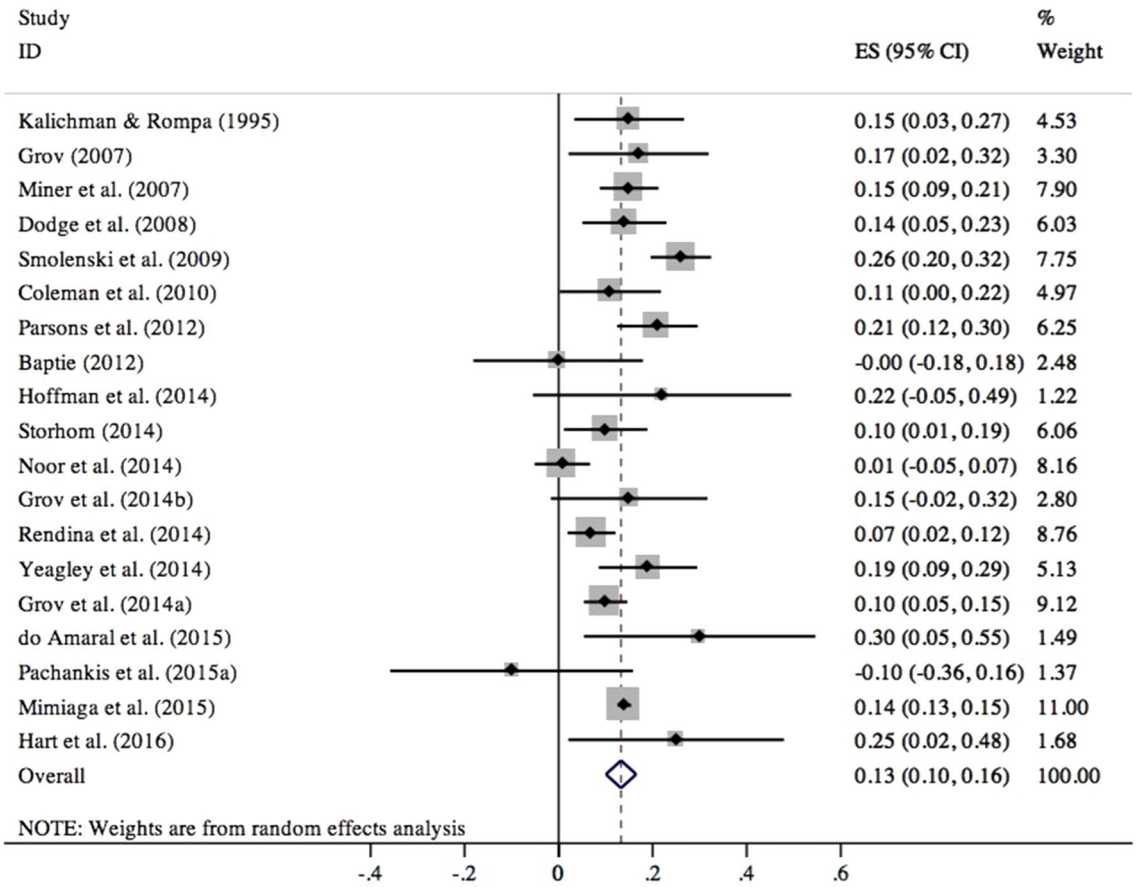

Fig. 7 Sexual risk behaviors forest plot. The *solid line* denotes the "line of null effect"; the *dashed line* indicates the overall mean effect size as it relates to the individual studies; the *horizontal lines* indicate the 95% confidence intervals for each study in the analysis; the *bottom diamond* indicates the 95% confidence interval for the overall mean effect size

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(*denotes study inclusion)

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