

Childhood Sexual Abuse and Adolescent Pregnancy: A Meta-analytic Update

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Objective Recent increases in adolescent pregnancies have sparked a renewed impetus to identify risk factors, such as childhood sexual abuse (CSA), associated with adolescent pregnancy. Given mixed evidence regarding the strength of the relationship between CSA and adolescent pregnancy (Blinn-Pike, Berger, Dixon, Kuschel, & Kaplan, 2002), our objective was to provide an estimate of the effect size of this relationship using updated literature and meta-analytic techniques. **Methods** Meta-analyses of 21 studies were conducted using a random effects model of binary outcomes to determine aggregate effect-size estimates controlling for study heterogeneity. **Results** CSA significantly increased the odds of experiencing an adolescent pregnancy by 2.21-fold (95% CI: 1.94–2.51). A supplemental analysis suggested that 4.5 out of 10 pregnant adolescents may have a prior history of CSA. **Conclusions** CSA places females at increased risk for subsequent adolescent pregnancy. Addressing conditions associated with CSA might impact the overall adolescent pregnancy rate.

Key words child abuse and neglect; high-risk behaviors; meta-analysis.

Introduction

Rates of adolescent pregnancy and motherhood, for all age groups and ethnicities within the United States, are at their lowest levels in recent history. Pregnancy and motherhood rates for adolescents 15–19 years of age have declined 36 and 34%, respectively, since 1991 (Martin et al., 2007; The Alan Guttmacher Institute, 2006). Yet, even with this substantial decline, rates of adolescent pregnancy and motherhood in the United States are still among the highest in industrialized nations, with 7.5% of adolescents becoming pregnant each year and over 4% becoming mothers (Hoffman, 2006; Martin et al., 2007). These numbers are considered in view of recent data showing a 3% overall increase in the number of adolescent births during 2006, the first time an increase has occurred in 15 years (Hamilton, Martin, & Ventura, 2007). Although the reasons for this increase in adolescent births are unknown, this result is especially troublesome because adolescent motherhood is known to be associated with poverty (Furstenberg, Brooks-Gunn, & Morgan, 1987; Moore et al., 1993), fewer years of maternal education (Hofferth, Reid, & Mott, 2001; Nord, Moore, Morrison, Brown, & Myers, 1992), and

rapid-repeat pregnancies (Boardman, Allsworth, Phipps, & Lapane, 2006). In addition, children of adolescent mothers are more likely to face cognitive and academic impairment, increased behavior problems, and a greater likelihood of becoming an adolescent parent themselves (Brooks-Gunn & Furstenberg, 1986; Corcoran, 1998; Furstenberg et al., 1987). At its current level, adolescent motherhood is estimated to cost 9.1 billion dollars annually (Hoffman, 2006). Given this inordinate public health impact, there is continued impetus to understand comprehensively the various pathways to adolescent pregnancy and motherhood in order for intervention and prevention programs to be at maximum efficacy.

A comprehensive picture of adolescent pregnancy risk factors includes (a) cognitive or attitudinal vulnerabilities such as positive or ambivalent attitudes toward sex and childbearing, perceived invulnerability to pregnancy, a lack of contraception knowledge, perceived parental approval of birth control use, and low educational and occupational expectations (Anda et al., 2001; Jaccard & Dittus, 2000; Miller, 2002; Polacsek, Celentano, O'Campo, & Santelli, 1999; Quinlivan, Tan, Steele, & Black, 2004;

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Stevens-Simon, Kelly, Singer, & Cox, 1996); (b) romantic partner characteristics such as being in a relationship with a violent romantic partner, dating older boyfriends, having early and high levels of seriousness with boyfriends, and difficulty negotiating the use of birth control with a partner (Berry, Shillington, Peak, & Hohman, 2000; Brazzell & Acock, 1988; Marin, Coyle, Gomez, Carvajal, & Kirby, 2000; Polacsek et al., 1999; Salazar et al., 2004; Santelli et al., 2004; Silverman, Raj, Mucci, & Hathaway, 2001; Whitbeck, Yoder, Hoyt, & Conger, 1999); and (c) familial and contextual factors such as socioeconomic status, single-parent families, family violence, having an older, sexually active sibling or pregnant/parenting adolescent sister, low maternal education, lack of parental warmth and supervision, parental approval of sex, contraception, early dating, and low perceived support from parents and peers (Berry et al., 2000; Chandy, Blum, & Resnick, 1996; Connolly, Furman, & Konarski, 2000; East & Jacobson, 2001; Jaccard & Dittus, 2000; Meschke, Zweig, Barber, & Eccles, 2000; Mezzich et al., 1999; Miller, Benson, & Galbraith, 2001; Miller, McCoy, & Olson, 1986; Quinlivan et al., 2004; Santelli, Lowry, Brener, & Robin, 2000; Scaramella, Conger, Simons, & Whitbeck, 1998; Sieving et al., 2001). Despite intervention efforts addressing these identified risk factors, adolescent pregnancy continues at a high rate and remains a significant social concern.

There are several plausible explanations for the persisting high rates of adolescent pregnancy and motherhood, such as additional, unidentified risk factors explaining a large proportion of adolescents who become pregnant. One area that has received considerable attention is whether individuals who experienced childhood maltreatment (sexual, physical, and emotional abuse) show higher rates of adolescent pregnancy and motherhood in comparison to their non-maltreated counterparts. Childhood sexual abuse (CSA), in particular, has received much of the focus, perhaps due to the sexual nature of the act and the considerable literature regarding sexual disturbances and distortions, greater pregnancy desire or intent, earlier age of intercourse, multiple sexual partners, and concerns about infertility that have been studied as developmental sequelae of CSA (Boyer & Fine, 1992; Butler & Burton, 1990; Noll, Trickett, & Putnam, 2003; Rainey, Stevens-Simon, & Kaplan, 1995; Raj, Silverman, & Amaro, 2000; Stevens-Simon & Reichert, 1994). While there have been several studies linking child maltreatment and adolescent pregnancy (Fiscella, Kitzman, Cole, Sidora, & Olds, 1998; Kellogg, Hoffman, & Taylor, 1999; Smith, 1996), there remains considerable controversy in this

literature because studies report inconsistent findings or a lack of relationship between abuse and adolescent pregnancy or motherhood (Adams & East, 1999; Widom & Kuhns, 1996).

In a comprehensive literature review, Blinn-Pike et al. (2002) examined previous studies to determine the connection between childhood maltreatment and adolescent pregnancy. The authors used explicit inclusion criteria that included a clear definition of maltreatment involving physical, sexual, or emotional abuse, or all, and limited their search criteria to empirical studies published between 1980 and 2000. The search yielded 15 published articles and, based on their review, Blinn-Pike et al. (2002) concluded that a causal link between child maltreatment and adolescent pregnancy could not be determined because of conflicting results in the literature and methodological limitations such as cross-sectional designs and retrospective methods of data collection.

The current article sought to build on issues raised in the review of Blinn-Pike et al.. First, we focused explicitly on CSA in order to provide homogeneity with regard to the group of "maltreated children." Second, we used meta-analysis to empirically derive estimates about the relationship between CSA and adolescent pregnancy instead of relying solely on an impressionistic review of the literature. Our primary meta-analysis relied on well-designed studies that included adequate comparison groups in order to evaluate stringently the relationship between CSA and rates of adolescent pregnancy in direct comparison to non-abused adolescent peers. We supplemented this primary analysis by executing a secondary analysis that included studies without relevant control conditions in order to provide a comprehensive analysis of the largest number of extant studies examining the topic. Finally, we included studies that have been published subsequent to the original review of Blinn-Pike et al. (2002) to ensure the most up-to-date findings. It should be noted that, by and large, the adolescent pregnancy literature [including the review of Blinn-Pike et al. (2002)] makes little distinction between adolescent pregnancy and adolescent motherhood and the two terms often are used interchangeably. Although these two outcomes are highly distinctive and each is associated with differing long-term sequelae for women, we found it very difficult to focus exclusively on one or the other, given that many of the study designs and operational definitions made it difficult to disaggregate the two outcomes. In order to be consistent with the literature and to avoid arbitrarily excluding relevant studies based solely on the operational definitions (or lack thereof) of outcomes, we combined studies that examined adolescent

pregnancy, studies of adolescent motherhood, and studies that did not make a distinction between the two, in the present meta-analyses. Henceforth, the term adolescent pregnancy is used to describe the outcome of interest with full acknowledgement that this term is inclusive of both adolescent pregnancy and adolescent motherhood.

Method

To be included in the analyses, each study was required to meet specific inclusion criteria. Inclusion criteria consisted of: (a) studies focused on female participants, (b) self-reported or documented experiences of some form of CSA, exclusively or in combination with other forms of childhood maltreatment, (c) reported or derived (e.g., via offspring birth dates) experiences of adolescent pregnancy as operationally defined by the respective authors, (d) studies published in English, and (e) original empirical contributions published in peer-reviewed journals. Attempts to contact the corresponding authors were made when sample characteristics needed to determine a study's inclusion were not reported or easily identifiable in the respective study. Studies using both prospective and retrospective methods of data collection were included in the analysis. Adolescent pregnancy was defined as pregnancy or motherhood prior to age 20 years for the majority of studies ($n = 18$) with two studies reporting an upper age limit of 20 years and one study reporting an upper age limit of 21 years (these studies are denoted in Table II, as is the fact that the percentage of enrollees older than 20 years is minute). CSA was defined per respective study operational definition criteria and thus is broadly defined to include unwanted sexual experiences ranging from overt verbal advances, exposure to sexual media, unwanted touching, or penetration. This range of sexual abuse constitutes a wide spectrum of relatively mild to more severe forms; however, most studies included cases at varying points along this continuum and there were no studies that focused solely on the mild or severe ends. Hence, this broad definition of CSA was essentially unavoidable and was utilized because it reflects the nature of the majority of definitions that currently comprise the CSA literature facilitating the inclusion of as many relevant studies as possible.

Literature Search

Literature searches of peer-reviewed journals were conducted on the PubMed, Medline, CINAHL, PsycArticles, and PsychInfo databases between the years 1980 and 2007 to identify studies meeting our inclusion criteria. Each search crossed the term "sexual abuse" with terms

associated with adolescent pregnancy. The reference sections of identified studies and literature reviews (Becker-Lausen & Rickel, 1995; Blinn-Pike et al., 2002; Tyler, 2002) examining child sexual abuse were also reviewed to retrieve studies not included in the results of our electronic searches.

The searches yielded a total of 407 articles, all of which were returned from electronic searches and article reviews, screened, and cross-referenced to remove duplicates. Of this pool, a total of 40 articles met our criteria, warranting further examination. A closer examination of these 40 articles resulted in 20 being excluded based on the following grounds: (a) the outcome variable did not include pregnancy per se but instead focused on high-risk sexual behaviors (Abma, Driscoll, & Moore, 1998; Hillis, Anda, Felitti, & Marchbanks, 2001; Rainey et al., 1995; Senn, Carey, Vanable, Coury-Doniger, & Urban, 2006; Upchurch & Kusunoki, 2004), (b) the study's focus was on childhood maltreatment combined into a single category precluding the disaggregating of child sexual abuse from other forms of maltreatment (Smith, 1996; Thornberry, Ireland, & Smith, 2001), (c) the study's author(s) did not respond to requests for additional data so as to facilitate the primary or secondary analyses (Buzi et al., 2003; Mason, Zimmerman, & Evans, 1998; Nagy, DiClemente, & Adcock, 1995; Roberts, O'Connor, Dunn, & Golding, 2004), (d) all the participants were sexually abused (i.e., a non-abused comparison group was not included) (Cinq-Mars, Wright, Cyr, & McDuff, 2003; Raj et al., 2000), (e) analyses focused on male paternity (Anda et al., 2001, 2002; Pierre, Shrier, Emans, & DuRant, 1998), and (f) the article reported a review of the literature and no original data were presented (Becker-Lausen & Rickel, 1995; Blinn-Pike et al., 2002; Resnick & Acierno, 1997; Stevens-Simons & Reichert, 1994). As a result, we were able to include a comprehensive array of extant data including 12 of the 15 articles referenced in the review of Blinn-Pike et al. (2002) [3 were excluded in our initial set of 20 articles (Nagy et al., 1995; Rainey et al., 1995; Smith, 1996)] plus 8 additional articles published between 1980 to 2007, totaling 20 articles.

Thirteen of the remaining 20 articles met all inclusion criteria, yielding 14 distinct studies; the article by Saewyc, Magee, and Pettingell (2004) reported on two samples (designated in this paper as Saewyc, 2004); therefore, we gleaned 14 studies from the 13 articles. These 14 studies constitute our primary meta-analysis: the aggregate between-group effect size estimate of an odds ratio (OR) test among four distinct cells of individuals including

sexually abused/pregnant, sexually abused/non-pregnant, non-abused/pregnant, and non-abused/non-pregnant cells (Table I). There were seven remaining articles meeting full inclusion criteria but whose study design did not include a non-pregnant comparison group (Table II). Although not optimally designed for inclusion in our primary meta-analysis, these studies contain valuable information about the rate of abused females within samples of pregnant adolescents and therefore were considered supplementary in nature. As such, our secondary meta-analysis included these seven supplementary studies in addition to the pregnant arms (sexually abused/pregnant vs. non-abused/pregnant) of the 14 studies used in the primary meta-analysis. Hence, all 21 studies constituted the basis for our secondary meta-analysis: the probability of having a history of CSA among pregnant adolescents.

Data Coding

All information was collected from tables, figures, or text of the respective study and coded accordingly. Based on the study descriptions and reported methodologies of the eligible studies, coding was accomplished to determine sample characteristics such as sexual abuse status, pregnancy status, study design, study method, and country where the study was conducted. Sexual abuse status was coded as sexually abused (1) versus non-abused (0) and adolescent pregnancy status was coded as pregnant (1) versus non-pregnant (0). Study design was categorized as either using a retrospective (retrospective recall of prior sexual abuse or adolescent pregnancy, or both) or

prospective (longitudinal follow-up of victims with substantiated, confirmed sexual abuse into adolescence and early adulthood in order to ascertain adolescent pregnancy rates) means of data collection. Study method was classified based on whether the researchers used interview (face-to-face interview), survey (checklist or medical record search), or documentation [via Child Protective Services (CPS) reports] to capture sexual abuse. Since there were only two studies relying on CPS reports (Noll et al., 2003; Widom & Kuhns, 1996), this method was combined with other interview studies for purposes of method evaluation because it most closely resembles interview methodology (i.e., interviews with social workers and other individuals comprise the case reports) and so that we could enhance power to detect differences between studies interview versus survey methods. Study country of origin was coded simply by identifying and listing where the study was conducted and categorized as US or Outside US. Study design, method, country, and sample and subsample sizes in Table I were rated to determine coding reliability by two independent coders. Kappa coefficients for these variables ranged from .69 to 1.00, indicating substantial to perfect agreement. Discrepancies in coding were reconciled and a consensus was achieved. Table I summarizes data retrieved and coded from each of the 14 studies in the primary meta-analysis and contrasts four distinct groups of females, as depicted in columns 1 through 4: sexually abused/pregnant, sexually abused/non-pregnant, non-abused/pregnant, and non-abused/non-pregnant. Table II summarizes data coded from each of the seven studies that

Table I. Summary of Studies Included in the Primary Meta-analysis

Citation	Sexually abused/ pregnant <i>n</i> (%)	Sexually abused/ Non-pregnant <i>n</i> (%)	Non-abused/ Pregnant <i>n</i> (%)	Non-abused/ non-pregnant <i>n</i> (%)	Total <i>N</i> ^a	Study design	Country
Adams and East (1999)	16 (55)	13 (45)	34 (49)	36 (51)	99	I; R	US
Chandy et al. (1996)	98 (10)	913 (90)	50 (5)	961 (95)	2,022	S; R	US
Fergusson et al. (1997)	14 (16)	76 (84)	29 (7)	401 (93)	520	I; R	NZ
Haley et al. (2004)	67 (48)	74 (52)	27 (32)	57 (68)	225	S; R	CAN
Herrenkohl et al. (1998)	33 (48)	36 (52)	20 (28)	51 (72)	140	I; R	US
Hillis et al. (2004)	728 (32)	1534 (68)	1,410 (21)	5,416 (79)	9,088	S; R	US
Kenney et al. (1997)	250 (37)	432 (63)	253 (21)	975 (79)	1,910	S; R	US
Noll et al. (2003)	22 (33)	44 (67)	7 (10)	65 (90)	138	I ^b ; P	US
Romans et al. (1997)	40 (16)	207 (84)	15 (7)	206 (93)	468	I; R	NZ
Roosa et al. (1997)	254 (36)	451 (64)	273 (21)	1,025 (79)	2,003	S; R	US
Saewyc et al. (2004)	979 (26)	2,786 (74)	1097 (11)	8,879 (89)	13,741	S; R	US
Saewyc et al. (2004)	580 (22)	2,058 (78)	952 (10)	8,569 (90)	12,159	S; R	US
Stock et al. (1997)	21 (7)	286 (93)	65 (3)	2,032 (97)	2,404	S; R	US
Widom & Kuhns (1996)	12 (16)	64 (84)	51 (21)	193 (79)	320	I ^b ; P	US

^aThe total *N* reflects the total number of subjects across each of the four cells analyzed and may not necessarily reflect the total *N* reported in studies where these four cells represents only a portion of the total *N*.

^bInterview method in these cases indicates a substantiated CPS investigation occurred.

I, Interview; S, Survey; P, Prospective; R, Retrospective; US, United States; CAN, Canada; NZ, New Zealand.

were included in the secondary meta-analysis and did not have non-pregnant comparison groups.

Results

Analytic Strategy

The goal of meta-analysis is to derive a single best estimate of a population effect size, utilizing individual parameter estimates reported across several studies. Our primary meta-analysis concerned the odds (as expressed in terms of ORs) of an adolescent pregnancy occurring in individuals with and without a history of CSA. We derived estimates of effect size using OR of the binary outcome (pregnant vs. not pregnant), via SAS PROC MIXED, and their associated log variances based on individual study point estimates. A mean OR was then calculated from all individual study point estimates to reflect the overall estimable effect size (Sutton, Abrams, Jones, Sheldon, & Song, 2000). Our secondary meta-analysis focused only on studies of adolescents who were already pregnant and the probability of prior CSA histories present in these studies. Hence, we consider this secondary analysis to be

Table II. Summary of Studies Included in the Secondary Meta-analysis^a

Citation	Sexually abused/ pregnant <i>n</i> (%)	Total <i>N</i>
Boyer and Fine (1992) ^b	295 (62)	476 ^c
Butler and Burton (1990)	22 (54)	41
Esperat and Esparza (1997) ^b	51 (46)	111
Fiscella et al (1998)	126 (13)	957 ^d
Herman-Giddens et al. (1998)	231 (31)	734
Kellogg et al. (1999) ^b	75 (49)	153 ^c
Steven-Simon and McAnarney (1994)	42 (33)	127

^aAll studies reported in this table examined samples where all subjects were currently pregnant or mothering.

^bThis study reported a total sample size of 535, however 59 subjects provided insufficient or conflicting data and were excluded from this analysis. This resulted in a reduced total sample size of 476.

^cAlthough the total sample size for this study was reported as 1,026 we analyzed only those who were sexually abused ($N = 126$) in comparison to the total number of non-abused ($N = 831$) resulting in total $N = 957$ for purposes of the present meta-analysis.

^dTotal sample size reported in this study was 166. However, the authors indicated 13 subjects (8% of sample) were unsure whether they experienced sexual abuse and were therefore excluded in our analysis.

^eOperational definitions of adolescent pregnancy included pregnancies over the age of 20 for these studies: 11% were aged 20–21 in the Boyer and Fine (1992) study; 6% were aged 19–20 in the Esperat and Esparza (1997) study; we were unable to obtain the distribution of 20–21 year-olds from the Kellogg et. al., (1999) study. To assess potential bias in the estimated odds attributable to these three studies, a nested likelihood ratio test was performed for the full ($N = 21$) versus nested ($N = 18$) models. Results indicated that there was not a significant difference in model fit between the full (Odds = 0.81; $-2 \log\text{-likelihood} = 49.10$) and nested (Odds = 0.77; $-2 \log\text{-likelihood} = 44.10$) models, $\chi^2(3) = 5.00$, $p = .17$. Hence, these three studies did not significantly influence the overall odds derived in the secondary meta-analysis.

supplemental and not definitive in nature because only non-comparative binary outcomes could be examined, simply reflecting the probability of these particular samples of pregnant adolescents having a prior history of CSA.

Primary Meta-analysis

Cochran's Q Homogeneity statistic indicated significant heterogeneity ($p < .01$) between studies. A significant Q -statistic suggests that the error observed in a group of studies is significantly different than what would be expected from sampling error alone and is likely the result of additional variation and indicates the necessity to apply a random effects model in order to estimate a common effect size while controlling this heterogeneity (Knapp & Hartung, 2003; Petitti, 2001). A random effects model was then examined to calculate a reliable estimate of the effect size while incorporating between study variance. Random effects models incorporate heterogeneity by assuming that the study effects are randomly distributed within a sample taken from a population of all studies. Results of the random effects model produced an effect size estimate of $OR = 2.21$ (95% CI: 1.94–2.51), indicating that victims of CSA are 2.21 times more likely to experience an adolescent pregnancy than are women without such histories. As is depicted in the forest plot of Fig. 1, 12 of the 14 studies reported significantly higher rates of adolescent pregnancy among girls who had a previous history of CSA.

Although by definition the random effects estimate is unbiased with respect to study heterogeneity, a set of post hoc analyses attempted to identify the potential sources of heterogeneity across studies, given the significant Q -statistic at the fixed effects level. Covariates defining study design, method, and country were univariately (one at a time) added to the primary meta-analysis. F -values associated with covariates were then evaluated for significance. Statistical tests of heterogeneity and covariate analyses typically have lower power than other meta-analytic tests. Hence, as suggested by others (Petitti, 2001), we adopted a significance level of $p < .10$ instead of traditional levels of $p < .05$ to avoid Type II errors. Each covariate had a non-significant F -value: study design, $F = 2.26$, $p = 0.13$; method, $F = 0.60$, $p = 0.44$; and country, $F = 0.06$, $p = 0.81$. Non-significant F -values suggested that covariates did not significantly alter the overall OR derived from the primary meta-analysis.

Sensitivity analyses were conducted in order to evaluate whether any single study was overly influential, thereby biasing the effect size estimate. Serial sensitivity analyses involving each of the 14 studies consisted

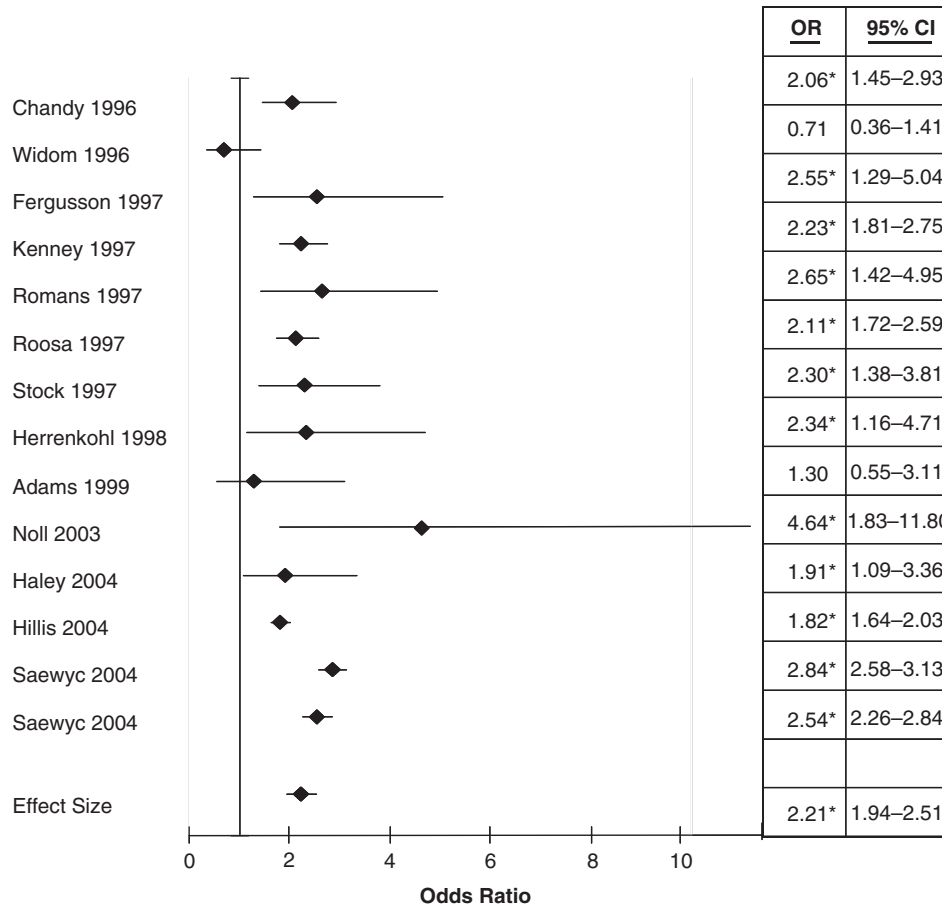


Figure 1. Forest plot of studies included in the primary meta-analysis depicting the likelihood (via odds ratio effect size calculations) of childhood sexual abuse victims experiencing an adolescent pregnancy. *Note:* *Significant OR ($p < .05$).

of comparisons between the mean effect size generated in the full random effects model and the effect sizes generated in reduced models that omitted one study at a time. If any single study was extremely influential in the overall mean effect size estimate, then omitting that study would produce a significantly different mean OR. Results indicate that the OR's did not significantly differ across the 13 nested models (range OR: 2.12–2.53), suggesting that there was not a single study biasing the overall mean estimate.

Secondary Meta-analysis

The secondary meta-analysis focused on the non-comparative binary outcome of the probability of pregnant adolescents having had a prior history of CSA. For this meta-analysis, the pregnant arms from each of the 14 studies used in the primary analysis were combined with the additional 7 pregnant-only studies described in Table II resulting in a total of 21 studies from which to calculate the probability of having a history of CSA in samples of pregnant adolescents. The effect sizes reported in Fig. 2

were calculated by evaluating the number of events (sexually abused/pregnant) divided by the number of non-events (non-abused/pregnant) using the same analytic procedures as described above for the primary meta-analysis. As was the case in the primary meta-analysis, the Q -statistic was significant, suggesting significant heterogeneity between studies and necessitating the use of a random effects model to control for this heterogeneity. Results from the random effects model yielded an overall effect size estimate (as expressed in terms of “odds” yielded from the SAS PROC MIXED output) equal to 0.81 (range 0.15–3.14), which was significantly different from zero, as illustrated in the forest plot of Fig. 2. This resulting statistic reflects that, on average across 21 studies, the probability that a pregnant adolescent had a prior history of CSA was roughly 4.5 out of 10 (i.e., $0.81 / (1 + 0.81) = 0.45$). As can be seen in Table II, three of the studies included on the secondary analysis included some women over the age of 20 years. Secondary analyses were performed with and with and without these three studies, with no significant differences in the overall odds for this nested comparison.

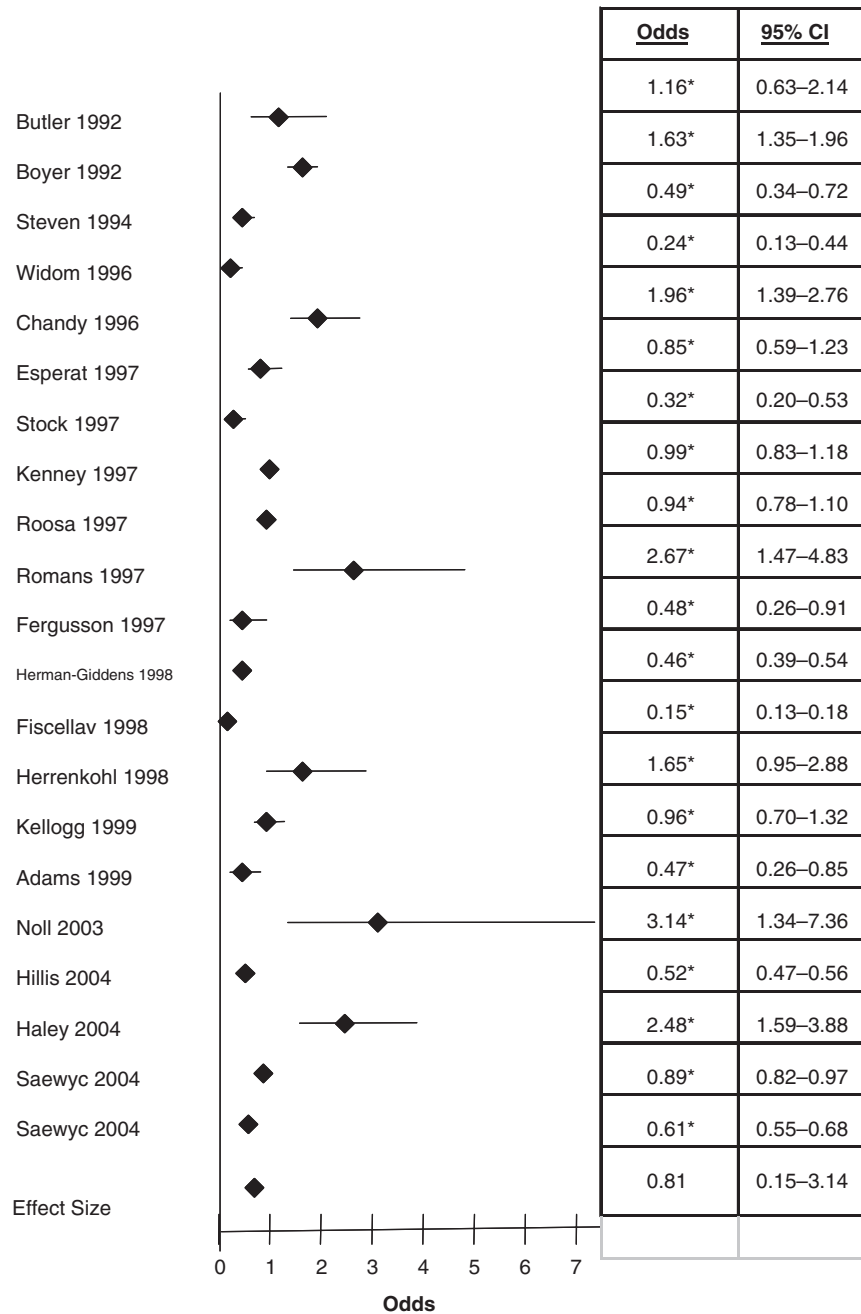


Figure 2. Forest plot of studies included in the secondary analysis depicting the odds of a pregnant adolescent having a history of childhood sexual abuse. *Note:* *Significant OR ($p < .05$).

Discussion

Overall, results from this study lend further empirical support to the conclusion that CSA increases the risk of becoming pregnant during adolescence. Based on our primary analysis of 14 distinct samples using appropriate comparison groups, women who had a history of CSA were more than two times more likely to have experienced a pregnancy in adolescence than women who did not experience abuse. This result, based on an aggregate

estimated effect size from 14 studies, was upheld when stringent evaluative procedures were employed including differential methodological covariates and serial study specificity evaluations. To our knowledge, this is the first systematic meta-analysis to empirically test the extent of the relationship between CSA and adolescent pregnancy, which is a considerable advancement relative to extant generalized conclusions that have been based on subjective reviews of the literature (Blinn-Pike et al., 2002).

A secondary, supplemental meta-analysis of the pregnant-only arms of 21 studies suggested that, on average, 4.5 in 10 pregnant adolescents likely have a prior history of CSA. It should be noted that the studies used in this secondary analysis may not necessarily be representative of the larger population of pregnant adolescents because several were regionally (Boyer & Fine, 1992) or racially (Fiscella et al., 1998) focused. However, none of these studies included samples at particularly high risk (i.e., samples selected solely on low socioeconomic status) such that generalizability would be systematically compromised. Albeit not based on controlled methodologies and not necessarily representative of all pregnant adolescents, this secondary meta-analysis provides supplemental evidence for an empirical association between CSA and adolescent pregnancy. Considered in light of US adolescent pregnancy rates that are on the rise for the first time in almost two decades, these results imply that victims of CSA may be a particularly important group of adolescents to target for intervention.

Possible Mechanisms Leading Sexually Abused Children to Adolescent Pregnancy

There are several plausible, theoretical reasons why CSA in particular might be associated with higher rates of adolescent pregnancy. First, many of the identified pregnancy risk factors for adolescents in general have also been studied as correlates or outcomes attributable, at least in part, to the experience of sexual abuse (Cicchetti & Lynch, 1995; Feiring, Taska, & Lewis, 2002; Kendler et al., 2000; Thornberry et al., 2001; Trickett & McBride-Chang, 1995). Ergo, it is quite plausible that the experience of CSA serves to amplify these risks. Second, due to the explicit sexual nature of this form of abuse, there are likely unique risk mechanisms operating for victims that may not necessarily be salient for non-victims or victims of other forms of childhood adversity.

For example, models for the development of psychopathology (Cicchetti & Carlson, 1989) posit that child abuse likely requires a child to make adaptations that may alter the child's developmental trajectory and disrupt the consolidation of emotional or social-cognitive skills, or both. Several conceptual models have been proposed describing how forms of maltreatment might affect social cognitions including the alteration of cognitive appraisals (i.e., cognitive distortions) of themselves, others, and the world (Briere, 1992). Such distortions may include confused sexual boundaries, ambiguities regarding sexual appropriateness, compulsive or overly negative attitudes toward sex, or both, and the pairing of sexuality with

violence or exploitation, or both. Distortions that directly impact sexual decision-making and sexual activities could be thought of as "pregnancy-vulnerable cognitions" and likely constitute one plausible pathway to inordinate early pregnancy. Indeed, in one of the few longitudinal, prospective studies of the sexual development of abused females (Noll et al., 2003), sexually abused females reported significantly greater sexual distortions (i.e., were more preoccupied with sex by reporting more sexual thoughts and feelings, displayed more ambivalent sexual attitudes, and expressed a heightened desire to become pregnant) than their non-abused adolescent counterparts. These variables were, in turn, related to early and risky sexual behaviors and teenage motherhood.

Post-traumatic stress disorder is highly common in victims of CSA (Kendall-Tackett, Williams, & Finkelhor, 1993; Paolucci, Genuis, & Violato, 2001) and, due in part to its associated dissociative features and high comorbidity with substance and alcohol use disorders, can contribute to impairments in judgment (Bugental, 1993; Jones & Barlow, 1990) and interfere with accurate appraisal of threat and consequences thereby precluding appropriate action in sexual risk situations. Furthermore, there is emerging evidence that children exposed to chronic and traumatic forms of stress, such as sexual abuse, experience a global dysregulation in the hypothalamus-pituitary-adrenal (HPA) axis (Carrion et al., 2002; DeBellis, Lefter, Trickett, & Putnam, 1994; Gunnar & Vazquez, 2001; Hart, Gunnar, & Cicchetti, 1996), which may in turn affect certain regions of the brain implicated in neurocognitive impairments and high-risk social and emotional functioning that are thought to predispose high-risk behaviors in adolescents (Dahl, 2001; Giancola, Mezzich, & Tarter, 1998; Kirisci, Tarter, Vanyukov, Reynolds, & Habeych, 2004).

Limitations and Recommendations for Future Study

The results presented in this meta-analytic study should be considered in light of several limitations. First, the generalizability of these analyses is limited to the effects of CSA. We focused on CSA because (a) there is theoretical parsimony in examining risk and outcome variables that are both sexual in nature, (b) much of the previous literature has focused on sexual abuse as opposed to other forms of abuse providing a substantial pool of articles from which to power our analysis, and (c) we hoped to clarify some of the mixed conclusions about whether any relationship exists between sexual abuse and adolescent pregnancy. While this deliberate focus on sexual abuse adds precision to

our aims and strengthens our primary conclusions, we are unable to comment on the risk posed by other forms of childhood abuse or adversity. Moreover, as highlighted in the Methods section, operational definitions of CSA varied widely across studies and adolescent pregnancy rates were not always reported for subtypes of sexual abuse. This made it difficult to discern if adolescent pregnancy might be more strongly related to one form of sexual abuse versus another.

We were also limited in our ability to conduct moderator analyses that would add important insight into factors that alter the risk posed by CSA. For instance, we were unable to examine the effects of race, socioeconomic status, or abuse severity (e.g., genital fondling vs. penetration) in moderator analyses because the power to do so was limited. More importantly, most studies, with notable exception (Stock et al. 1997), lacked sufficient detail regarding differential rates of adolescent pregnancy associated with these types of variables. The limited reporting of such detail also rendered us unable to differentiate between those who only experienced sexual abuse versus those who experienced sexual abuse in conjunction with other forms of child maltreatment. Although we were careful to maximize homogeneity by focusing on studies of victims of CSA, we did so in full acknowledgment that sexual abuse quite often occurs within the context of other forms of abuse and that it would be almost impossible to have conducted this investigation utilizing studies of sexual abuse alone or as isolated from other forms of overlapping, co-occurring, or past maltreatment (cf. Smith, 1996; Thornberry et al., 2001). Although we cannot definitively conclude that CSA in and of itself increases risk for adolescent pregnancy, the presence of this variable (albeit overlapping with other forms of abuse in some studies) was strongly related to adolescent pregnancy in almost all of the studies included in this review.

There was considerable methodological heterogeneity in the studies included in the present analysis, which could potentially limit generalizability. Studies varied in terms of retrospective recall versus protective service reports of childhood abuse, country of origin, longitudinal versus cross-sectional study, and interview versus survey data collection. Despite this heterogeneity, use of the random effects model provided a reliable estimate of the relationship between CSA and adolescent pregnancy while controlling for this heterogeneity. Moreover, sources of methodological variation did not significantly alter the average effect size estimation nor did any one study significantly bias the overall effect size estimate. Use of the random effects model, assessing for the effects of specified

covariates, and the conducting of the sensitivity analysis adds support to the conclusions drawn from the main finding of this article—that CSA is a significant risk factor for adolescent pregnancy.

In light of these limitations, we make the following recommendations for future studies aimed at examining how childhood abuse might be related to adolescent pregnancy. First, we recommend the assessment and reporting of the specific details regarding abuse characteristics and the types and subtypes of abuse. Such reporting would facilitate continuity in operational definitions of abuse across studies, and more comprehensive statistical models elucidating the moderating effects of distinct abuse types, the co-occurrence of multiple forms of abuse, and abuse severity. Second, we recommend the inclusion of assessment methods with the greatest potential for reliable and detailed reporting of CSA such as interview methods confirmed by protective service records. Finally, the employment of controlled prospective, longitudinal designs, that include large sets of potential confounding and mediating variables, is greatly needed in order to (a) determine whether CSA, in and of itself, sets females at risk and (b) more fully understand the processes that place victims on a trajectory that increases their chances of becoming pregnant during adolescence—a line of research that is sorely needed before causal assertions can be drawn and before systematic study of protective factors can commence.

Conclusions

Findings gleaned from this meta-analysis indicate that the experience of CSA significantly increased the risk of becoming pregnant during adolescence. We join other researchers and practitioners (Adams & East, 1999; Kellogg et al., 1999) in recommending that the assessment and monitoring of abuse survivors should extend into adolescence and specifically address issues related to sexual development, sexual decision-making, and other factors associated with sexual risk-taking and early pregnancy. These results may be particularly important for pediatric psychologists and other practitioners who have knowledge of patient victimization histories. In such cases, careful monitoring of abuse-related risk factors (such as persisting PTSD symptoms, distortions in self-concept or sexual attitudes, and physiological dysregulation) may improve overall care and health outcomes for victims. In pediatric settings, psychologists who encounter young mothers should be aware of the possibility of abuse histories in order to provide optimal care and appropriate pre- and

post-natal services for both the mother and her infant. Given that there are approximately 140,000 new substantiated cases of CSA each year in the US (National Child Abuse and Neglect Data System, 2007), addressing the risk factors associated with being sexually abused may have a considerable impact on the overall national rate of adolescent pregnancy.

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