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EXPLORATORY STUDY

An Exploratory Investigation of Childhood Sexual Abuse and Other Theory-Driven Predictors of Sex Work Among Women with and without Childhood ADHD

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Abstract
Limited research has identified prospective risk factors for young-adult sex work or examined overlapping predictors concurrently. We investigated childhood sexual abuse (CSA), along with other theory-driven predictors of sex work, among a well-characterized sample of girls with and without childhood diagnoses of attention/deficit-hyperactivity disorder (ADHD). Methods: Participants were a racially and socioeconomically diverse sample of 140 girls with rigorously diagnosed ADHD (47 Inattentive [ADHD-I], 93 Combined [ADHD-C]), and 88 age- and ethnicity-matched comparison girls, all followed longitudinally into adulthood. Self-report data on young-adult occupations revealed a subsample of 7 participants reporting engagement in "sex work" or "prostitution." Logistic regressions tested whether CSA, measured both dichotomously and by discrete age ranges, predicted later sex work, accounting for other risk factors. Results: A lifetime history of CSA was positively associated with sex work in initial analyses ($\beta = 1.51$, $p = .045$), but not after adjusting for additional risk factors. When examined by age ranges, only CSA occurring between ages 9–15 significantly predicted sex work ($\beta = 2.84$, $p = .043$), even after adjusting for additional risk factors. Childhood ADHD-C also emerged as a significant predictor ($\beta = 4.94$, $p = .015$). ADHD-related medication and years of education were protective factors only when CSA was considered dichotomously. Conclusions: Findings from this exploratory study underscore the need for longitudinal research that (a) considers the developmental timing of CSA and (b) accounts for impulsivity and inattention as risk factors for sex work among young-adult women. Implications for clinical practice are briefly discussed.

Keywords Childhood sexual abuse · Sex work · ADHD · Impulsivity · Longitudinal analysis

Introduction

Sex work—also termed prostitution or transactional sex—is typically defined as the exchange of sexual services for money or other forms of material compensation. Sex workers experience numerous health inequities and adverse outcomes, including high rates of sexual trauma and victimization (Puri et al., 2017). The criminalization of sex work in the United States, as well as its associated stigmatization (Dodsworth, 2012), contributes to the difficulty of conducting rigorous longitudinal research with this population, as sex workers may be hesitant to speak openly about their experiences or consent to being tracked for follow-up for fear of incarceration. Thus, most studies in this area are cross-sectional and focus on specific populations, such as youth who are homeless, in the juvenile justice system, or receiving treatment for substance abuse. Although informative and clinically relevant, such research suffers from selection bias and may capture only a subset of the adolescents and young adults who engage in sex work. Moreover, almost no research has *prospectively* investigated early risk factors related to sex work or examined these variables concurrently, despite substantial overlap between many key risk factors (Klatt et al., 2014). Herein, we explore whether childhood sexual abuse

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(CSA) and other theoretically informed risk factors predict later engagement in sex work among a sample of young women followed longitudinally from childhood through adulthood. We also examine childhood attention-deficit/hyperactivity disorder (ADHD), both categorically and dimensionally, as a prospective predictor of sex work in adulthood and discuss possible implications for clinical practice.

A variety of terms exist to capture the phenomenon of selling sexual services for money or other goods. We use the term "sex work" to refer to the act of engaging in sexual activities (namely those that include skin-to-skin genital contact) with the goal of receiving payment. This terminology aligns with many HIV/AIDS researchers who argue that the term "prostitution" carries negative connotations of criminality, immorality, and a lack of integrity (McMillan et al., 2018; Vanwesenbeeck, 2001).

Prevalence and Consequences of Sex Work

National prevalence estimates of adult sex workers in the U.S. are arguably impossible to come by. First, the lack of a consistent terminology or consensus as to what constitutes sex work complicates reliable findings. Second, the majority of research on sex work utilizes convenience samples that may not reflect the overall population (Kaestle, 2012). Third, the criminalization of sex work and the underreporting of known cases by law enforcement and social service agencies obfuscate the true number of individuals engaged in sex work (Estes & Weiner, 2001). Fourth, the immense stigma attached to sex work undoubtedly contributes to the difficulty of recruiting sex workers for scientific research, as stigma may well dissuade many from speaking openly about their experiences. Finally, the longstanding Puritanical mindset about sex in the U.S., where the federal government has dedicated more than $2 billion in funding to abstinence-only programs since 1998 (Fox et al., 2019), may hinder research on sexual practices, especially those also deemed illegal. In sum, there are no credible, supported estimates about the current number of sex workers in the U.S. Estimates of juvenile sex workers specifically have ranged from 1,400 to 2.4 million, related to imprecise or speculative methodologies (Stransky & Finkelhor, 2012).

Still, sex work remains an essential area of investigation. Sex workers face increased health risks relative to the general population, including high rates of sexually transmitted infections (STIs), substance abuse, and exposure to violence—both work- and non-work-related (Cohan, 2006; Puri et al., 2017). They are also at high risk for psychopathology, particularly depression, post-traumatic stress disorder (PTSD), and suicidal ideation (Roxburgh et al., 2006; Surratt et al., 2004). Given the cascade of associated social and health risks, prospective research should continue to improve our understanding of predictors and developmental turning points.

Childhood Sexual Abuse as a Key Risk Factor

A salient risk factor for sex work is the experience of childhood sexual abuse (CSA), typically defined as sexual abuse occurring before the age of 18 (Lalor & McElvaney, 2010). An early investigation of both juvenile and adult sex workers found that 60% reported at least one past experience of CSA (Silbert & Pines, 1981). Since then, disproportionately high rates of CSA have been identified among sex workers in retrospective cross-sectional surveys (McClanahan et al., 1999; Puri et al., 2017; Roxburgh et al., 2006; Simons & Whitbeck, 1991; Steel & Herlitz, 2005; Stoltz et al., 2007; Surratt et al., 2004) and qualitative studies (Caputo, 2009; Dodsworth, 2012; Dunlap et al., 2003; Servin et al., 2015). Yet other researchers have found no group difference in CSA prevalence among sex workers relative to comparison groups (Nadon et al., 1998; Potterat et al., 1998). In a rare prospective investigation, Wilson and Widom (2010) found that childhood *physical* abuse was a stronger predictor of sex work than was CSA. Yet both forms of trauma explained significant variance in sex work, and physical and sexual abuse cases are likely to have overlapped given the wide range of charges filed under CSA (including "assault and battery with intent to gratify sexual desires") (Wilson & Widom, 2010, p.218).

Several mechanisms have been proposed to explain the link between CSA and later sex work. One common theory suggests that, unlike other forms of childhood trauma, CSA triggers sexualized behavior patterns that are compounded over development and ultimately expressed in various forms of "promiscuity," including sex work, by adulthood (Abramovich, 2005; Kendall-Tackett et al., 1993). In one study of women shoplifters and sex workers, Caputo (2009) found that CSA was far more common among interviewed sex workers (46%) compared to shoplifters (8%), providing further support for a specific link between CSA and sex work. Kaestle (2012) builds on this idea by noting that CSA may increase future vulnerability to others' sexual advances, increasing the likelihood of engagement in risky sexual behaviors (and victimization). In parallel, a recent review found that women with past CSA reported higher rates of sexual dysfunction, lower self-esteem, and more negative body image than did those without such histories (Pulverman et al., 2018). Thus, CSA could engender mistrust or even hatred of one's body via strong associations with the sexual abuse. In turn such low self-regard could set the stage for both sexual dysfunction and risk-taking behaviors such as sex work.

Emerging research on sensitive periods—signifying specific age ranges when children may be particularly susceptible to the maladaptive effects of trauma—suggests that the *timing* of trauma exposure is of substantial importance for developmental trajectories and outcomes (Andersen et al., 2008; Dunn et al., 2018). To our knowledge, only one study has explicitly examined whether age of CSA affects the likelihood of engaging in sex work. Rotheram-Borus et al. (1996) interviewed a sample of runaway youth (M age = 15.5 years, 52% female) about CSA histories. Compared to those sexually abused before age 13, those abused after age 13 were five times more likely to be involved in sex work. The latter group also endorsed significantly lower levels of self-esteem, perhaps reflecting a tendency to internalize the abuse (Rotheram-Borus et al., 1996). Thus, trauma occurring in preadolescence or early adolescence (versus earlier in childhood) could be particularly damaging, as adolescents are more likely to remember, process, and internalize the abuse (Dunn et al., 2018). We note that the majority of CSA research emanates from retrospective, self-report studies that rely heavily on participants' memory of the abuse, which may contribute to the difficulty of obtaining reliable data on CSA timelines.

Additional Risk Factors

Beyond CSA, a variety of environmental and individual risk factors have been suggested as risk factors for involvement in sex work. We review these in turn, highlighting key interrelations among CSA and other variables.

Environmental/contextual Relevant research suggests that early financial insecurity significantly contributes to the likelihood of later involvement in sex work (Potter et al., 1999; Roberts et al., 2010; Vanwesenbeeck, 2001; Warf et al., 2013). In ethnographic interviews with female sex workers, Dunlap et al. (2003) found that sex work was perceived as one of the most practical sources of income given participants' lack of access to other jobs. Thus, many sex workers may be motivated by financial incentives, particularly for women trying to establish independence or take care of dependent children (Morris et al., 2013; Romans et al., 2001). Of note, CSA rates appear to be roughly equivalent across different socioeconomic classes in community surveys, although *reported* rates (i.e., cases referred to protective services) are disproportionately higher for children living in low income households (Olafson, 2011).

A related risk factor is growing up in an "unstable" home environment, defined in myriad ways (Abramovich, 2005). For example, in a study of Norwegian adolescents, Pedersen and Hegna (2003) found that parental break-up, along with alcohol exposure, predicted a greater likelihood of selling sex for both boys and girls. Bagley and Young (1987) similarly found that women with a history of sex work, versus those in a control group, were less likely to have experienced a conventional two-parent home. In fact, a growing body of research suggesting that adolescents who grow up in "biologically disrupted families" (particularly those with absent fathers) are particularly likely to engage in various forms of risky sexual behavior (Ellis et al., 2012; Hehman & Salmon, 2019). Of course, the clear majority of children who grow up in non-intact families do not ultimately pursue sex work. An unstable home environment is simply one of many variables that may combine to increase vulnerability, especially in the context of CSA, financial hardship, and other risk factors.

Additional research suggests that lower levels of education predict involvement in sex work (Bagley & Young, 1987; Kaestle, 2012; McCarthy et al., 2014; Morris et al., 2013; Potter et al., 1999). Through a comparative design study, McCarthy et al. (2014) examined predictors of employment in sex work relative to two other low-income service occupations. Limited education and employment experience, along with childhood poverty and family instability, were specifically associated with engaging in sex work. From another angle, Kaestle (2012) found that being happy at school significantly reduced adolescents' likelihood of selling sex, even after adjusting for demographic variables. Thus, schooling factors may protect youth against sex work in multiple ways, offering adolescents a safe space to obtain social support from teachers and peers, and expanding their employment opportunities via increased educational attainment. Yet education is likely to be disrupted or derailed by CSA, which predicts fewer years of completed high school and higher rates of truancy (Boden et al., 2007; Perez & Widom, 1994).

Finally, the biological mother's age at childbirth may be relevant for offspring sexual behavior and development. Warf et al. (2013) recruited a sample of homeless young women, comparing those who had engaged in survival sex (e.g., the exchange of sex for food, drugs, money, or shelter) to those who had not. Among the former, the average age of their mothers was more than 4 years younger than that of women who had not engaged in survival sex. Although high rates of criminal or "problem" behaviors appear among adolescents whose mothers were young at the time of birth (D'Onofrio et al., 2009; Nagin et al., 1997), prospective relations to sex work have not been reported. Younger maternal age has also been associated with higher rates of CSA (Boden et al., 2007; Fergusson & Woodward, 1999), although some research suggests this finding may be due to lower maternal education rather than age per se (Martin et al., 2011).

Individual Sex work has been linked to precocious sexual and reproductive development, including early age of first

sexual intercourse and teen pregnancy. For example, relative to other juvenile problem behaviors, Wilson and Widom (2010) found that initiating sexual behavior before age 15 was the strongest predictor of later engagement in sex work. Bagley and Young (1987) also found that 31% of former sex workers reported becoming pregnant before age 17, compared to 2% of their comparison group (see also Potter et al., 1999). Given the financial burden associated with child-rearing, sex work may well be perceived by teen parents as a uniquely practical source of income, especially if other occupations are seen as unattainable.

Regarding pubertal development, no work to our knowledge has explicitly linked early puberty to later engagement in sex work. Yet intriguing longitudinal research suggests that young women with histories of CSA show earlier age at menarche (Boynton-Jarrett et al., 2013) and earlier pubertal onset for breast growth and pubic hair, even after adjusting for alternative factors such as obesity (Noll et al., 2017). In addition to warping internalized sexual norms and increasing vulnerability to coercion, CSA may trigger an early onset of puberty and physical development in girls, heightening their risk of exposure to predatory advances. In fact, early pubertal development in girls is associated with several sexual health risks, including inconsistent condom use and earlier initiation of sexual behavior (Baams et al., 2015; Deardorff et al., 2005)—with the latter being a risk factor for eventual sex work (Wilson & Widom, 2010).

Substance use has also been frequently linked to sex work, although the cross-sectional nature of most relevant research does not address temporal sequences. An exception is Potterat et al. (1998), who found that 66% of sex workers reported regular non-injectable drug use prior to initiating sex work, 17% reported using these drugs after initiating sex work, and 18% reported that the two behaviors happened concurrently. A later study found that nearly half (46%) of the sample initiated sex work prior to injecting drugs, while 29% initiated injection drug use first (Morris et al., 2013). Such findings suggest heterogeneity with respect to temporal sequences of drug use and sex work, cautioning against assumptions about individuals' entering into sex work largely to fund a drug habit (see also McClanahan et al., 1999).

Finally, with respect to psychopathology, elevated rates of depression and suicidality have been found in several studies of sex workers (Bagley & Young, 1987; Puri et al., 2017). Yet little research has examined dimensions of psychopathology as *antecedents* of sex work. Attention-deficit/hyperactivity disorder (ADHD) is a prevalent neurodevelopmental condition typically characterized by high levels of inattention and/or impulsivity (Ahmad & Hinshaw, 2017). ADHD symptoms have been linked to a range of sexual risk behaviors, including earlier initiation of sexual behavior and more unprotected sex (Flory et al., 2006; Isaksson et al., 2017), as well as high rates of unplanned pregnancy (Owens et al., 2017). Still, more remains to be discovered regarding specific outcomes for girls and women with ADHD (Halkett & Hinshaw, 2020; Hosain et al., 2012). Notably few data exist on ADHD in relation to sex work (for an exception, see Blum et al., 2018). Still, girls and women with ADHD are at increased risk for numerous factors related to sex work, including relatively high rates of CSA (Briscoe-Smith & Hinshaw, 2006) as well as low educational attainment, financial insecurity, and being a single parent (Brassett-Grundy & Butler, 2004). Those diagnosed with the ADHD presentation that includes impulsivity (that is, ADHD-Combined) may be especially likely to engage in certain sexual risk behaviors, such as early initiation of sexual activity or sex with multiple partners (Halkett & Hinshaw, 2020; Hosain et al., 2012).

Study Purpose

Given overlapping relations among CSA and other risk factors reviewed herein, our primary aim was to clarify CSA as a key predictor of sex work by examining multiple risk factors simultaneously among a longitudinal sample of women with and without childhood ADHD. Thus, we investigate whether CSA and its developmental timing predict involvement in sex work beyond the effects of additional theory-informed predictors. We also examine the role of ADHD, both diagnostically and dimensionally, in predicting later sex work given its emerging associations with some sexual risk behaviors. The original study was not designed to investigate sex work specifically; as such, findings should be interpreted as exploratory and hypothesis-generating. Limited sample sizes (see Method) call for follow-up research and replication.

We hypothesize the following:

1. A history of CSA, measured both dichotomously and by discrete age ranges, will be positively associated with sex work in young adulthood, even after accounting for key covariates and additional risk factors. We also expect that CSA experienced during late childhood/early adolescence will be the most predictive time period.
2. A childhood diagnosis of ADHD, particularly one involving early impulsivity (such as those with ADHD-Combined presentation), will be positively associated with sex work in adulthood, accounting for CSA, additional risk factors, and key covariates.

Method

Participants and Procedures

Data were obtained from the 228 participants in an ongoing prospective study of girls with ADHD and their age-and

ethnicity-matched comparison counterparts. Participants were recruited at age 6–12 years (M_{age} = 9.6 years) from schools, mental health care centers, pediatric practices, and direct advertisements to participate in research summer programs in 1997, 1998, and 1999. Programs were designed not as therapeutic interventions but rather to provide recreational and educational activities and collect ecologically valid participant data. Extensive details regarding recruitment, thorough diagnostic assessments, and participant information are available elsewhere (Hinshaw, 2002; Hinshaw et al., 2006). All procedures from the original prospective study were approved by the University's Institutional Review Board.

Following evaluation procedures (multi-informant and multi-method), a total of 140 girls with ADHD (47 Inattentive presentation, 93 Combined presentation) and 88 comparison girls were included in the study. The sample was ethnically diverse (53% White, 27% African-American, 11% Latina, and 9% Asian-American). The average family income was between $50,000 to $60,000, and 74% of mothers reported having attained a college degree. These demographics are generally reflective of populations in the San Francisco Bay Area in the 1990's. Extensive analyses have yielded no significant diagnostic group differences in terms of demographic variables (Hinshaw et al., 2006).

Participants and their families participated in follow-up assessments taking place 5 (Wave 2 [W2]; M_{age} = 14.2 years; 92% retention), 10 (Wave 3 [W3]; M_{age} = 19.6 years; 95% retention), and 16 years (Wave 4 [W4]; M_{age} = 25.6 years; 93% retention) after Wave 1 (W1). At follow-up, participants (and for some measures, informants) completed objective and subjective measures conducted by trained post-baccalaureate students and graduate students in clinical psychology. When necessary, follow-up assessments were conducted via telephone or at the participant's home (e.g., if a participant moved to another state or was unable to travel).

We utilized (a) sexual abuse data collected in childhood and adolescence (W1 and W2, with additional retrospective accounts from W3), (b) ADHD diagnosis and symptom data collected across development (W1-W4), and (c) occupation data (i.e., engagement in sex work) from early adulthood (W4). We also included theory-informed covariates from various waves.

Measures

Childhood Sexual Abuse (CSA)

CSA was determined via thorough, multi-step chart review according to methodology described in detail by (Guendelman et al., 2016). Briefly, a master graduate-level coder and three additional trained raters reviewed participants' charts for documented indications of CSA (e.g., molestation, rape). Charts contained standard measures comprising the Background Information Questionnaire (BIQ), Family Information Profile (FIP), Hot Sheet, Report from the Summer Program, Child Protective Services (CPS) reports, and relevant psychological and/or medical reports reviewed for CSA data from multiple informants. Charts did not contain participant ADHD status; only the master coder was aware of the study hypotheses.

The BIQ (W1) is a parent-reported, project-derived measure assessing demographic information about participants and their families, including incidents of childhood maltreatment (e.g., CSA) contributing to out-of-home placement (Hinshaw et al., 2006). The FIP, administered at W2 and W3, assesses yearly changes since the previous assessment (Hinshaw et al., 2006). Although the FIP does not assess specifically for new instances of CSA, significant life changes (e.g., why a participant moved into foster care) were examined for clinical relevance. The Hot Sheet, a clinician-reported measure administered at W1, W2, and W3, was designed to serve as a more sensitive measure of abuse by consolidating information across measures about "known" or "suspected" abuse, including dates of abuse and participant age (Hinshaw et al., 2006). Raters were trained to look specifically for CPS reports, relevant notes from study clinicians, and any statements from participants or caregivers indicating potential CSA. We used a conservative approach and counted incidents of CSA that were "substantiated" (not simply "suspected") to avoid coding solely based on behavioral manifestations of abuse (e.g., inappropriate sexual comments or aggression). Substantiation of CSA was made available from CPS reports, confirmed parent reports, and reported CSA from school districts or treating clinicians (Hinshaw et al., 2006). Individual reports written about each participant from the summer program (W1) by staff and licensed psychologists were also included in the final chart review to assess for CSA not captured by other measures.

We applied the coding scheme from Guendelman et al. (2016), derived from a comprehensive literature review, to assess for CSA reported between W1-W3. Lifetime history of CSA was coded if there was any completed or attempted sexual act or sexual contact with the participant by a caregiver, peer, stranger, or acquaintance when she was under age 18 (consistent with the definition of CSA from the Centers for Disease Control; see Leeb et al., 2008). CSA was also classified by three discrete age ranges. Bin 1 = CSA that took place between ages 2–8, bin 2 = CSA between ages 9–15, and bin 3 = CSA at ages 16–17. We chose age bins based on (a) research identifying developmental shifts in fear circuitry around age 10 (Stevens et al., 2018) and (b) greater independence associated with ages 16–17 that may increase exposure to CSA from specific sources, particularly extrafamilial perpetrators (Kloppen et al., 2016). Inter-rater reliability was good to excellent (kappa = 0.78; range = 0.64–0.89; Bakeman & Gottman, 1997).

ADHD Diagnostic Status

W1 ADHD diagnostic status (present vs. absent) was determined from the Diagnostic Interview Schedule for Children (4th ed., DISC-IV; Shaffer et al., 2000) and the Swanson, Nolan, and Pelham Rating Scale (4th ed., SNAP-IV; Swanson et al., 1992). The SNAP-IV was completed by parents and teachers as part of initial screening. Those eligible had to surpass minimal ADHD thresholds to prevent false negatives. The DISC-IV is a well-validated, structured diagnostic interview administered to parents by highly trained research staff. For participants diagnosed with ADHD, the DISC-IV also yields a "presentation" status—that is, Inattentive (ADHD-I) or Combined (ADHD-C), with the latter diagnosis reflecting symptoms of hyperactivity/impulsivity (HI) in addition to symptoms of inattention (IA).

Participants were diagnosed as having ADHD if they met full diagnostic criteria for either ADHD-I or ADHD-C on the DISC-IV. For instances ($n = 28$) where participants' HI symptoms were in the borderline range, clinical consensus from four senior camp staff made the final designation. At W3 and W4, ADHD symptoms were assessed on the SNAP-IV by participant and parent report. For all measures, respondents were asked to rate the participant's ADHD symptoms during periods in which she was not taking ADHD medication.

Sex Work

Lifetime involvement in sex work was first assessed via participant self-report of occupation at W4 on the General Information Packet, which assesses yearly changes since the previous assessment (similar to the FIP at W2 and W3) (Owens et al., 2017). If a participant endorsed engaging in sex for payment (e.g., listing "prostitute" or "sex worker" as a job title), she was considered positive for lifetime involvement in sex work. In addition, we also assessed lifetime involvement in sex work by documentation of engaging in sex work on the Hot Sheet at W3. A single dichotomous variable (0 or 1) reflected involvement in sex work.

Additional Predictor Variables and Covariates

We included predictor variables that were (a) identified from existing literature and (b) significantly different ($p < 0.05$) between those who had vs. had not engaged in sex work. These included childhood ADHD diagnostic status, age of biological mother at birth, and being raised by at least one biological parent. Age of pubertal development (obtained from the FIP at W2), adolescent/young adult HI symptoms (obtained from the SNAP-IV at W3), educational attainment (total years of education, obtained from the GIP at W4), and self-reported age of first sexual intercourse (collected at W4) were also included. This final variable was obtained from the Social Relationships Interview (SRI), a project-derived measure designed to assess sexual behavior, close relationships, and social functioning (omitted for blind review, 2006). Predictors excluded because they did not differ significantly by sex work status were the following: adolescent substance use severity from at W2 (Molina & Pelham, 2003), running away from home overnight (FIP at W3), adolescent/young adult IA symptoms (SNAP-IV at W3), teenage pregnancy (SRI at W4), and current responsibility for a dependent child (GIP at W4).

We statistically adjusted for demographic measures associated with the outcome of interest, including (a) mother's education, (b) family's receipt of public assistance at W1, (c) participant age, and (d) W2 stimulant medication. The latter was included given the unique sample characteristics (e.g., oversampled for ADHD symptoms) and the clinical relevance of stimulant medication for health outcomes, including risky behavior, among youth with ADHD (Dalsgaard et al., 2014; Ruiz-Goikoetxea et al., 2018).

Data Analytic Approach

Statistical analyses were performed with SPSS, Version 27 and RStudio, Version 1.4.1103. First, we conducted a series of Pearson's chi-square tests and independent-samples t-tests to assess whether predictor variables were related to sex work status (see above). We calculated effect sizes using Cohen's d for continuous variables and odds ratios for categorical variables. We include qualitative information on abuser relationships at each age bin.

We then conducted two series of binary logistic regressions to test whether CSA predicted sex work over and above the influence of key covariates and additional predictor variables. In Series 1, we examined CSA as a dichotomous variable (e.g., any lifetime history of CSA before age 18). In Series 2, to gauge whether the developmental timing of CSA predicted sex work by W4, CSA was split into three separate variables categorized by age range (see Measures). Both models were analyzed in block-wise fashion. First, we tested whether the CSA variable(s) alone predicted involvement in sex work. Second, we adjusted for sociodemographic covariates (mother's education, childhood receipt of public assistance, participant age), plus prescription of medication for ADHD symptoms. Finally, we added predictor variables revealing group-level significance in the initial analyses, to determine whether CSA was associated with sex work above and beyond the influence of other key risk factors. We used Firth's penalized likelihood method to address the issue of complete separation (e.g., the finding that all sex workers are in the ADHD-C group) (Firth, 1993). This approach has the additional advantage of minimizing small sample bias by placing a penalty term on the standard maximum likelihood

function used to generate parameter estimates in logistic regression models (Karabon, 2020).

Results

Descriptive Findings

Descriptive data for all predictor variables are presented in Table 1. A total of seven women disclosed involvement in sex work by W4. Strikingly, all seven of the sex workers had received a childhood diagnosis of ADHD-C ($\chi^2 = 12.4$, $p = 0.002$, $OR = 2.34$ [ADHD-C (7/74) versus Comparison (0/82)] and = 2.02 [ADHD-C (7/74) versus ADHD-I (0/42)]). As noted above, sex workers differed significantly from the rest of the sample on several dimensions, including mean age of biological mother at birth, having been raised with at least one biological parent, age of pubertal development, W3 HI symptoms, total years of education, and age of first consensual sexual intercourse (all $p < 0.05$).

Across the full sample, 35 girls (15.4%) were found to have experienced any CSA before age 18. One girl was lost to follow-up and had CSA data available only during the first age bin (ages 2–8). Of the 34 girls with CSA data available in all three age bins, 6 (17.6%) had CSA between ages 2–8 only; 14 (41.2%) had CSA between ages 9–15 only; and 7 (20.6%) had CSA at ages 16–17 only. A total of 6 girls (17.6%) had experienced CSA during 2–8 and 9–15, and 1 girl (2.9%) experienced CSA at all three age ranges. Some girls reported multiple abusers within a single age bin, so we include data based on the total number of perpetrators rather than number of participants. Of 16 abusers in age bin 1, 8 (50%) were family members, 3 (19%) were family friends, 3 (19%) were other children, and 2 (12%) were institutional authority Figs. (1 student teacher, 1 care facility worker). Of

Table 1 Descriptive statistics by sex work outcome

		Sex work by Wave 4 (N = 200)			
Variable	**Overall sample (N = 228)**	**No (N = 193)**	**Yes (N = 7)**	***P* value**	**Effect size [95%CI] [a]**
CSA Predictor Variables % (n)					
% ANY CSA before 18	15.4 (35)	14.5 (27)	42.9 (3)	.042	1.71 [1.01, 2.88]
% had CSA between 2–8	6.1 (14)	5.7 (11)	0.0 (0)	.516	1.18 [0.71, 1.96]
% had CSA between 9–15	9.2 (21)	8.1 (15)	42.9 (3)	.002	2.29 [1.35, 3.90]
% had CSA between 16–17	3.5 (8)	3.5 (7)	0.0 (0)	.600	1.15 [0.68, 1.09]
Additional Predictor Variables [b]					
W1					
% with baseline diagnosis of ADHD-C	40.8 (93)	34.7 (67)	100.0 (7)	.002	2.34 [1.30, 4.22] [c] 2.02 [1.02, 4.00] [d]
Age of biological mother at participant's birth	29.4 (6.8)	29.8 (6.5)	23.7 (5.4)	.015	0.94 [0.18, 1.71]
% Raised with at least one biological parent	80.7 (184)	82.9 (160)	28.6 (2)	.002	2.26 [1.34, 3.80]
W2					
Age of pubertal development	11.1 (1.2)	11.2 (1.2)	10.2 (1.2)	.035	0.82 [0.05, 1.58]
Number of illicit substances used in past year	0.66 (1.4)	0.61 (1.3)	0.71 (1.5)	.847	0.07 [-0.83, 0.69]
W3					
% Ran away from home overnight	14.0 (32)	13.4 (25/186)	28.6 (2)	.257	1.16 [0.70, 1.92]
Number of inattentive (IA) symptoms	4.4 (3.6)	4.26 (3.5)	6.71 (3.7)	.071	0.70 [-0.06, 1.46]
Number of hyperactive / impulsive (HI) symptoms	3.0 (2.9)	2.72 (2.7)	5.71 (3.5)	.005	1.10 [0.33, 1.86]
W4					
Total years of completed schooling	14.5 (1.9)	14.6 (1.9)	12.8 (0.9)	.011	1.99 [1.21, 2.78]
Age of first sexual intercourse	16.9 (2.2)	17.0 (2.2)	15.3 (1.4)	.049	0.76 [0.00, 1.53]
% Reported teen pregnancy	13.8 (26)	13.8 (25)	14.3 (1)	.972	1.01 [0.60, 1.70]
% Responsible for child	16.2 (37)	16.1 (31)	42.9 (3)	.182	1.41 [0.85, 2.35]

[a]Effect sizes calculated using Cohen's *d* for continuous variables and Odds Ratios [ORs] for categorical variables

[b]Data are reported as means (SD) for continuous variables and % (n) for categorical variables

[c]ADHD-C versus Comparison group

[d]ADHD-C versus ADHD-I group

the 24 abusers age bin 2, 6 (25%) were family members, 6 (25%) were family friends, 3 (13%) were other children, 4 (17%) were current or ex boyfriends, 2 (8%) were friends, and 2 (8%) were strangers. Of the 10 abusers in age bin 3, 5 (50%) were current or ex boyfriends, 3 (30%) were strangers, and 2 (20%) were friends of friends.

Logistic Regressions

Series 1: Lifetime CSA

We first tested whether any history of CSA was significantly associated with sex work, both alone and beyond the influence of covariates and other predictor variables. With no other variables in the logistic regression model, any history of CSA significantly predicted a greater likelihood of sex work by W4 ($\beta = 1.51$, $p = 0.045$). However, after adjusting for sociodemographic covariates (mother's education, childhood receipt of public assistance, participant age) and ADHD-related medication, the effect of any CSA dropped to marginal significance. No other variables emerged as statistically significant.

We then included those predictor variables with group-level significance in initial analyses. In this final model of Series 1 (involving lifetime CSA as a predictor), having a W1 diagnosis of ADHD-C was significantly and positively associated with sex work by W4 ($\beta = 7.17$, $p = 0.016$). Being on ADHD-related medication at W2 ($\beta = -3.32$, $p = 0.033$) and educational attainment ($\beta = -1.00$, $p = 0.020$) were significantly and *negatively* associated with engagement in sex work. Being raised with at least one biological parent and age of first sexual intercourse were marginally significant and negatively weighted contributors. This final model explained 68.0% of the variance and was statistically significant ($\chi^2 = 35.1$, df = 13, $p = 0.001$) (see Table 2).

Series 2: CSA by Age Range

To clarify whether the developmental timing of CSA was related to young-adult sex work, we next examined CSA reported within the three separate age bins (ages 2–8, 9–15, and 16–17 years). With no other variables in the model, only CSA in bin 2 (ages 9–15) predicted a greater likelihood of sex work by W4 ($\beta = 2.46$, $p = 0.002$). After adjusting for sociodemographic covariates and ADHD-related

Table 2 Output from Series 1 and Series 2 final logistic regression models

Predictors	Logistic Regression Series 1			Logistic Regression Series 2		
	Beta coefficient (standard error)	*p* value	Odds Ratio [a]	Beta coefficient (standard error)	*p* value	Odds Ratio
Series 1 only:						
Any CSA	1.71 (1.16)	.139	5.53			
Series 2 only:						
CSA from 2–8				-1.07 (1.62)	.509	0.34
CSA from 9–15				2.84 (1.40)	.043	17.2
CSA from 16–17				.388 (1.72)	.822	1.47
Both series:						
Subgroup ADHD-I	3.01 (2.56)	.240	20.3	1.58 (1.90)	.406	4.86
Subgroup ADHD-C	7.17 (2.98)	.016	1,304	4.94 (2.03)	.015	139.5
Age biological mother at birth	-.052 (.083)	.532	0.95	-.082 (.080)	.303	0.92
Raised with biological parent	-2.15 (1.17)	.066	0.12	-1.86 (1.05)	.076	0.16
Age of pubertal development	.320 (.441)	.468	1.38	.181 (.372)	.626	1.20
Hyperactive/impulsive symptoms	-.036 (.157)	.817	0.96	-.061 (.152)	.689	0.94
Age of first sexual intercourse	-.925 (.472)	.050	0.39	-.621 (.365)	.089	0.54
Total years of education	-.996 (.428)	.020	0.37	-.535 (.312)	.087	0.59
Covariates						
Mom education	.704 (.566)	.214	2.02	.321 (.512)	.531	1.38
Receipt of public assistance	1.78 (1.68)	.288	5.94	1.94 (1.41)	.169	6.93
Current age	-.392 (.361)	.277	0.68	-.051 (.274)	.853	0.95
W2 ADHD-related medication	-3.32 (1.56)	.033	0.04	-2.39 (1.27)	.060	0.09

[a]As noted in the main text, OR estimates drawn from a dataset with complete separation are variable and should thus be interpreted with relative caution

medication, only CSA between ages 9–15 continued to be a significant predictor (β = 2.16, $p = 0.007$). No other variables emerged as statistically significant. We then included those additional predictor variables with group-level significance in our initial analyses. In this final model of Series 2, CSA between ages 9–15 remained a significant predictor of sex work by W4 (β = 2.84, $p = 0.043$). A W1 diagnosis of ADHD-C was also positively associated with later sex work (β = 4.94, $p = 0.015$). Being on ADHD-related medication at W2, educational attainment, being raised with at least one biological parent, and age of first sexual intercourse were marginally significant contributors, all in the negative direction. This final model explained 65.9% of the variance and was statistically significant ($\chi^2 = 30.7$, df = 15, $p = 0.010$) (see Table 2).

Note that with the presence of complete separation in the dataset (that is, all seven individuals reporting sex work emanated from the childhood ADHD-C group), odds ratio (OR) estimates will be based on the last iteration carried out prior to convergence failure, leading to considerable variance in estimates based on statistical approach (Giaimo et al., 2006; Mansournia et al., 2018). As shown in Table 2, OR estimates for the majority of variables are relatively similar across Series 1 and Series 2, but are highly dissimilar for ADHD-C as the independent variable causing complete separation. Thus, we caution against drawing any firm conclusions solely from the OR estimates presented herein.

We used analysis of variance (ANOVA) to determine whether the final logistic regression models from Series 1 and Series 2 differed significantly from each other in residual deviance. ANOVA results showed that there was no significant difference in residual deviance between the Series 1 and Series 2 models, suggesting that both models were equally effective at predicting the outcome variable of sex work.

Discussion

We examined whether CSA and its timing predicted involvement in sex work within a diverse, longitudinally followed sample of women with and without childhood histories of ADHD. To our knowledge, this is the first prospective study exploring whether childhood ADHD, along with CSA and other theory-informed predictors, may be associated with later sex work as an occupation. We found that lifetime CSA predicted involvement in sex work when considered by itself, but not after adjusting for other key risk factors. When we examined the developmental timing of CSA, only CSA in late childhood/early adolescence ($M_{age} = 11.6$ years ($SD = 3.1$), range = 9–15) independently and significantly predicted sex work by young adulthood. This association remained significant even after adjusting for covariates and additional predictor variables. A childhood diagnosis of ADHD-C also emerged as a significant predictor in both logistic regression models, such that sex work was more likely among those women with childhood ADHD-C. Use of ADHD-related medication and educational attainment were both significantly negatively associated with sex work when CSA was measured dichotomously, but were reduced to marginal significance when CSA was examined by discrete age bins.

Overall, these exploratory results are consistent with the literature indicating that CSA is a risk factor for later sex work (El-Bassel et al., 2001; Puri et al., 2017; Roxburgh et al., 2006; Steel & Herlitz, 2005; Stoltz et al., 2007; Surratt et al., 2004). However, the effects often attributed solely to CSA may be related, at least in part, to other risk factors. In fact, as posited by Simons and Whitbeck (1991), CSA may indirectly increase vulnerability by motivating children and adolescents to leave their home environments and fend for themselves at an early age, further disrupting protective factors such as education. Per Vanwesenbeeck (2001), the link between CSA and sex work may also be overestimated because of the predominant focus on quite specific groups of sex workers, such as individuals who are homeless or involved in the juvenile justice system. Our data add to the literature by investigating this association in a prospective, naturalistic study with a socioeconomically and racially diverse sample of women.

Our findings also support the hypothesis that the developmental timing of CSA is important to consider with respect to later outcomes. We found that CSA occurring only between ages 9–15 was a significant predictor of sex work, when considered alongside CSA at other time points. This predictive association persisted even after adjustment for additional risk factors and covariates. This finding aligns with the only other explicit investigation of CSA timing in relation to sex work (Rotheram-Borus et al., 1996), which found that children sexually abused after age 13, rather than before, were five times more likely to be involved in sex work. Recent research on neural circuitry following exposure to childhood trauma reveals that developmental shifts that increase vulnerability to later maladaptive outcomes begin to occur around age 10 (Stevens et al., 2018), consistent with a growing body of literature highlighting early adolescence as a sensitive period for trauma (Andersen et al., 2008; Dunn et al., 2018). Indeed, although their seminal study did not explicitly examine age of CSA as an independent variable, Silbert and Pines (1981) note that the mean age of first victimization for sexually abused participants was 10. Much research remains to understand the effects of the developmental timing of CSA and sensitive periods, especially as related to engagement in sex work and other high-risk outcomes.

A childhood diagnosis of ADHD-C was significantly and prospectively associated with later sex work in our

sample. Indeed, all seven of the sex workers had this diagnosis as young children. An early ADHD-C diagnosis is not, of course, a condition that consigns women to adverse outcomes but rather comprises an additional factor to be monitored in tandem with other childhood and adolescent variables that increase risk for sex work. ADHD-C has been linked to a range of sexual risk behaviors, including earlier sexual intercourse and oral sex, higher rates of teenage pregnancy, and a greater number of sexual partners (Flory et al., 2006; Halkett & Hinshaw, 2020; Hechtman et al., 2016), several of which are themselves risk factors for sex work (Pedersen & Hegna, 2003; Potter et al., 1999; Wilson & Widom, 2010). Although exploratory in nature, our results suggest that early impulsivity, along with other vulnerabilities, may be a crucial construct to consider with respect to later health risks, both sexual and non-sexual (Meza et al., 2020). Clinicians treating girls with ADHD-C would do well to ask about sexual activity as patients approach adolescence and provide youth with psychoeducation about how to engage in safe sex. While clinicians may be hesitant to address sexual activity with young clients in practice, an open dialogue about the risks and benefits associated with sex is critical to empower young women to make informed decisions about their own health.

Beyond CSA and ADHD-C, we found that ADHD-related medication and educational attainment were protective against sex work when CSA was measured dichotomously. These findings are consistent with research demonstrating that stimulant medication may reduce the likelihood of risky behavior among youth with ADHD (Dalsgaard et al., 2014; Ruiz-Goikoetxea et al., 2018). One possible explanation is that ADHD medication curtails risky sexual behaviors to some extent by reducing impulsivity, thereby disrupting the prevailing theory linking CSA to sex work via increasingly risky sexual behaviors (Abramovich, 2005; Kendall-Tackett et al., 1993). ADHD medication also contributes to increased academic success in youth with ADHD (Boland et al., 2020), such that stimulants may further bolster the protective effect of education for this population. Research from our laboratory has shown that low educational attainment in early adolescence mediates the link between ADHD and unplanned pregnancy (Owens & Hinshaw, 2019). It may be that young women with lower educational attainment, relatively common among those with childhood ADHD, are more likely to engage in sex work because of its increased financial dividends as compared to other available job opportunities. Social support from peers and teachers in school settings may also contribute to protective effects associated with greater education (Kaestle, 2012). Clearly, early education is a critical area of intervention for individuals at risk for sex work, especially those with histories of ADHD, and school involvement should be actively encouraged by both clinicians and parents throughout development.

Although our small subsample of women who identified as sex workers precludes investigation of possible mechanisms, we highlight important areas focr future inquiry. First, increased memory capacity may contribute to heightened effects of CSA in late childhood/early adolescence by strengthening memories of traumatic events (Dunn et al., 2018). Second, normative developmental increases in sexual behavior may provide further opportunities for revictimization and reinforcement of the dysfunctional sexual model initially instilled by CSA. These interactions may lead to a self-reinforcing cycle of risky behavior and subsequent engagement in sex work (Kaestle, 2012). Other hypothesized mechanisms include early puberty (Ryan et al., 2015), deficits in emotion regulation capacities (Chaplo et al., 2017; Dunn et al., 2018), and low self-esteem (Lalor & McElvaney, 2010; Pulverman et al., 2018), all of which become quite salient in adolescence. In fact, our laboratory revealed that low childhood self-esteem significantly predicted later self-harm, of which the highest rates emerged among women with ADHD-C (Meza et al., 2020). Examining such mechanisms will be essential for targeted intervention. Clinicians working with adolescents in particular should incorporate progress monitoring into their clinical practice to ensure that these developmental changes are being identified and discussed regularly with patients.

Finally, we briefly advocate for the decriminalization of sex work as a progressive policy change with substantial public health implications. Decriminalizing sex work would facilitate greater access to treatment for sexual abuse and STIs, both of which have high costs to society (Letourneau et al., 2018)—and would further increase sex workers' capacity to negotiate for safer work-place regulations such as mandatory condom use. Countries such as New Zealand and the Netherlands have shown that decriminalization reduces rates of violent crime, sexual abuse, and rape (Bisschop et al., 2017), offering convenient policy models that the U.S. could replicate. Currently, clinicians working with current or former sex workers should be mindful of the stigma surrounding sex work, maintain a nonjudgmental stance in their own practice, and support sex workers' agency and decision-making with respect to their sexual health.

Our study has several important limitations. First, the extremely small number ($n = 7$) of participants engaging in sex work provides a clear limit on statistical power and cautions against drawing any firm conclusions based on the present data alone. That is, our results should not be considered generalizable to the larger populations of sex workers and women with ADHD until findings have been replicated with more representative samples. Given the paucity of longitudinal research examining pathways to sex work, however, we believe that these exploratory findings still add to the literature. Moreover, we used Firth's penalized likelihood method as an approach

shown to provide a reasonably accurate discriminatory performance when predicting rare events such as sex work (Adhikary & Rahman, 2021). Second, with the presence of complete separation in the dataset, OR estimates will vary considerably by statistical approach (Giaimo et al., 2006; Mansournia et al., 2018), particularly for the variable causing separation (in this case, the ADHD-C group). Thus, although we included OR estimates for predictor variables in each Series for the sake of transparency, we acknowledge potential reliability concerns for these specific values and call for follow-up research to replicate these findings. Third, despite its strengths in assessing developmental timing and providing a conservative, multi-informant validation of abuse, our measure of CSA made it impossible to examine abuse characteristics such as frequency or severity of abuse. It is also conceivable that some instances of CSA were missed, if the abuse occurred but was unsubstantiated or did not lead to an out-of-home placement. Also, we do not have data on the age at which participants started engaging in sex work, such that it is possible that some girls may have initiated sex work prior to experiencing CSA in early adolescence. Given that no participants reported sex work as an occupation before W4 (e.g., when all participants were in their 20 s) and that numerous multi-informant measures indexed sexual behavior throughout adolescence, we deem it unlikely that sex work occurring before CSA went uncaptured; but we cannot know with total certainty whether this is the case. Next, as this study is naturalistic, we have limited data on participants' dosage and frequency of stimulant medication use during adolescence, such that our binary variable does not capture differing degrees of medication use. Finally, we could not examine potential mechanisms in the developmental pathway from CSA to sex work because of the extremely small sample size and unclear temporal ordering of variables. We were thus unable to test the prevailing theory of CSA predicting engagement in sex work via increasing risky sexual behaviors (Abramovich, 2005; Kaestle, 2012).

Limitations notwithstanding, we suggest that the developmental timing of CSA is crucial to consider with respect to sex work and other behavioral outcomes. Early impulsivity, as exemplified by a childhood diagnosis of ADHD-C, may be an additional factor of relevance, although replication studies are necessary to confirm this link. Given the health risks of engaging in sex work and cascading developmental outcomes associated with ADHD, further prospective research in this area is critically needed.

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Availability of Data and Material All data and materials support our claims and comply with field standards.

Code Availability Not applicable.

Declarations

Ethics Approval This research study was approved by the Committee for the Protection of Human Subjects at the University of California, Berkeley.

Consent to Participate Youth provided assent and parents or legal guardians provided informed consent for themselves and for their children to participate in all study procedures when participants were minors. All participants provided informed consent once they were aged 18 or older.

Consent for Publication Youth provided assent and parents or legal guardians provided informed consent for publication when participants were minors. All participants provided informed consent once they were aged 18 or older.

Conflicts of Interest The authors declare that they have no relevant financial or non-financial conflicts of interest to disclose.

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