Are There Early Risk Markers for Pedophilia? A Nationwide Case-Control Study of Child Sexual Exploitation Material Offenders

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Abstract

Although prior research suggests associations between parental characteristics and later sexual offending in offspring, possible links between early pregnancy-related factors and sexual offending remain unclear. Early risk markers unique to sexual offending, however, may be more prominent among sexual offenders with atypical sexual interests, such as individuals involved with child sexual exploitation material (CSEM; also referred to as child pornography). We examined the prospective association between parental and pregnancy-related risk markers and a behavioral indicator of pedophilic interest, CSEM offending. All 655 men born in Sweden and convicted of CSEM offending between 1988 to 2009 were matched 1:5 on sex, birth year, and county of birth in Sweden to 3,928 controls without sexual or nonsexual violent convictions. Paternal age (adjusted odds ratio [AOR] = 1.3, 95% confidence interval [CI] [1.1, 1.7]), parental education (AOR = 0.8, 95% CI [0.6, 0.9]), parental violent criminality (AOR = 2.9, 95% CI [2.2, 3.8]), number of older brothers (AOR = 0.8, 95% CI [0.6, 0.9] per brother), and congenital malformations (AOR = 1.7, 95% CI [1.2, 2.4]) all independently predicted CSEM convictions. This large-scale, nationwide study suggests parental risk markers for CSEM offending. We did not, however, find convincing evidence for pregnancy-related risk markers, with the exception of congenital malformations and having fewer older brothers.

A breadth of evidence suggests that pregnancy-related factors and parental characteristics are important predictors of many later life outcomes. For example, an adverse intrauterine environment, as indicated by fetal growth restriction (e.g., low birth weight, small head circumference) and preterm birth, is linked to poorer cognitive outcomes (D'Onofrio et al., 2013; Griffith, Mann, & McDermott, 2011; Lundequist, Böhm, Lagercrantz, Forssberg, & Smedler, 2015), psychopathology (D'Onofrio et al., 2013; Fazel et al., 2012; Johnco et al., 2016; Lindström, Lindblad, & Hjern, 2009; Nosarti et al., 2012; Robinson et al., 2009;

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Tuovinen et al., 2012), and violent offending (Babchishin et al., 2016). In a large Swedish population-based cohort, preterm births were associated with three times higher odds of autism and a doubling of the odds of attention deficit-hyperactivity disorder (ADHD) compared with children born at full term (D'Onofrio et al., 2013). Furthermore, in a nested case-control study of offenders assessed forensically for psychiatric disorders, Fazel et al., (2012) found that those diagnosed with personality disorders ($n = 150$) had three times higher odds of preterm birth and immaturity not otherwise specified compared with offenders without any diagnoses for psychiatric disorder ($n = 97$).

In addition to pregnancy-related factors, several parental characteristics have been associated with later life outcomes in their children. For example, young age of parents, lower parental education, parental criminality, and parental mental health issues have been found to increase offspring criminality risk (Connolly, Schwartz, Jackson, & Beaver, 2018; Coyne, Långström, Rickert, Lichtenstein, & D'Onofrio, 2013; Dean et al., 2012; Kendler, Morris, Lönn, Sundquist, & Sundquist, 2014; Kolvin, Miller, Scott, Gatzanis, & Fleeting, 1990; Kuja-Halkola, Pawitan, D'Onofrio, Långström, & Lichtenstein, 2012; Mok et al., 2016) and psychopathology (McAdams et al., 2015; Singh et al., 2011). In summary, several population-based studies suggest small to moderately strong associations between early risk markers (including pregnancy-related factors and parental characteristics) and various life outcomes, such as criminality and psychopathology.

In the current study, we examined early risk markers for CSEM offending to contribute improved etiological understanding and possibly identify targets useful in primary and secondary prevention programs, such as maternal health initiatives.

Are Early Risk Markers Also Associated With Pedophilia?

Pedophilia is considered a major risk marker for both the onset and persistence of sexual offending against children (Seto, 2008). A recent online survey of 8,718 self-selected German men found that 4% of the sample reported sexual fantasies involving prepubescent children, 3% reported committing a sexual offense against a prepubescent child, a limited 0.1% endorsed a pedophilic sexual preference, and sexual interest in children was associated with sexual offending behavior against children (Dombert et al., 2016; for a review of prevalence studies, see Tenbergen et al., 2015). In contrast to the general male population, it has been estimated that only about half of the individuals who commit sexual offenses against children can be categorized as pedophilic (Seto, 2008).

Smaller, retrospective, and cross-sectional studies of forensic or correctional samples suggest that certain early risk markers might also be associated with pedophilia (e.g., Cantor et al., 2004; Dyshniku, Murray, Fazio, Lykins, & Cantor, 2015). The available literature suggests that pedophilic men who sexually offended against children are marginally shorter (1.7 cm; McPhail & Cantor, 2015) and exhibit moderately more minor physical anomalies, indicative of neurodevelopmental perturbations, than nonpedophilic male sexual offenders against children (Dyshniku et al., 2015). Pedophilic male offenders against children are also reported to have moderately lower general cognitive ability than male sexual offenders with

either a sexual interest in pubescent children (7 Intelligence Quotient [IQ] points less) or in adults (9 IQ points less), respectively (Blanchard et al., 2007).

In addition to more easily observable indicators, structural brain differences between pedophilic and nonpedophilic men have been detected using small groups of offending and nonoffending men with pedophilia, non–sex offenders, and nonoffender controls (Cantor & Blanchard, 2012; Cantor et al., 2008; Poeppl et al., 2013; Ponseti et al., 2012; Schiffer et al., 2008a, 2008b, 2007; Schiltz et al., 2007). Affected brain regions may be involved in processing potential sexual partner cues, including youthfulness (see Seto, in press). Given that the findings from these early neuroimaging studies are inconsistent, the results are merely suggestive (for review, see Mohnke et al., 2014), similar to neuroimaging research on interpersonal violence (for review, see Lamsma, Mackay, & Fazel, 2017). Pedophilic male sexual offenders also have later birth order positions and, specifically, a slightly greater number of older brothers than non-sexual offenders and heterosexual men. This finding holds after controlling for female siblings and overall number of siblings (Blanchard, 2018; Blanchard et al., 2000; Lalumière, Harris, Quinsey, & Rice, 1998; Langevin, Langevin, & Curnoe, 2007). These minor neurological, and at least partly prenatally determined perturbations are typically cited to support the view that pedophilia may be prenatally influenced (Seto, 2012).

Finally, a nationwide study (Babchishin et al., 2016) examined early risk markers among all 13,773 male sexual offenders convicted in Sweden between 1973 and 2009 with matched controls and found only three pregnancy-related factors that could be considered early risk markers for sexual offending in general. Specifically, being small for gestational age, any congenital malformation, and small head circumference were independent but weak risk markers of being convicted of a sexual offense against children. Babchishin et al.'s study (2016) was unique in controlling for important parental characteristics (e.g., parental criminality) when examining the association between pregnancy-related factors and offspring sexual offending. Given the robust link between parental characteristics and offspring outcome (e.g., parental sexual offending and sexual offending in the offspring; Långström, Babchishin, Fazel, Lichtenstein, & Frisell, 2015) and associations between parental characteristics and pregnancy-related factors (e.g., maternal age and preterm birth; Goldenberg, Culhane, Iams, & Romero, 2008), large sample sizes are required to control for these important variables. These studies, however, have complementary limitations.

Smaller clinical studies can identify pedophilic offenders but are not representative and do not control for important confounds, whereas population studies like Babchishin et al. (2016) are representative and can control for important confounds, but cannot identify pedophilic sex offenders. One way of addressing this limitation is to conduct similar analyses focusing on offenders who committed child sexual exploitation material (CSEM, or child pornography) offenses, because a higher proportion of these offenders—compared with all sexual offenders against children—are pedophilic (Babchishin, Hanson, & VanZuylen, 2015). In one study, 61% of CSEM offenders were classified as pedophilic based on penile plethysmography, whereas only 35% of contact sexual offenders against children were classified as such (Seto, Cantor, & Blanchard, 2006). The difference in pedophilic interest is even more pronounced for offenders who committed both contact

sexual offenses against children and CSEM offenses. A systematic review (Babchishin et al., 2015) found 61% of CSEM-exclusive offenders and 71% of mixed offenders to score higher on sexual interest in children than contact sexual offenders against children. In short, individuals with CSEM offenses are more likely to be pedophilic, more so than typical contact sexual offenders against children, whereas mixed offenders are those most likely to be pedophilic.

Risk Markers for Sexual Offending

Risk markers (or risk factors) for sexual offending against children vary but are often partitioned into sexuality related (also referred to as "sexual deviancy") and general criminality related (Brouillette-Alarie, Babchishin, Hanson, & Helmus, 2016; Seto, 2017). Sexuality-related risk markers encompass hypersexuality or sexual preoccupation, problems with sexual self-regulation, and atypical sexual interests, such as pedophilia. The prevalence and strength of sexuality-related risk markers varies across sexual offenders. For example, pedophilia is neither a sufficient nor necessary condition for sexual offending against children; only about half of offenders are estimated to fulfill diagnostic criteria for pedophilia (Seto, 2008). It is plausible that sexual-offending-specific risk markers may be detected more easily among sexual offenders with more prominent sexuality-related risk markers. Such offenders may have different causal risk markers compared with sexual offenders low on sexuality-related risk markers but instead be more similar in general criminality to non-sexual offenders.

Albeit suggestive, prior studies suffer from recall and selection biases, limited power, and inadequate consideration of important confounds, including parental age at childbirth, parental violent criminality, and psychiatric morbidity. Hence, further studies specifically sampling pedophilic sexual offenders would be informative for the etiology of sexual offending and pedophilia. Men who committed CSEM offenses, and especially those with both CSEM and contact sexual offenses against children, offer one way of addressing this on the population level, because these individuals are likely to have pedophilia, and thus risk markers would be more clearly identified. Meta-analyses suggest that CSEM offenders are more likely to have pedophilic interests, sexual preoccupation, and other atypical sexual interests than contact sexual offenders against children (Babchishin, Hanson, & Hermann, 2011; Babchishin et al., 2015; Seto, 2013). Indeed, CSEM offending is a valid diagnostic indicator of pedophilia (Seto et al., 2006; Seto, Stephens, Lalumière, & Cantor, 2015). Mixed offenders—who have engaged in two different offenses that suggest a sexual interest in children—may be even more likely to fulfill criteria for pedophilia than contact sexual offenders against children (Babchishin et al., 2015). Thus, if early risk markers are primarily or exclusively detected among pedophilic sex offenders, examining CSEM offenders may reveal these unique factors. Such a study would be informative to our understanding of the etiology of pedophilia, sexual offending, and CSEM offending.

In the current study, we tested potential early risk markers for sexual offending suggested in the literature (for reviews, see Seto, 2008, 2013) using an unselected sample of men (all convicted CSEM offenders in Sweden from 1988 to 2009) and accounted for possible confounding variables (e.g., parental risk markers) using a case-control design.

Method

Study Setting and Case Identification

Applying a similar methodology as Babchishin and colleagues (2016), we used Swedish population-based registries with prospectively collected data, linked using the unique personal identification number assigned to every Swedish resident. We included men only because too few women were convicted of CSEM offenses for meaningful analyses. A 1:5 nested case-control design with matching on sex, birth year, and county of birth in Sweden was used to examine factors associated with CSEM offending in men. A 1:5 matching was used to increase statistical power and the precision of estimates as expressed by narrowed confidence intervals (CIs) (Grimes & Schulz, 2005). Matching on birth year was done so that each case and its respective controls would have the same period at risk for committing a sexual offense and similar likelihoods of being apprehended, prosecuted, and convicted as reflected in national registers. Matching on birth year also controlled for any cohort effects in the incidence of risk markers for offending, or their associations over time, as well as left truncation (i.e., nonregistration of data before register establishment in 1973). In addition, we matched for county of birth to manage bias from variability across Sweden in documentation practices or data quality. Each case had at least one conviction for a CSEM offense according to the Swedish Penal Code, from 15 years of age (the age of criminal responsibility in Sweden). If there was more than one conviction date, the first conviction date was used as the matching date. Matched controls were not allowed to have any sexual or violent nonsexual conviction up until the offense date for the CSEM offender. This study was approved by the Royal Ottawa Hospital Research Ethics Board (protocol 2015006).

Measures

Crime Measures—The National Crime Register (held by the Swedish National Council for Crime Prevention) provided data on all criminal convictions in lower court for 1973 to 2009. According to Swedish Penal Law, offenders are convicted regardless of mental illness; hence, the register includes those receiving not-guilty-by-reason-of-insanity verdicts and forensic psychiatric care, as well as noncustodial sentences, fines, and cautions. Plea bargaining is not permitted in Sweden; hence, sexually motivated offenses were always registered as such. A minority of cases (13%) are appealed, sometimes followed by an altered sentence, yet seldom full acquittal, in higher court. *Nonsexual violent crime* was defined as convictions for homicide, assault, robbery, or illegal threats, including aggravated or attempted versions, according to the Swedish Penal Code. *Sexual offending* was also defined according to the Swedish Penal Code, and included two main categories: (a) intra- or extrafamilial contact sex offenses against children and (b) CSEM offenses. Only men with CSEM offenses were included in the current study.

Obstetric and Birth Data—The Medical Birth Register (National Board of Health and Welfare) holds prospective data on more than 99% of births and preceding pregnancies in Sweden from 1973 onward. The register includes detailed pregnancy-related information, including maternal and paternal age at birth, as well as pregnancy and delivery characteristics, including gestational age, small head circumference (33 centimeters), low birth weight (< 2,500 g), and being small for gestational age (2 SD below the mean birth

weight for gestational age). Congenital malformations were coded according to the International Statistical Classification of Diseases and Related Health Problems (ICD-8/9: 760–779; ICD 10: P00–P99). A low Apgar score at 5 minutes was defined as a score below 7.

Parental Characteristics—Information on highest education obtained by either parent (0 = primary school, 1 = secondary school, 2 = postsecondary qualification) was collected from the Swedish Education Registry. Data on parental psychiatric morbidity requiring inpatient treatment before the son's birth were obtained from the National Patient Register, comprising data for all individuals discharged from a Swedish hospital. We coded any major psychiatric disorder among the parents (yes/no; psychotic [schizophrenia spectrum and other nonorganic psychoses but not bipolar disorder, ICD-8: 291, 295, 297, 298, 299; ICD-9: 295, 297, 298; ICD-10: F20–F25, F28–F29, F32.3, x.5 in F10–F19], *affective* [depressive and bipolar disorders, ICD-8: 296.1, 296.0, 296.2–296.8, 300.4, ICD-9: 296A, 296B–296E, 296W, 296X, 300E, 311, ICD-10: F30–F39 except 32.3], *personality disorder* [ICD-8/ICD-9: 301 and ICD-10: F60]), any *substance use disorder* (yes/no; ICD-8: 303, 304; ICD-9: 303, 305A, 305X; ICD-10: F10, except F10.5, and F11–F19, except x.5), and any *suicide attempt* (yes/no; ICD-8/ICD-9: E950–E959, E980–E989; ICD-10: X60–X84, Y10–Y34). Paraphilia diagnoses, seldom a cause for inpatient care, were not reliably available in the registry.

As violent and sexual offending run in families (Frisell, Lichtenstein, & Långström, 2011; Långström et al., 2015), we addressed violent crime convictions (including violent sexual offenses but excluding nonviolent sexual offenses [primarily noncontact, sexual harassment offenses including exhibitionistic acts]) by parents of cases and controls from 1973 to 1985 (0 = no parental convictions; 1 = at least one parent had a conviction for a violent offense; data obtained from the National Crime Register).

Statistical Analyses

Conditional logistic regression, recommended for matched case-control designs (e.g., Hosmer, Lemeshow, & Sturdivant, 2013), was used to examine associations of early risk markers and subsequent offending by male offspring. Specifically, the purpose is to examine whether the presence of the marker (e.g., being small for gestational age) increased the likelihood to be identified as a case (i.e., men with CSEM convictions) relative to a control (i.e., men in the general population without CSEM, sexual, or violent convictions). Two independent models were used, one for parental factors and the other for pregnancy-related factors. The final multivariate model included all variables significant at $p < .05$ in bivariate analyses. Given that previous research (Babchishin et al., 2015) suggested possible meaningful differences between subgroups of CSEM offenders, we also examined if risk markers were different for CSEM-exclusive offenders compared with mixed offenders. Nonoverlapping 95% CIs indicate a significant difference at $p < .01$ (Tryon, 2001). Analyses were conducted using Stata 14 (StataCorp, 2015).

Results

Participants included all 655 male convicted CSEM offenders born in Sweden between 1973 and 1994 (*Mdn* = 1981). Twenty-three women convicted for CSEM offenses (and their 135 matched controls) were excluded. Age at first CSEM offense, following the age of criminal responsibility,[1] ranged from 15 to 38 years (*M* = 25.2, *SD* = 5.7). The majority of CSEM offenders did not have any prior or concurrent conviction for a contact sexual offense (i.e., they were CSEM-exclusive offenders, 65.0%, *n* = 426). The remaining 229 (35.0%) were CSEM offenders with any contact sexual offense against children under the age of 15 years of age or, if the adult was in a position of trust, under the age of 18 (i.e., mixed offenders, those most likely to be pedophilic according to Babchishin et al., 2015). Further, 74 out of 229 (32.3%) mixed offenders had, in addition to a contact offense against a minor, been convicted of a contact sexual offense against adults 18 years of age or older. Dates for these contact offenses against children occurred prior to the CSEM offense date (91.7%, *n* = 210) or on the same offense date as the CSEM offense (8.3%, *n* = 19). About half of mixed offenders (51.5%; *n* = 118) and 27.9% of CSEM-exclusive offenders also had a conviction for a nonsexual violent offense (based on Swedish criminal code, defined as homicide and attempted homicide, assault, robbery, arson, and illegal threats or intimidation) where the offense occurred before, concomitant to, or after the CSEM offense. Offenders were matched 1:5 to 3,928 controls without a sexual or nonsexual violent offense at the time of the index offense of their matched case (also ages 15 to 38 years; *M* = 25.2, *SD* = 5.7). Table 1 provides descriptive information for each participant group.

Risk Markers

Six out of the seven parental risk markers measured in the current study predicted CSEM offending in the bivariate analyses (unadjusted model, Table 2). Multivariate analyses suggested that three of these parental characteristics (i.e., young paternal age, lower parental education, and parental violent crime) independently predicted CSEM offending, with similar moderate effect sizes. Two of the six pregnancy-related risk markers (i.e., having fewer older brothers[2] and any congenital malformation) remained statistically significant and of similar moderate strength in the multivariate analysis. A final combined model (Table 2, last column) found that paternal age (adjusted odds ratio [AOR] = 1.33, 95% CI [1.06, 1.67]), parental education (AOR = 0.75, 95% CI [0.64, 0.89]), parental violent convictions (AOR = 2.92, 95% CI [2.23, 3.81]), number of older brothers (AOR = 0.76, 95% CI [0.64, 0.90] per brother), and congenital malformations (AOR = 1.68, 95% CI [1.18, 2.38]) were uniquely associated with CSEM offending, with similar effect sizes as the prior multivariate models (1 and 2) and bivariate analyses.

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[1] We conducted a sensitivity analysis by removing all offenders who were under 19 years of age (*n* = 112) and their matched controls. There was no appreciable effect on the findings. See Online Supplemental Materials for tables.

[2] The effect of older brothers may be confounded by family size. Hence, we examined a multivariate model that controlled for total number of siblings. The number of older brothers continued to predict CSEM offenses even after controlling for total number of siblings (older brother AOR = 0.81, 95% CI [.68, .97]; total siblings AOR = .84, 95% CI = [.76, .93]). We also computed the older brothers ratio (number of older brothers/total number of other siblings; Barbaree, 2018, with larger ratios reflecting a greater number of older brothers relative to other sibling types) as an alternative way to control for sibling number. We found a mean ratio of .15 (*SD* = .38) for the CSEM group and .23 (*SD* = .50) for control group; this ratio had a similar association with CSEM offending (older brothers ratio OR = 0.67, 95% CI [0.51, 0.90]) as the raw total number of older brothers. In short, the effect of older brothers remains relevant even after controlling for other siblings.

Only marginal differences in risk markers between CSEM-exclusive and mixed offenders emerged (Table 3). Lower parental education, parental violent convictions, and fewer older brothers predicted offending similarly for both CSEM subgroups in multivariate analyses (overlapping CIs). Younger paternal age remained an equally strong independent risk marker among both CSEM-exclusive offenders and mixed offenders, although failed to reach statistical significance in the latter case because of limited statistical power. Finally, any congenital malformation remained an independent risk marker for mixed offenders but not for CSEM-exclusive offenders, resulting from both a weaker effect size and limited statistical power.

Discussion

The current study is the first to examine the association between early risk markers and later CSEM offending using an unselected, population-based sample and matched controls. CSEM offenders, especially mixed offenders, are sex offenders most likely to be pedophilic (Babchishin et al., 2015). As such, if early risk markers are primarily or exclusively detected among pedophilic sex offenders, then examining CSEM offenders may reveal such unique factors. We had two main findings. First, multivariate modeling suggested that parental risk markers (younger paternal age, lower parental education, parental violent crime) and fewer older brothers were independent, weak to moderate predictors of CSEM offending. Second, with the exception of congenital malformations, we did not find pregnancy-related factors that distinguished male CSEM offenders from male controls without a history of sexual or other violent offenses.

Parental risk markers were less common in men convicted of CSEM offenses than men convicted of any sexual offense (including sexual offenses against children and CSEM; Babchishin et al., 2016). The associations between parental characteristics and offending were similarly strong, however, for both CSEM offending and contact sexual offending against children. CSEM offenders had lower rates of pregnancy-related risk markers compared with sexual offenders against children, and the associations between pregnancy-related factors and CSEM offending were generally weaker than their associations with sexual offending against children (Babchishin et al., 2016). Being small for gestational age (i.e., weighing < 2500 g) and having a small head circumference at birth (i.e.,   33 cm) were previously found to be related to any sexual offending and sexual offending against children (Babchishin et al., 2016). In the current study, we found weaker, non-significant associations between these two pregnancy-related factors and CSEM offending. Congenital malformations had a similar association for the onset of both CSEM offending and sexual offending against children. Having fewer older full brothers was a significant risk marker for the onset of CSEM offending, but had a small and non-significant association with sexual offending against children. In sum, there are few and inconsistent pregnancy-related risk markers for CSEM offending and sexual offending in general. In contrast to pregnancy-related risk markers, parental risk markers appear to have similarly strong associations to CSEM offending, sexual offending in general, and violent nonsexual offending.

Limitations

It is possible that the early risk markers examined here may not be specific to sexual offending or even to pedophilic sexual interest but rather related more broadly to sexuality. For example, selected samples of men who identify as asexual (Yule, Brotto, & Gorzalka, 2014) or gay (Blanchard, 2018; Breedlove, 2017) report more older brothers than men who do not identify as asexual or gay. Two to four times the rate of left-handedness (for review, see Veale, Clarke, & Lomax, 2010) and a moderately smaller 2D:4D finger length ratio (e.g., Kraemer et al., 2009; Schneider, Pickel, & Stalla, 2006), both determined in utero, were found in clinical studies of transgendered individuals. Samples of lesbians also have moderately smaller 2D:4D finger length ratios than straight women (Breedlove, 2017). As such, future studies examining the association of early risk markers with pedophilia would benefit from the inclusion of general sexuality measures.

It is also possible that some of these early risk markers are associated with general criminality, others to sexual behavior, and others to both. Older brothers offer one illustration of this conundrum. A number of studies suggest that having older siblings is associated with more antisocial behaviors in younger siblings (Argys, Rees, Averett, & Witoonchart, 2006; Breining, Doyle, Figlio, Karbownik, & Roth, 2017; Kolvin et al., 1990; Silles, 2010). Studies, however, also suggest that having more older brothers is associated with pedophilia and preference for watching coercive sexual scenes among sexual offenders (Bogaert, Bezeau, Kuban, & Blanchard, 1997; Lalumière et al., 1998). Mixed offenders and CSEM-exclusive offenders differ on general criminality and pedophilic interests, with mixed offenders typically scoring higher on both (Babchishin et al., 2015). As such, it is difficult to disentangle whether observed differences on early risk markers between these two groups can be attributed to differences in pedophilia, general criminality, or both. In addition, the ratio of older brothers to total number of brothers appears higher for pedophilic homosexual than pedophilic heterosexual sex offenders against children (Bogaert et al., 1997; Lalumière et al., 1998). It is possible, therefore, that we may have found different associations had we been able to separate CSEM offenders based on sexual orientation for gender.

Importantly, despite a complete national sample of 655 men convicted of CSEM from 1988 to 2009, the statistical power remained limited, resulting in wide CIs. In addition, the current study relied on official convictions for CSEM offenses as a proxy for pedophilia. Although CSEM offenses are a valid indicator of pedophilia diagnoses (Seto et al., 2006), we were not able to ascertain the reliability of these diagnoses. It is also plausible that some of these individuals were hebephilic (i.e., having a sexual interest in pubescent children; Blanchard et al., 2009). Swedish CSEM legislation defines "child" as someone under the age of 18 or who has not yet completed his or her pubertal development. Most children portrayed in CSEM, however, are prepubescent and estimated to be younger than 12 years old (Wolak, Finkelhor, & Mitchell, 2011), likely due to police and prosecutorial decision making. Specifically, Wolak et al. (2011) found that 28% of individuals arrested for CSEM offending had images depicting children estimated to be under three years of age, 46% had images depicting children estimated to be three to five years old, 86% had images depicting children estimated to be six to 12 years old, and 27% had pictures depicting children estimated to be 13 to 17 years old. Hence, samples of adjudicated CSEM offenders may be biased toward

persons with pedophilia rather than hebephilia. Focusing on convicted offenders, however, suggests our sample of mixed offenders was less likely to include pedophilic men who prefer boys, because boys are less likely to disclose victimization to police (Seto, 2008). It is important to note that case-control studies, such as the current study, suggest associations that are not necessarily causal. Finally, given the absence of genetically informative data (e.g., twin study), the study cannot speak to the influence of nature (genetics) versus nurture (environment) on risk markers for CSEM offending.

Conclusion

We studied CSEM offenders who are more likely to have pedophilia than the broader category of sexual offenders against children (e.g., Babchishin et al., 2015). We did not find clear evidence for the specificity of early risk markers for pedophilia. Compared to a previous study examining sexual offenders (Babchishin et al., 2016), associations with parental risk markers were similar in strength, whereas fewer pregnancy-related factors were associated with CSEM offending. Importantly, selection effects were less pronounced in the current total population study compared with prior studies that found pregnancy-related risk markers in pedophilic individuals. Prior studies primarily sampled adjudicated sexual offenders referred for assessment and also suffered from retrospective recall bias and small sample sizes (e.g., Bogaert et al., 1997; Langevin et al., 2007). Some neurodevelopmental factors may be specific to pedophilia and others to general criminality and/or to sexuality in general. This raises an interesting follow-up question: To what extent is the link between pedophilia and pregnancy-related factors confounded by general criminality and sexuality generally? Future studies using both nonoffending and offending individuals with pedophilic sexual interest, such as via online surveys, and general measures of sexuality and general criminality might help distinguish pregnancy-related factors specific to pedophilia from those related to sexuality and to general offending behavior (e.g., Massau et al., 2017).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Descriptives of Early Risk Markers in a Nationwide Case-Control Study of All Convicted, Male, Swedish-Born, Child Sexual Exploitation Material (CSEM) Offenders and Matched General Population Controls

	CSEM Offenders			
	All Offenders	**Mixed**	**CSEM Exclusive**	**Matched Population Controls**
Variables	**% (*n/N*) or *M* (*SD, N*)**			
Birth year	1981	1981	1981	1981
	(5.4, *n* = 655)	(5.9, *n* = 229)	(5.4, *n* = 426)	(5.4, *n* = 3,928)
Parental				
Age of mother at delivery < 25 yrs[a]	38.0%	41.8%	36.5%	29.7%
	(246/647)	(94/225)	(154/422)	(972/3,271)
Age of father at delivery < 25 yrs[a]	22.6%	22.9%	22.5%	15.0%
	(141/623)	(50/218)	(91/405)	(480/3,196)
Highest parental education	0.97	0.97	0.97	1.04
	(0.54, *n* = 644)	(0.53, *n* = 225)	(0.54, *n* = 419)	(0.57, *n* = 3,899)
Any parental violent conviction	17.4%	20.4%	15.7%	7.8%
	(112/645)	(46/225)	(66/420)	(305/3,903)
Any parental psychiatric disorder	2.9%	1.3%	3.8%	1.8%
	(19/647)	(3/225)	(16/422)	(60/3,273)
Any parental substance use disorder	2.6%	2.2%	3.1%	1.2%
	(17/647)	(5/225)	(13/422)	(40/3,273)
Any parental suicide attempt	2.6%	1.5%	0.8%	1.1%
	(17/647)	(3/204)	(3/359)	(35/3,273)
Pregnancy-Related				
Number of older full brothers	0.26	0.23	0.27	0.37
	(0.51, *n* = 647)	(0.48, *n* = 225)	(0.53, *n* = 422)	(0.64, *n* = 3,273)
Low Apgar (< 7 at 5 min)	1.1%	1.5%	0.8%	1.3%
	(6/563)	(3/204)	(3/359)	(44/3,404)
Birth weight < 2,500 g	3.0%	3.1%	3.0%	3.4%
	(20/655)	(7/229)	(13/426)	(135/3,928)
SGA	4.4%	5.3%	3.8%	3.3%
	(28/643)	(12/226)	(16/417)	(127/3,827)
Any congenital malformation	7.2%	9.2%	6.1%	4.7%
	(47/654)	(21/229)	(26/425)	(183/3,922)
Head circumference 33 cm	20.0%	25.3%	17.1%	18.4%
	(131/655)	(58/229)	(73/426)	(724/3,928)

Note. Mean (standard deviation, sample size) for continuous variables, % (*n*) for categorical variables. "Mixed" denotes CSEM offenders who were also convicted of a contact sexual offense against children. Male population control subjects were matched 1:5 on birth year and county of birth in Sweden. Highest parental education (across both biological parents): 0 = primary school, 1 = secondary school, 2 = postsecondary qualification. SGA = small for gestational age, defined as two standard deviations or more below the mean birth weight for gestational age.

[a]Reference category is 25 to 44.9 years of age.

Table 2

Early Risk Markers Among All Convicted, Male, Swedish-Born, Child Sexual Exploitation Material (CSEM) Offenders Compared to Matched Population Controls in a Nationwide Case-Control Study (Full Sample)

| | Unadjusted (Bivariate) Logistic Regression | | Adjusted (Multivariate) Logistic Regression[b] | | | |
| | | | Parental/Pregnancy-Related Models Separately | | Parental/Pregnancy-Related Models Combined | |
Variables	OR	[95% CI]	AOR	[95% CI]	AOR	[95% CI]
Parental						
Age of mother at delivery < 25 yrs[a]	**1.47**	**[1.23, 1.76]**	1.15	[0.92, 1.42]	—	—
Age of father at delivery < 25 yrs[a]	**1.64**	**[1.33, 2.03]**	**1.33**	**[1.03, 1.71]**	**1.33**	**[1.06, 1.67]**
Highest parental education	**0.79**	**[0.68, 0.92]**	**0.78**	**[0.66, 0.92]**	**0.75**	**[0.64, 0.89]**
Any parental violent conviction	**2.44**	**[1.93, 3.09]**	**2.76**	**[2.10, 3.63]**	**2.92**	**[2.23, 3.81]**
Any parental psychiatric disorder	1.60	[0.95, 2.72]	—	—	—	—
Any parental substance use disorder	**2.16**	**[1.22, 3.84]**	1.08	[0.54, 2.15]	—	—
Any parental suicide attempt	**2.46**	**[1.37, 4.43]**	1.55	[0.78, 3.08]	—	—
Pregnancy-Related						
No. of older full brothers	**0.71**	**[0.61, 0.84]**	**0.71**	**[0.61, 0.84]**	**0.76**	**[0.64, 0.90]**
Low Apgar (< 7 at 5 min)	0.78	[0.33, 1.85]	—	—	—	—
Birth weight (< 2,500 g)	0.89	[0.55, 1.43]	—	—	—	—
SGA	1.38	[0.90, 2.11]	—	—	—	—
Any congenital malformation	**1.57**	**[1.13, 2.18]**	**1.54**	**[1.10, 2.15]**	**1.68**	**[1.18, 2.38]**
Head circumference (33 cm)	1.11	[0.90, 1.38]	—	—	—	—

Notes. Male population control subjects were matched 1:5 on birth year and county of birth in Sweden. Highest parental education (across both biological parents): 0 = primary school, 1 = secondary school, 2 = postsecondary qualification. SGA = small for gestational age, defined as two standard deviations or more below the mean birth weight for gestational age. Unadjusted odds ratios (ORs) were generated with bivariate logistic regression, not controlling for any other variables. Each adjusted OR (AOR) represents the change in the odds of committing a CSEM offense for each one unit increase of each risk marker, after controlling for/maintaining all other variables in the model constant. Sample size was reduced in the final model due to listwise deletion (i.e., participants were excluded from analysis if any single value was missing). Bolded figures are statistically significant at $p < .05$. Model fit: Model 1 (adjusted model, controlling only for parental risk factors): pseudo $R^2 = .044$, log likelihood = $-1,050.90$, $N = 3,655$ (n cases = 622). Model 2 (gray shaded, adjusted model, controlling only for pregnancy-related risk factors): pseudo $R^2 = .011$, log likelihood = -1140.92, $N = 3,862$ (n cases = 640). Model 3 (controlling for both parental and pregnancy-related variables, last two columns): pseudo $R^2 = .051$, log likelihood = $-1,043.43$, $N = 3,655$ (n cases = 622).

[a] Reference category is 25 to 44.9 years of age.

[b] Only risk markers with statistically significant odds ratios ($p < .05$) in bivariate analyses were included in adjusted conditional models.

Table 3

Early Risk Markers Among All Male, Convicted, Swedish-Born, Child Sexual Exploitation Material (CSEM) Offenders Compared to Matched Controls in a Nationwide Case-Control Study (Presented by Offender Subtype)

	CSEM-Exclusive Offenders						Mixed CSEM Offenders					
	Unadjusted (Bivariate) Logistic Regression		Adjusted (Multivariate) Logistic Regression[b]				Unadjusted (Bivariate) Logistic Regression		Adjusted (Multivariate) Logistic Regression[b]			
			Parental/Pregnancy-Related Models Separately		Parental/Pregnancy-Related Models Combined				Parental/Pregnancy-Related Models Separately		Parental/Pregnancy-Related Models Combined	
Variables	OR	[95% CI]	AOR	[95% CI]	AOR	[95% CI]	OR	[95% CI]	AOR	[95% CI]	AOR	[95% CI]
Parental												
Age of mother at delivery < 25 yrs[a]	1.36	[1.10, 1.70]	1.08	[0.82, 1.41]	—	—	1.69	[1.26, 2.28]	1.26	[0.89, 1.80]	—	—
Age of father at delivery < 25 yrs[a]	1.62	[1.24, 2.10]	1.38	[1.002, 1.91]	1.33	[1.01, 1.76]	1.68	[1.18, 2.40]	1.28	[0.85, 1.95]	—	—
Highest parental education	0.81	[0.68, 0.98]	0.81	[0.66, 0.99]	0.78	[0.64, 0.95]	0.75	[0.58, 0.97]	0.72	[0.54, 0.96]	0.72	[0.55, 0.96]
Any parental violent conviction	2.00	[1.48, 2.68]	2.26	[1.59, 3.20]	2.35	[1.68, 3.30]	3.59	[2.42, 5.34]	3.76	[2.39, 5.90]	4.63	[2.99, 7.17]
Any parental psychiatric disorder	2.13	[1.16, 3.91]	1.12	[0.52, 2.42]	—	—	0.71	[0.21, 2.39]	—	—	—	—
Any parental substance use disorder	2.65	[1.34, 5.21]	1.40	[0.59, 3.30]	—	—	1.34	[0.44, 4.10]	—	—	—	—
Any parental suicide attempt	2.27	[1.14, 4.53]	1.36	[0.58, 3.20]	—	—	3.07	[1.004, 9.39]	1.52	[0.44, 5.29]	—	—
Pregnancy-Related												
No. of older full brothers	0.75	[0.62, 0.91]	0.75	[0.62, 0.91]	0.78	[0.63, 0.95]	0.65	[0.49, 0.86]	0.64	[0.48, 0.86]	0.65	[0.49, 0.87]
Low Apgar (< 7 at 5 min)	0.70	[0.21, 2.36]	—	—	—	—	0.88	[0.26, 3.01]	—	—	—	—
Birth weight < 2,500 g	1.05	[0.58, 1.90]	—	—	—	—	0.68	[0.31, 1.53]	—	—	—	—
SGA	1.40	[0.80, 2.44]	—	—	—	—	1.36	[0.71, 2.61]	—	—	—	—
Any congenital malformation	1.31	[0.84, 2.02]	—	—	—	—	2.09	[1.25, 3.49]	1.90	[1.12, 3.24]	2.11	[1.23, 3.63]
Head circumference 33 cm	0.99	[0.75, 1.30]	—	—	—	—	1.35	[0.96, 1.88]	—	—	—	—

Notes. Male population control subjects were matched 1:5 on birth year and county of birth in Sweden. "Mixed" denotes CSEM offenders who were also convicted of any contact child sexual offense. "CSEM-Exclusive" denotes CSEM offenders without a contact sex offense. Highest parental education (across both biological parents): 0 = primary school, 1 = secondary school, 2 = postsecondary qualification.

SGA = small for gestational age, defined as two standard deviations or more below the mean birth weight for gestational age. Unadjusted odds ratios (ORs) were generated with bivariate logistic regression, not controlling for any other variables. Sample size was reduced in the final model due to listwise deletion (i.e., participants were excluded from analysis if any single value was missing). Each adjusted OR (AOR) represents the change in the odds of committing a CSEM offense for each one unit increase of each risk marker, after controlling for/maintaining all other variables in the model constant. Bolded figures are statistically significant at $p < .05$. Model fit: CSEM-exclusive offenders: Model 1 (adjusted model, controlling only for parental risk factors): pseudo $R^2 = .033$, log likelihood = −690.36, $N = 2,371$ (n cases = 404). Model 2 (gray shaded, adjusted model, controlling only for pregnancy-related risk factors): pseudo $R^2 = .0003$, log likelihood = −654.44, $N = 2,261$ (n cases = 422). Model 3 (controlling for both parental and pregnancy-related variables): pseudo $R^2 = .036$, log likelihood = −688.39, $N = 2,371$ (n cases = 404). CSEM Mixed offenders: Model 4 (adjusted model, controlling only for parental risk factors): pseudo $R^2 = .073$, log likelihood = −357.87, $N = 1,284$ (n cases = 218). Model 5 (gray shaded, adjusted model, controlling only for pregnancy-related risk factors): pseudo $R^2 = .$ 019, log likelihood = −395.88, $N = 1,353$ (n cases = 225). Model 6 (controlling for both parental and pregnancy-related variables): pseudo $R^2 = .084$, log likelihood = −369.08, $N = 1,351$ (n cases = 225).

[a]
Reference category is 25 to 44.9 years of age.

[b]
Only risk markers with statistically significant odds ratios ($p < .05$) in bivariate analyses were included in adjusted (multivariate) conditional models.