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Paraphilic Sexual Interests and Sexually Coercive Behavior: A Population-Based Twin Study

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Abstract Prior research with selected clinical and forensic samples suggests associations between paraphilic sexual interests (e.g., exhibitionism and sexual sadism) and sexually coercive behavior. However, no study to date used a large, representative and genetically informative population sample to address the potential causal nature of this association. We used self-report data on paraphilic and sexually coercive behavior from 5990 18- to 32-year-old male and female twins from a contemporary Finnish population cohort. Logistic regression and co-twin control models were employed to examine if paraphilic behaviors were causally related to coercive behavior or if suggested links were confounded by familial (genetic or common family environment) risk factors. Results indicated that associations between four out of five tested paraphilic behaviors (exhibitionism, masochism, sadism, and voyeurism, respectively) and sexually coercive behavior were moderate to strong. Transvestic fetishism was not independently associated with sexual coercion. Comparisons of twins reporting paraphilic behavior with their paraphilic behavior-discordant twin further suggested that associations were largely independent of shared genetic and environmental confounds, consistent with a causal association. In conclusion, similar to previously reported predictive effects of paraphilias on sexual crime recidivism, paraphilic behavior among young adults in the general population increases sexual offending risk. Further, early identification of paraphilic interest and preventive interventions with at-risk individuals might also reduce perpetration of first-time sexual violence.

Keywords Paraphilic behavior · Sexually coercive behavior · Twin study · Genetics · Family environment · DSM-5

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Introduction

Sexual violence is an important societal concern worldwide (e.g., Krug, Mercy, Dahlberg, & Zwi, 2002), and reviews suggest that one-quarter of women and one-tenth of men are victimized sexually during childhood (Gilbert et al., 2009) or at any time in life (Abrahams et al., 2014; Jewkes, Garcia-Moreno, & Sen, 2002). Some national surveys suggest both lower (UK; Macdowall et al., 2013) and higher prevalence figures (USA; Black et al., 2011), indicating that methodological issues including the definition of sexual violence substantially influence self-reported base rates (Stoltenborgh, van Ijzendoorn, Euser, & Bakermans-Kranenburg, 2011).

Preventing Sexually Coercive Behavior

Attempts to prevent sexual violence often focus on known perpetrators. However, recent systematic reviews have failed to find clear support for the effectiveness of existing sex offender treatment programs (Dennis et al., 2012; Grønnerød, Grønnerød, & Grøndahl, 2015; Långström et al., 2013). One reason may be that programs have insufficiently focused on risk factors with established causality for sexual violence (see, for example, Ward &

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Beech, 2006; Ward & Siegert, 2002). However, there are indications, primarily from selected clinical samples, that *paraphilias* might be causally related to sexually coercive behavior (see, for example, Abel, Becker, Cunningham-Rathner, Mittelman, & Rouleau, 1988; Knight & Prentky, 1990; Krueger, 2010; Mann, Hanson, & Thornton, 2010).

Paraphilias

A paraphilia can be defined as any "intense and persistent sexual interest other than sexual interest in genital stimulation or preparatory fondling with phenotypically normal, physically mature, consenting human partners" (American Psychiatric Association, 2013). It is necessary to stress that having, or acting on, a paraphilic interest is not necessarily pathological. Most people with atypical sexual interests do not have a mental disorder. Therefore, the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013) makes a clear distinction between paraphilias, that is, atypical sexual interests, and *paraphilic disorders* that additionally cause "distress or impairment to the individual" or cause "personal harm, or risk of harm, to others" (American Psychiatric Association, 2013, p. 685).

The DSM-5 specifies eight paraphilias and their corresponding paraphilic disorders. These are exhibitionism (with a specific focus on sexual arousal from… exposing one's genitals to nonconsenting others), fetishism (…using non-living objects or having a highly specific focus on non-genital body parts), frotteurism (…touching or rubbing against a non-consenting individual), pedophilia (…prepubertal children), sexual masochism (…undergoing humiliation, bondage, or suffering), sexual sadism (…inflicting humiliation, bondage, or suffering), transvestic fetishism (…engaging in cross-dressing), and voyeurism (…spying on others in intimate sexual activities).

Paraphilias and Sexually Coercive Behavior

Intuitively, associations between at least some paraphilias and sexually abusive or coercive behavior seem likely. Acting on certain paraphilias, such as pedophilia or frotteurism, is *per definition* sexually coercive behavior. Sexually sadistic or pedophilic interests, although rarely sufficient since additional offending risk factors are needed in a cumulative fashion, would increase the risk that an individual acts out according to these paraphilic interests compared to someone without such sexual interests. Consistent with this, prevalence rates, although sparse and incomplete, do suggest an overrepresentation of essentially all studied paraphilias in sex offenders compared to the general population (see Abel et al., 1988; Krueger, 2010; Seto, 2008). More specifically, prior research indicates an association between sexual sadism and rape. Abel et al.'s (1988) report on 561 men undergoing evaluation or treatment for deviant sexual interests in the U.S. suggested that 18 % of men with masochism to a high 46 % among those with sadism anonymously reported also having raped an adult woman. The proportions among those with the six remaining specified DSM paraphilias (pedophilia, transvestic fetishism, frotteurism, fetishism, exhibitionism, and voyeurism) that reported having raped an adult woman were all in between the figures for masochism and sexual sadism. The suggested link between sadism and rape is also reflected in sexual offender typologies. For example, the Massachusetts Treatment Center: Rape classification system revision 3 (MTC: R3, Knight, 1999; Knight & Prentky, 1990) describes four primarily sexually motivated rapist subtypes, all characterized by extensive sexual or sadistic fantasies.

There is also considerable support for paraphilic interests predicting sexual recidivism among sex offenders (Mann et al., 2010). In an influential systematic review of recidivism studies, broadly defined as sexual deviancy, including paraphilias, sexual preoccupation or hypersexuality, and gender dysphoria, was one of the strongest individual predictors of sexual reoffending among sex offenders ($d = .30$; Hanson & Morton-Bourgon, 2005). However, specific interest in using violence in relation to sex, or sexual sadism, did not significantly predict repeat sexual violence whereas it did so in Knight and Thornton's (2007) large-scale recidivism prediction study. Additionally, when data from both studies were combined, interest in sexual sadism significantly predicted sexual reoffending among sexual offenders (Mann et al., 2010). Finally, the presence of two or more paraphilias was significantly associated with sexual reoffending in Knight and Thornton's (2007) study.

The Present Study

Prior studies with primarily forensic or correctional samples suggest a non-trivial association between paraphilias and sexually coercive behavior. However, the size and possible causal nature of this association is much less clear. We addressed three main research questions in a large, contemporary, population-based twin cohort:

1. What are the risks of sexually coercive behavior as a function of specific paraphilic behaviors?
2. Are specific paraphilic behaviors related to sexually coercive behavior independently of age, gender, and other co-occurring paraphilic behavior?
3. Are paraphilic behaviors related to sexually coercive behavior independently of confounding familial (genetic or common family environment) risk factors, consistent with a causal effect?

Method

Participants

Participants were part of the project The Genetics of Sexuality and Aggression (GSA), established in 2005 at the Abo

Akademi University in Turku, Finland. The major research goal was to conduct investigations with genetically sensitive designs in large, population-based samples on phenotypes related to sexuality and aggression. Two data collections have been completed since then (see Johansson et al., 2013 for a detailed description). The data used in this study originated from the second data collection, which targeted all 18- to 33-year-old twins ($M = 25.0$ years; $SD = 4.0$) and their 18-year-old or older siblings (age range: 18–49 years), identified through the Finnish population registry. Altogether, 23,577 individuals were contacted by regular mail in March 2006 and invited to complete a questionnaire. Questionnaires were filled out by those consenting either online through a secured webpage or with a paper-and-pencil version returned in a pre-stamped envelope. A reminder letter was sent in July 2006. In total, 10,524 male and female individuals, 6531 of which were twins, participated. This yielded an overall response rate of 45 % (women: 57 %, men: 33 %). The sample selected for this study included twins who provided at least one valid response (answering yes or no) to both the paraphilic behavior and the sexual coercion questions, respectively. Overall, this yielded 5990 male and female twins aged 18–32 years with complete data. Twin zygosity was determined based on two standard questionnaire items addressing physical resemblance previously validated through genotyping (95 % correct classification; Eisen, Neuman, Goldberg, Rice, & True, 1989). Hence, the sample consisted of 673 monozygotic male twins, 1498 monozygotic female twins, 685 same-sex dizygotic male twins, 1156 same-sex dizygotic female twins, and 1978 opposite-sex dizygotic twins. Non-twin sibling data were not used in the present study.

Measures

Variables of interest were measured using self-report questionnaires. Paraphilic behavior items were based on DSM-IV/-5 paraphilia definitions as assessed in the Swedish Sexual Survey (Lewin, Fugl-Meyer, Helmius, Lalos, & Månsson, 1998). Exhibitionism was addressed by asking "have you ever exposed your genitals to a stranger and become sexually aroused by this?" Sexual masochism was measured with "have you every deliberately received physical pain and become sexually aroused by this?", and sexual sadism by asking "have you ever deliberately used physical pain and become sexually aroused by this?" Transvestic fetishism was assessed by asking "have you ever dressed in clothes pertaining to the opposite sex and become sexually aroused by this?", and voyeurism was tapped with "have you ever spied on what other people are doing sexually and become sexually aroused by this?" Pedophilia was addressed with questions about sexual interests, masturbation fantasies, and sexual partners across two specified age groups (0–6, 7–12 years). Data on pedophilia were not included in regression analyses due to limited statistical power (however, see Table 1 for prevalence rate). Response options to all paraphilia-related questions included "yes," "no," "don't know," and "don't want to answer." Additional questions addressing recurrence, persistence, or intensity were not posed. Therefore, these items capture *paraphilic behavior* but not paraphilias or full paraphilic disorders as such.

Sexually coercive behavior was assessed with the Sexual Coercion Scale (SCS), a questionnaire based on the Sexual Experiences Survey (Koss & Oros, 1982, revised by Forbes & Adams-Curtis, 2001). Participants were asked "have you ever engaged in sexual interaction with somebody even if that person did not want to because you: (1) said things you did not mean?; (2) pressured him/her by making continuous demands?; (3) threatened to otherwise end the relationship?; (4) exploited the fact that the person was unable to resist (e.g., after drinking too much alcohol)?; (5) threatened to use physical force? or (6) used physical force?" Each question had five response categories: "no," "yes, kissed and touched," and "yes, oral, vaginal, or anal intercourse," and "I don't know" or "I don't want to tell." Further, one item from the Hare Self-Report Psychopathy Scale (Hare SRP; Paulhus, Hemphill, & Hare, 2002); "I had or tried to have sex with someone against their will" was used as an additional measure of sexual coercion and was possible to answer on a 5-point Likert scale from 1 (disagree completely) to 5 (agree completely). Participants that answered positively to any of these seven items; ("yes, kissed and touched" or "yes, oral, vaginal, or anal intercourse" on the SCS, or 4 (agree) or 5 (completely agree) on the Hare SRP, were coded as having exhibited sexually coercive behavior.

Because it could be argued that the SCS-item "said things you did not mean" might more strongly reflect dishonesty rather than coercion, we summed the dichotomous variables in the SCS to see how that summary score correlated with the Hare SRP item. Correlation with and without "saying things you did not mean" were .32 and .31, respectively. Hence, since excluding this specific SCS-item did not provide a stronger correlation and deleting it could result in losing statistical power, we kept all original items in the SCS.

Statistical Analyses

We examined associations between paraphilic behaviors and sexually coercive behavior with logistic regression modeling. Generalized estimating equation analyses (GEE, PROC GENMOD in SAS, version 9) were performed using the full twin sample ($N = 5990$) to control for the clustering of (lack of independence between) twins within a pair. First, we adjusted for the potential confounding effect of age and gender and, subsequently also for other co-occurring paraphilic behaviors. Second, we used the co-twin control design in an attempt to further strengthen causal interferences by controlling also for confounding by genetic and common family environmental factors while adjusting for other co-occurring paraphilic behavior. Thus, we compared monozygotic and dizygotic paraphilic behavior-discordant twin pairs ($n = 444$ for any paraphilia, that is, one twin self-reported at least

Table 1 Lifetime prevalence of paraphilic behavior and sexually coercive behavior in a representative nationwide cohort of 5990 18- to 33-year-old Finnish twins

Paraphilic behavior	Males ($n = 2092$)	Females ($n = 3898$)	Total ($n = 5590$)
Any paraphilic behavior	25.0 (524)	14.2 (553)	18.0 (1077)
Exhibitionism	4.3 (88)	0.6 (24)	1.9 (112)
Masochism	4.9 (100)	8.6 (329)	7.3 (429)
Sadism	2.7 (53)	2.3 (88)	2.4 (141)
Pedophilia	0.9 (19)	0.4 (17)	0.6 (36)
Transvestic fetishism	4.6 (95)	0.5 (18)	1.9 (113)
Voyeurism	18.2 (375)	6.3 (243)	10.5 (618)
Sexually coercive behavior	18.5 (388)	3.6 (142)	8.8 (530)

Figures denote percentages of participants self-reporting each specified paraphilic behavior at any time in life. Absolute numbers of individuals are provided within brackets

Table 2 Co-occurrence of lifetime paraphilic behavior among 5990 18- to 33-year-old male and female twins in a representative Finnish, nationwide cohort

Paraphilic behavior	Exhibitionism ($n = 112$)	Masochism ($n = 429$)	Sadism ($n = 141$)	Transvestic fetishism ($n = 113$)	Voyeurism ($n = 618$)
Exhibitionism	**100 % (112/112)**	5.1 % (22/429)	6.4 % (9/141)	12.4 % (14/113)	8.7 % (54/618)
Masochism	19.6 % (22/112)	**100 % (429/429)**	68.8 % (97/141)	24.8 % (28/113)	16.7 % (103/618)
	OR = 3.29, 2.04–5.29				
Sadism	8.0 % (9/112)	22.6 % (97/429)	**100 % (141/141)**	11.5 % (13/113)	7.6 % (47/618)
	OR = 3.80, 1.88–7.68	OR = 36.63, 25.23–53.20			
Transvestic fetishism	12.5 % (14/112)	6.5 % (28/429)	9.2 % (13/141)	**100 % (113/113)**	7.3 % (45/618)
	OR = 8.34, 4.60–15.11	OR = 4.50, 2.90–6.98	OR = 5.84, 3.19–10.68		
Voyeurism	48.2 % (54/112)	24.0 % (103/429)	33.3 % (47/141)	39.8 % (45/113)	**100 % (618/618)**
	OR = 8.77, 6.00–12.84	OR = 3.10, 2.44–3.93	OR = 4.62, 3.22–6.63	OR = 6.13, 4.16–9.02	

ORs indicate unadjusted odds ratios with 95 % confidence intervals for each pair of paraphilic behaviors. Figures in each cell indicate the percentage of subjects (proportion within brackets) within each column that also endorsed the interest indicated at the beginning of each row

one of the studied paraphilic behaviors whereas the co-twin reported none) in terms of risk for sexually coercive behavior. If paraphilic interest truly caused sexually coercive behavior, one would expect this exposure to be associated with the outcome both in comparisons of respondents with unrelated controls, and within twin pairs discordant for the studied paraphilia. In contrast, if the association between exposure and outcome decreased from comparisons with unrelated controls to co-twin controls, this would suggest confounding by genetic and/or common family environmental factors (for a review, see McGue, Osler, & Christensen, 2010). No data on shared environmental family-of-origin factors were collected since the classical twin design assumes that common family environmental factors are those events that happen to both twins and affect them in the same way.

The risk for sexually coercive behavior within twins was modeled with conditional logistic regression (SAS, version 9.3). Odds ratios (ORs) with 95 % confidence intervals (CIs) were calculated for all associations.

Results

The lifetime prevalence for at least one of the studied paraphilic behaviors was 18 % in the full sample, approximately four times higher in men compared to women. Similar differences across gender were found for the specific paraphilic behaviors related to exhibitionism, transvestic fetishism, and voyeurism. Interestingly, and in contrast, any lifetime masochistic, sadistic or pedophilic sexual experiences were much less gender-incongruent (see Table 1). We also found substantial co-occurrence of five specific paraphilic behaviors, odds ratios ranged from 3.10 (95 % CI 2.44–3.93) to 36.63 (95 % CI 25.23–53.20; see Table 2).

The overall lifetime prevalence of sexually coercive behavior was 8.8 % (Table 1), approximately five times higher in men compared to women. Out of 530 individuals reporting sexually coercive behavior on either the SCS or the Hare SRP item, 35 scored positive on both measures, 33 on the Hare SRP item only, and 462 on the SCS only (see Table 3). Table 4 displays associations between paraphilic and sexually coercive behaviors; the

Table 3 Lifetime prevalence of sexually coercive behavior in a representative nationwide cohort of 5990 18- to 33-year-old Finnish twins

Sexually coercive behavior	Sexual Coercion Scale (SCS)	
	Yes ($n = 497$)	No ($n = 5493$)
Hare Self-Report Psychopathy Scale (Hare SRP) item		
Yes ($n = 68$)	35	33
No ($n = 5922$)	462	5460

Figures denote absolute numbers of participants self-reporting sexually coercive behavior at any time in life according to their responses on the Sexual Coercion Scale (SCS) and the specific Hare Self-Report Psychopathy (Hare SRP) item

Table 4 Associations between lifetime paraphilic behavior and sexually coercive behavior in 5990 18- to 33-year-old general population twins

Paraphilic behavior	Sexually coercive behavior ($n = 530$) (%)	Odds ratio (95 % CI)		
		Adjusted[a]	Adjusted[b]	Adjusted co-twin control[c]
Any paraphilic behavior				
Yes ($n = 1077$)	21.1	3.25 (2.67–3.97)	N/A	3.57 (2.25–5.66)
No ($n = 4913$)	6.2			
Exhibitionism				
Yes ($n = 112$)	33.9	3.15 (2.07–4.81)	1.88 (1.17–3.01)	2.32 (0.72–7.52)
No ($n = 5791$)	8.4			
Masochism				
Yes ($n = 429$)	16.6	3.18 (2.35–4.30)	1.98 (1.34–2.93)	1.73 (0.79–3.80)
No ($n = 5459$)	8.3			
Sadism				
Yes ($n = 141$)	27.0	4.36 (2.91–6.52)	2.17 (1.28–3.67)	1.98 (0.65–6.03)
No ($n = 5680$)	8.5			
Transvestic fetishism				
Yes ($n = 113$)	28.3	2.09 (1.35–3.23)	1.19 (0.70–2.04)	–
No ($n = 5785$)	8.6			
Voyeurism				
Yes ($n = 618$)	25.9	3.17 (2.53–3.97)	2.63 (2.07–3.34)	3.10 (1.78–5.42)
No ($n = 5283$)	6.9			

Numbers of individuals with each paraphilic behavior and sexually coercive behavior, respectively, are for full sample and not for co-twin comparisons in rightmost column. Odds ratios express the strength of the relationship between paraphilic behavior and sexually coercive behavior. *95 % CI* 95 % confidence interval; 95 % CI's that do not include 1.00 indicate a statistically significant odds ratio at $p < .05$

[a] Odds ratios adjusted for age and gender

[b] Odds ratios adjusted for age, gender and co-occurring paraphilic behavior

[c] Odds ratios within paraphilia-discordant MZ and DZ twin pairs (also adjusted for co-occurring paraphilic behavior except overall "any paraphilic behavior")

rate of sexually coercive behavior among those reporting any paraphilic behavior was 21.1 % compared to 6.2 % in those who did not. Comparable patterns were found for each of the five specific paraphilic behaviors.

As shown in Table 4, paraphilic behavior in general ("any paraphilic behavior") and each of the five tested specific paraphilic behaviors were moderately to strongly associated with sexually coercive behavior when individuals with paraphilic behaviors were compared to unrelated individuals without paraphilic behaviors. Risks decreased somewhat but generally remained significant when controlling for other co-occurring paraphilic behavior, suggesting independent associations between each paraphilic behavior and sexual coercion, except for transvestic fetishism. This indicates that the co-occurrence of transvestic fetishism with one or more of the other tested paraphilic behaviors accounted for its association with sexually coercive behavior. Because transvestic fetishism was not independently associated with sexually coercive behavior, it was excluded from co-twin control analyses.

The risk of sexually coercive behavior in twins reporting any paraphilic behavior remained similarly increased when compared

also to their paraphilic behavior-discordant co-twins, hence controlling for unmeasured genetic and shared environmental confounding, and other co-occurring paraphilic behavior. However, limited statistical power led all associations but for any paraphilic behavior and voyeurism to fall short of statistical significance at $p < .05$.

We also conducted interaction analyses by gender; the effect of any paraphilic behavior was independent of gender (i.e., no interaction effect was identified; data not shown). For reasons of completeness, we also present separate analyses by gender in Appendix Tables 5, 6 and 7. Notably, despite our large sample, the gender-separated results suffered from substantially reduced statistical power and imprecise estimates. Nonetheless, overall association patterns appeared mostly similar for men and women. In men, co-twin control analyses suggested trivial to strong associations between any paraphilic behavior, exhibitionistic, sadistic, and voyeuristic behaviors with sexually coercive behavior (see Appendix Table 6). Only the association for any paraphilic behavior retained significance at $p < .05$. Among women, co-twin control analyses suggested trivial to moderately strong and non-significant associations between sexually coercive behavior and any paraphilic, masochistic and voyeuristic behaviors, respectively (see Appendix Table 7).

Finally, we calculated the population attributable fraction (PAF) to estimate the proportion of sexually coercive behavior in the population that could be explained by any paraphilic behavior, assuming a causal relationship and that distributions of other associated potential risk factors remained unchanged. Based on the substantial relative increase in sexually coercive behavior related to paraphilic interest and the non-negligible population prevalence of the risk factor, PAF was a relatively high 29 % ($\text{PAF} = \frac{P_e(OR-1)}{P_e(OR-1)+1}$, P_e = prevalence [0.18; Table 1, column 4]; OR = odds ratio [3.25, Table 4, column 3]).

Discussion

Using a contemporary, nationwide population cohort of almost 6000 adult twins, we examined potential risk effects of paraphilic behaviors on sexually coercive behavior. To the best of our knowledge, this is the first study to investigate risk of sexually coercive behavior in individuals with specific lifetime paraphilic behaviors, while controlling for potentially confounding familial factors.

First, our results indicated that paraphilic behaviors, except for transvestic fetishism, were consistently and independently associated with sexually coercive behavior, albeit with some variation in effect size across gender. However, this probably resulted from different base-rates of tested paraphilic behaviors in men compared to women rather than gender-separate risk effects. In fact, formal interaction testing found the association strength of any paraphilic behavior with sexually coercive behavior to be independent of gender (data not shown). Second, we used co-twin control analysis to compare the risk of sexually coercive behavior in paraphilic behavior-reporting twins contrasted with their co-twins that did not report paraphilic behavior. These analyses suggested that risk increases of sexually coercive behavior due to paraphilic behavior remained at similar levels to those seen in comparisons with unrelated individuals. Thus, these data did not support that the observed association between paraphilic and sexually coercive behavior was due to shared familial (genetic and common family environment) confounding. Instead, the results are consistent with a causal interpretation of the link between the two.

One possible causal mechanism behind the associations reported here could be that paraphilic interest, under certain circumstances, escalates in frequency and intensity. Following solitary behaviors such as frequent masturbation in combination with paraphilic fantasies, exhibitionistic and voyeuristic behaviors that involve others but do not include physical contact may follow, and finally continuing into more aggressive sexual behaviors such as rape. This is also related to the courtship disorder construct suggested by Freund (1990). For example, although with methodological limitations regarding the detection or reporting of paraphilic behavior, some studies suggest that a substantial minority of exhibitionists, identified or self-admitted, might move into more serious contact sexual offending including rape (Abel & Rouleau, 1990; Firestone, Kingston, Wexler, & Bradford, 2006; Freund, 1990; Sugarman, Dumughn, Saad, Hinder, & Bluglass, 1994). Alternatively, environmentally determined unique factors, not shared by the twins, may have contributed to the discordance in paraphilic behavior and, at the same time, caused sexually coercive behavior. For example, some smaller clinical studies suggest that traumatic brain injury may be associated with paraphilias and sexually aggressive behavior (see, for example, Blanchard et al., 2003; Langevin, 2006; Luiselli, Arons, Marchese, Potoczny-Gray, & Rossi, 2000; Simpson, Blaszczynski, & Hodgkinson, 1999). However, a large, longitudinal nationwide study found that the association between traumatic brain injury and violent crime (which included rape, sexual coercion, child molestation, indecent exposure, and sexual harassment) may be smaller than previously suggested (Fazel, Lichtenstein, Grann, & Långström, 2011). Although the co-twin control method can handle genetic and shared environmental confounding of a possible link between paraphilic behavior and sexually coercive behavior, it cannot do this for such non-shared or unique environmental confounding.

Strengths and Limitations

First, the large population-based sample and acceptable response rates for the sensitive topics studied are clear strengths of this study. This suggests that the findings might be generalizable to the general population. Second, separate variables tapped sadistic and masochistic sexual behavior, respectively; the few previous studies of paraphilias used items that combined the two under the terms sadomasochism or BDSM (e.g., Långström & Seto, 2006, Richters, De Visser, Rissel, Grulich, & Smith, 2008). Indeed,

sadism and masochism appear to be linked in that the individuals concerned often alternate between both roles, or report both kinds of fantasies (Yates, Hucker, & Kingston, 2008). However, sadism and masochism still described two distinct, albeit highly associated, paraphilic behaviors in this study (overall 7.3 % masochism, 2.4 % sadism; OR = 36.63, 95 % CI 25.23–53.20), with masochism being the only of the five tested here that was clearly more prevalent in women. Third, and importantly, we were able to account for genetic and shared environmental confounding with the co-twin control method. Experimental testing for a causal relationship between paraphilic behavior and sexually coercive behavior is impossible; however, the co-twin control design allows for approaching causality in observational research. Co-twin control analyses have been used to study the potential causal nature of various associations, for example between smoking and heavy alcohol use and mortality (see, for example, Kaprio & Koskenvuo, 1989; Kujala, Kaprio, & Koskenvuo, 2002), obesity and dementia (Xu et al., 2011), social engagement and physical and cognitive functioning (McGue & Christensen, 2007), child abuse and violent crime (Forsman & Långström, 2012; Forsman, Johansson, Santtila, Sandnabba, & Långström, 2015) and many more (see, for example, McGue et al., 2010). The co-twin control approach adjusts for genetic and early environmental confounding by comparing exposure-discordant (here: specific paraphilic behavior) twin pairs for the risk of a certain outcome. In summary, whenever randomized experiments are not feasible, the co-twin control method offers improved opportunity to investigate possible causal associations in observational studies.

This study also has several limitations. First, paraphilic behaviors were measured with one question. A formal diagnosis of paraphilia would additionally require assessment of frequency, intensity, and persistence of sexual fantasies and behavior (American Psychiatric Association, 2013). The current questions, however, were designed for use in an extensive general population study of sexuality and health (Lewin et al., 1998); hence, detailed follow-up questions were not asked to avoid upsetting respondents and compromise participation rates and reliability. Second, despite the large sample size of the current study, very low prevalence and associated limited statistical power forced us to exclude pedophilic behavior from further analysis. Hence, to examine the relationship between pedophilia and sexually coercive behavior, further studies may need even larger population cohorts with relevant information on familial (genetic and early environmental) confounding. Third, the overall response rate for the second data collection of the *Genetics of Sexuality and Aggression* project was 45 %. However, Johansson et al. (2013) investigated differences between respondents and potential non-respondents by comparing respondent data to information already collected from individuals who prematurely exited the online survey. Only minor differences were found between these groups, suggesting small differences between responders and non-responders. Fourth, the reliability of retrospective self-reports has been questioned on the grounds of the ability or will of participants to respond truthfully to these. For example, social desirability may prevent people to disclose information concerning sexuality or socially sensitive behaviors in general (Durant, Carey, & Schroder, 2002). Another possible bias is the tendency to choose only the extreme answer choices (the highest and lowest points of a scale, for example) and avoid the middle range of the scale. Research has shown, however, that participants are consistent in patterns of either overreporting or underreporting with underreporting being the most common type of bias (Hardt & Rutter, 2004; Schroder, Carey, & Vanable, 2003). Importantly, consistent under- or overreporting is not likely to influence the strength and direction of the association between paraphilic and sexually coercive behavior—unless sexually coercive individuals would retrospectively under- or overreport paraphilic behaviors compared to non-coercive control individuals. We have no reason to suspect that to be the case. Nevertheless, part of the association might still be explained by the effect of response bias. Finally, although cross-sectional data with co-twin controls suggest possible causal associations, study cross-sectionality as such precludes firm conclusions about the temporal ordering of paraphilic behaviors and sexual coercion.

Conclusion

Our results are consistent with a causal interpretation of the observed association between paraphilic sexual behavior and sexually coercive behavior, except for transvestic fetishism. The findings, however, need validation through additional, causally informative studies. The PAF statistic suggested that 32 % of all sexual coercion in society could possibly be prevented if the risk effects mediated by paraphilias could be eliminated. Obviously, this finding has to be carefully weighed against fears from BDSM practitioners, sexual rights organizations etc. that paraphilic interests might be overpathologized. Historically, clinical interventions for paraphilic interests that cause personal distress, functional impairment, or that harm others have primarily targeted individuals in criminal justice or forensic psychiatric settings. Although small studies indicate possible efficacy of pharmacotherapy in conjunction with CBT for those diagnosed with pedophilia or exhibitionism (Beech & Harkins, 2012), the overall evidence-base for treatment of DSM-IV paraphilic interest or corresponding DSM-5 paraphilic disorders is weak (Beech & Harkins, 2012; Dennis et al., 2012; Kaplan & Krueger, 2012; Långström et al., 2013). However, screening and identification of individuals with paraphilic behavior to offer voluntary treatment reducing sexually coercive behavior risk might be ethically acceptable provided that these practices cause no harm. Nonetheless, sufficient empirical support for such screening and prevention efforts requires further causally informative studies of the mechanisms that underlie the putative causal relationship between paraphilic behavior and sexually coercive behavior.

Appendix

See Tables 5, 6 and 7.

Table 5 Lifetime prevalence of paraphilic behavior among 5990 18-to 33-year-old males and female twins and any sexually coercive behavior divided by paraphilic behavior category

Paraphilic behavior	Percentage[a]		Sexually coercive behavior[b]	
	Males ($N = 2092$)	Females ($N = 3898$)	Males ($N = 2092$)	Females ($N = 3898$)
Any paraphilic behavior	25.0 (524)	14.2 (553)	33.4 (175)	9.4 (52)
Exhibitionism	4.3 (88)	0.6 (24)	40.9 (36)	8.3 (2)
Masochism	4.9 (100)	8.6 (329)	38.0 (38)	10.0 (33)
Sadism	2.7 (53)	2.3 (88)	56.6 (30)	9.1 (8)
Transvestic fetishism	4.6 (95)	0.5 (18)	32.6 (31)	5.6 (1)
Voyeurism	18.2 (375)	6.3 (243)	37.1 (139)	8.6 (21)

[a] Figures denote percentages of participants that self-reported each specified paraphilic behavior at any time in life (number of individuals within brackets)

[b] Percentages; males and females with each paraphilic behavior that also self-reported any lifetime sexually coercive behavior (number of individuals within brackets)

Table 6 Associations between lifetime paraphilic behavior and sexually coercive behavior among 2092 *male*, 18- to 33-year-old general population twins

Paraphilic behavior	Sexually coercive behavior ($n = 388$)	Odds ratio (95 % CI)		
		Adjusted[a]	Adjusted[b]	Adjusted co-twin control[c]
Any paraphilic behavior				
Yes ($n = 524$)	33.4 % (175)	3.10 (2.45–3.91)	N/A	2.30 (1.10–4.83)
No ($n = 1568$)	13.6 % (213)			
Exhibitionism				
Yes ($n = 88$)	40.9 % (36)	3.28 (2.10–5.11)	2.00 (1.21–3.32)	2.01 (0.29–13.98)
No ($n = 1973$)	17.7 % (349)			
Masochism				
Yes ($n = 100$)	38.0 % (38)	2.81 (1.84–4.28)	1.15 (0.67–2.00)	–
No ($n = 1958$)	17.7 % (346)			
Sadism				
Yes ($n = 53$)	56.6 % (30)	5.85 (3.34–10.23)	3.87 (1.95–7.64)	6.17 (0.71–53.74)
No ($n = 1932$)	18.0 % (348)			
Transvestic fetishism				
Yes ($n = 95$)	32.6 % (31)	2.12 (1.35–3.31)	1.25 (0.71–2.18)	–
No ($n = 1966$)	18.1 % (355)			
Voyeurism				
Yes ($n = 375$)	37.1 % (139)	3.31 (2.57–4.25)	2.81 (2.15–3.67)	1.91 (0.85–4.28)
No ($n = 1689$)	14.6 % (247)			

Numbers of males with each paraphilic behavior and sexually coercive behavior, respectively, are for full sample and not for co-twin comparisons in rightmost column. Odds ratios express the strength of the relationship between paraphilic behavior and sexually coercive behavior. *95 % CI* 95 % confidence interval; 95 % CI's that do not include 1.00 indicate a statistically significant odds ratio at $p < .05$

[a] Odds ratios adjusted for age

[b] Odds ratios adjusted for age and co-occurring paraphilic behavior

[c] Odds ratios within paraphilia-discordant MZ and DZ twin pairs (also adjusted for other co-occurring paraphilic behaviors except overall "any paraphilic behavior)

Table 7 Associations between paraphilic behavior and sexually coercive behavior among 3898 *female*, 18- to 33-year-old general population twins

Paraphilic behavior	Sexually coercive behavior ($n = 142$)	Odds ratio (95 % CI)		
		Adjusted[a]	Adjusted[b]	Adjusted co-twin control[c]
Any paraphilic behavior				
Yes ($n = 553$)	9.4 % (52)	3.76 (2.64–5.36)	N/A	2.17 (0.82–5.70)
No ($n = 3345$)	2.7 % (90)			
Exhibitionism				
Yes ($n = 24$)	8.3 % (2)	2.43 (0.57–10.45)	1.23 (0.26–5.72)	–
No ($n = 3818$)	3.6 % (139)			
Masochism				
Yes ($n = 329$)	10.0 % (33)	3.52 (2.34–5.29)	3.15 (1.92–5.15)	1.73 (0.63–4.74)
No ($n = 3501$)	3.1 % (108)			
Sadism				
Yes ($n = 88$)	9.1 % (8)	2.73 (1.29–5.77)	1.12 (0.46–2.72)	–
No ($n = 3748$)	3.5 % (132)			
Transvestic fetishism				
Yes ($n = 18$)	5.6 % (1)	1.57 (0.21–11.86)	1.15 (0.14–9.18)	–
No ($n = 3819$)	3.7 % (140)			
Voyeurism				
Yes ($n = 243$)	8.6 % (21)	2.72 (1.68–4.41)	2.06 (1.19–3.56)	1.41 (0.63–3.18)
No ($n = 3594$)	3.3 % (120)			

Numbers of females with each paraphilic behavior and sexually coercive behavior, respectively, are for full sample and not for co-twin comparisons in rightmost column. Odds ratios express the strength of the relationship between paraphilic behavior and sexually coercive behavior. *95 % CI* 95 % confidence interval; 95 % CI's that do not include 1.00 indicate a statistically significant odds ratio at $p < .05$

[a] Odds ratios adjusted for age

[b] Odds ratios adjusted for age and co-occurring paraphilic behavior

[c] Odds ratios within paraphilia-discordant MZ and DZ twin pairs (also adjusted for co-occurring paraphilic behavior, except for overall "any paraphilic behavior")

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