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PERSONALITY DISORDERS, VIOLENCE, AND ANTISOCIAL BEHAVIOR: A SYSTEMATIC REVIEW AND META-REGRESSION ANALYSIS

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The risk of antisocial outcomes in individuals with personality disorder (PD) remains uncertain. The authors synthesize the current evidence on the risks of antisocial behavior, violence, and repeat offending in PD, and they explore sources of heterogeneity in risk estimates through a systematic review and meta-regression analysis of observational studies comparing antisocial outcomes in personality disordered individuals with controls groups. Fourteen studies examined risk of antisocial and violent behavior in 10,007 individuals with PD, compared with over 12 million general population controls. There was a substantially increased risk of violent outcomes in studies with all PDs (random-effects pooled odds ratio [OR] = 3.0, 95% CI = 2.6 to 3.5). Meta-regression revealed that antisocial PD and gender were associated with higher risks (p = .01 and .07, respectively). The odds of all antisocial outcomes were also elevated. Twenty-five studies reported the risk of repeat offending in PD compared with other offenders. The risk of a repeat offense was also increased (fixed-effects pooled OR = 2.4, 95% CI = 2.2 to 2.7) in offenders with PD. The authors conclude that although PD is associated with antisocial outcomes and repeat offending, the risk appears to differ by PD category, gender, and whether individuals are offenders or not.

The prevalence of personality disorder (PD) in the general population ranges from 4% to 13% (Coid, Yang, Tyrer, Roberts, & Ullrich, 2006b; Samuels et al., 2002; Torgersen, Kringlen, & Cramer, 2001). Around a fifth of people with PD are seen by health services due to the severity of their symptoms, comorbidity with other mental disorders, or the risks they pose to themselves and other people (Andrews, Issakidis, & Carter, 2001). In relation to these risks, individuals with PD are at increased risk of suicide, and it is estimated that 30%–50% of individuals who die from suicide have personality disorders (Foster, Gillespie, & McClelland, 1997; Hawton & van Heeringen, 2009). The degree of risk to others, however, is uncertain, and estimates are likely to be confounded by background sociodemographic factors and comorbidity with substance abuse (Alwin et al., 2006). Narrative reviews have suggested an increased risk of violence in personality disorder (Duggan &

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Howard, 2009; Fountoulakis, Leucht, & Kaprinis, 2008), but to our knowledge a quantitative synthesis of the primary studies has not been conducted. Thus, the extent of the increased violence risk and how this compares with other psychiatric disorders is unknown. In this report, we aimed to synthesize the evidence on PD as a risk factor for violence, criminality, and antisocial behavior. We sought to build on previous research by using quantitative methods and exploring sources of heterogeneity. We distinguished between two related questions. First, we examined the association between personality disorder and antisocial behavior compared with the general population. Second, we investigated whether this association differed in offenders—in other words, what is the risk of repeat offending in individuals with PD compared with offender controls?

METHOD

INCLUSION CRITERIA

Studies were included if (1) PDs were diagnosed by clinical and/or semistructured interviews using explicit criteria (e.g., *DSM*, ICD); and (2) they were case-control studies (including cross-sectional surveys) and cohort studies that reported the risk of antisocial behavior in individuals with PD compared with controls without PD in the general population (first study) or risk of repeat offending in PD compared with other offenders without PD (second study); and (3) studies provided sufficient information to allow for the calculation of odds ratios (ORs). We chose to use a broad and inclusive definition of antisocial behavior, that of any chronic violation of social rules and norms that could lead to both violent and nonviolent manifestations (Hinshaw & Zupan, 1997).

EXCLUSION CRITERIA

Studies were excluded if (1) the presence of PD was assessed using self-report questionnaires; these studies were excluded because self-report instruments are likely to overestimate prevalence rates (Zimmerman & Coryell, 1990); or (2) the studies were restricted to one type of antisocial behavior, such as homicide (Putkonen, Komulainen, Virkkunen, Eronen, & Lonnqvist, 2003; Tiihonen & Hakola, 1994) or sexual offending (Langstrom, Sjostedt, & Grann, 2004); or (3) there were no appropriate comparison data (Grann, Langstrom, Tengstrom, & Kullgren, 1999; Tikkanen, Holi, Lindberg, & Virkkunen, 2007). We also excluded one further study because it did not include antisocial PD in an adult sample (Pulay et al., 2008).

SEARCH STRATEGY

We searched published and unpublished sources (including theses) using six bibliographic databases (Medline, Embase, PsycInfo, CINAHL, US National Criminal Justice Reference System, and Web of Science) from January 1, 1966, to July 31, 2009. No language limit was set for searched articles. Search strategies were tailored to the individual database. Search terms for PD were

personality disorder*, personality pathology, axis II, personality dysfunction, personality abnormality, and abnormal personality. Terms for antisocial behavior were: viol*, offen*, aggress*, assault*, antisocial, anti-social, dangerous*, crim*, delinquen*, and unlawful*. The terms used for repeat offending were recidi*, reoffend*, repeated offend*, rearrest, reconvict*, reincarcerat*, revoke*, and recur*. Terms for antisocial behavior and recidivism of antisocial behavior were combined with terms for PDs in the search process. In order to increase the sensitivity of the search, the terms mental disorder*, mental illness*, and psychiatric disorder* were also used, combined with the search terms for antisocial behavior or recidivism. Reference lists were also searched. When raw data could not be extracted or derived, original authors were contacted. Non-English publications were translated.

PROCEDURE

Identification of Studies. In the initial screening, titles and abstracts were examined. We screened 2,460 papers for the first review and 208 papers for the second review. A final decision to include studies identified on initial screening was made by two of the authors independently (R.Y. and S.F.). Any discrepancies were resolved by further review and correspondence with authors. We avoided duplication of data by checking for overlapping samples and by using the most complete data available when multiple papers of the same dataset were published. If a study reported two outcomes (e.g., violent crime and all criminality), both were extracted.

Data Extraction. A standardized extraction sheet was used, and data were extracted by one of the authors (R.Y.) with discussion with another (S.F.) if queries arose. The number of participants with or without PD cross-classified by antisocial behavior, violence, or repeat offending were drawn up for each paper, either by direct extraction from published tables and text or by derivation from summary percentages. The resultant 2 by 2 tables were cross-checked against all information within each published paper (counts, percentages, summary statistics, and test statistics), and any inconsistencies were resolved by discussion with the author of the primary study if possible. The following information was also recorded: study size (e.g., 1–100 cases, 101–1,000 cases, more than 1,000 cases), study design (e.g., cohort, case-control, cross sectional), study period (before 1990 vs. after 1990), study location, diagnostic tool (e.g., ICD, *DSM*), comparison group, diagnosis (e.g., all PDs, only antisocial PD [ASPD], and PD not including ASPD), method of ascertainment of outcome (register [police or other crime registers] and self-report), and descriptive statistics of the sample (e.g., age [30 years or younger vs. older than 30 years] and sex distribution). In addition, risk estimates with and without adjustment were recorded. These were variables such as gender, age, or socioeconomic status that were controlled statistically in individual studies or matched between cases and controls in study designs.

STATISTICAL ANALYSES

Meta-analyses of risk of antisocial and recidivism outcomes were done, which produced pooled odds ratios (ORs) with 95% confidence intervals

(CI). Because different characteristics between studies might contribute to variation in effect sizes, simply focusing on overall pooled outcomes could be misleading, especially if the included individual studies were not clinically similar. Thus, we investigated sources of between-study heterogeneity as recommended in reviews of observational data (Egger, Schneider, & Smith, 1998; Lau, Ioannidis, & Schmid, 1998).

Heterogeneity between studies was estimated using Cochran's Q (reported with a χ^2-value and p value) and I^2 statistic. The latter describes the percentage variation across studies due to heterogeneity rather than chance. I^2, unlike Q, does not inherently depend on the number of studies considered. For I^2, the values of 25%, 50%, and 75% indicate low, moderate, and high levels of heterogeneity, respectively (Higgins & Thompson, 2002).

In both studies, fixed-effects models, which average the summary statistics, weighting them according to a measure of the quantity of information they contain, were used when heterogeneity was considered low to moderate based on I^2 values. Random-effects models, which incorporate an estimate of between-study heterogeneity into the calculation of the common effect, were used when the heterogeneity between studies was high (Deeks, Altman, & Bradburn, 2001). Random-effect estimates give relatively similar weight to studies of different size. In contrast, fixed-effect estimates are weighted by study size (Deeks et al., 2001).

We explored factors associated with observed heterogeneity using subgroup analyses and meta-regression. To compare the risk estimates of different groups, subgroup analyses were performed by gender, age, diagnosis, size of study, study origin, study region, adjustment, comparison group, diagnostic criteria, and ascertainment of outcome. All subgroup analyses involved nonoverlapping data. Meta-regression was conducted to estimate the extent to which one or more measured covariates (the same variables as used in the subgroup analysis) explained the observed heterogeneity in risk estimates (Higgins & Thompson, 2002). All factors were entered individually and in combination to test for possible associations. The influence of individual studies on the summary effect was explored using an influence analysis, in which meta-analytic estimates were computed omitting one study at a time (Deeks et al., 2001). Publication bias was tested by funnel plot asymmetry using the rank correlation method (Begg & Mazumdar, 1994) and weighted regression approach (Egger, Smith, Schneider, & Minder, 1997). Analyses were performed in STATA version 10.0 (StataCorp, 2007).

To investigate the population impact on criminality, we also calculated population attributable risk fractions. We used the number of convicted individuals for this analysis because the number of criminal convictions was not available in studies included in our review. Therefore the base rate r was defined as the number of criminal individuals per 1,000 patients with PD. We defined r_0 as the number of criminal individuals per 1,000 individuals who had not been patients with PD. We then calculated the population attributable risk as the difference in $r–r_0$ and the population attributable risk fraction as population attributable risk/r.

In addition, for offenders with PD, we examined the number needed to detain. The number needed to detain is the number of individuals who would need to be treated and detained to prevent one adverse event (Fleminger, 1997). It can be derived from the base rate of violence in a population

by the sensitivity and specificity of the prediction method. It is the ratio of true positives plus false positives to true positives, and equals the inverse of positive predictive value.

RESULTS

STUDY 1: RISK OF VIOLENCE AND ANTISOCIAL BEHAVIOR IN PERSONALITY DISORDER

We identified 14 studies from 11 publications that reported on risk of antisocial behavior in individuals with PD (see Appendix Table). The total number of individuals with PD in these studies was 10,007, of whom 1,362 (13.6%) were involved in antisocial behavior (including violence) at a median follow-up of 4.5 years (with a range of 19 weeks to 60 years). These persons were compared with 12,742,916 individuals from the general population, of whom 442,057 (3.5%) reported antisocial behavior. Studies were conducted in the United States, Denmark, England, Switzerland, Canada, Finland, and Israel. All studies were conducted after 1977.

Of the 14 studies included, 10 studies investigated violent outcomes (reported in eight publications), including violent crime (Elonheimo et al., 2007; Hodgins, Mednick, Brennan, Schulsinger, & Engberg, 1996; Ortmann, 1981) and other outcome measures (including self- and informant report) (Coid et al., 2006a; Johnson et al., 2000; Monahan & Appelbaum, 2000; Stueve & Link, 1997; Swanson, Bland, & Newman, 1994). Three investigations reported in two publications provided data for both violent and any antisocial behavior (Elonheimo et al., 2007; Hodgins et al., 1996). In the studies with violence outcomes, there were 9,578 persons with PD, of whom 1,024 (10.7%) were violent. They were compared with 327,293 persons from the general population, of whom 3,841 (1.2%) were violent.

There was a significant association between PD and violence. In studies that sampled all PDs (including ASPD), the overall fixed-effects pooled OR was 3.0 (95% CI = 2.6 to 3.5) with low heterogeneity between the studies (χ^2_5 = 4.8, p = 0.3, I^2 = 16.6 %; see Figure 1). Three studies, reported in two publications (Coid et al., 2006a; Johnson et al., 2000), examined the risk of violence in PDs excluding ASPD, leading to an OR of 2.3 (95% CI = 1.8 to 2.9).

Studies of any antisocial behavior (including violence) in all PDs reported an overall random-effects pooled OR of 6.2 (95% CI = 3.9 to 10.0) with moderate to high heterogeneity between the investigations (χ^2_4 = 9.5, p < 0.01, I^2 = 68.4%; Figure 2).

Antisocial Personality Disorder (ASPD). We investigated those samples with only ASPD individuals and found a greater association with violent outcomes (random-effects OR = 12.8 [95% CI = 7.9 to 20.7]), with high heterogeneity between studies (χ^2_5 = 35.3, p < 0.01, I^2 = 88.7%). When one outlier (Swanson et al., 1994) was excluded from the analysis, the OR was 10.4 (95% CI = 7.3 to 14.0) with high heterogeneity between studies (χ^2_4 = 10.4, p = 0.02, I^2 = 71.2%). The positive predictive value of a diagnosis of ASPD on violence was 14%—that is, 14% of those with ASPD were violent. This was

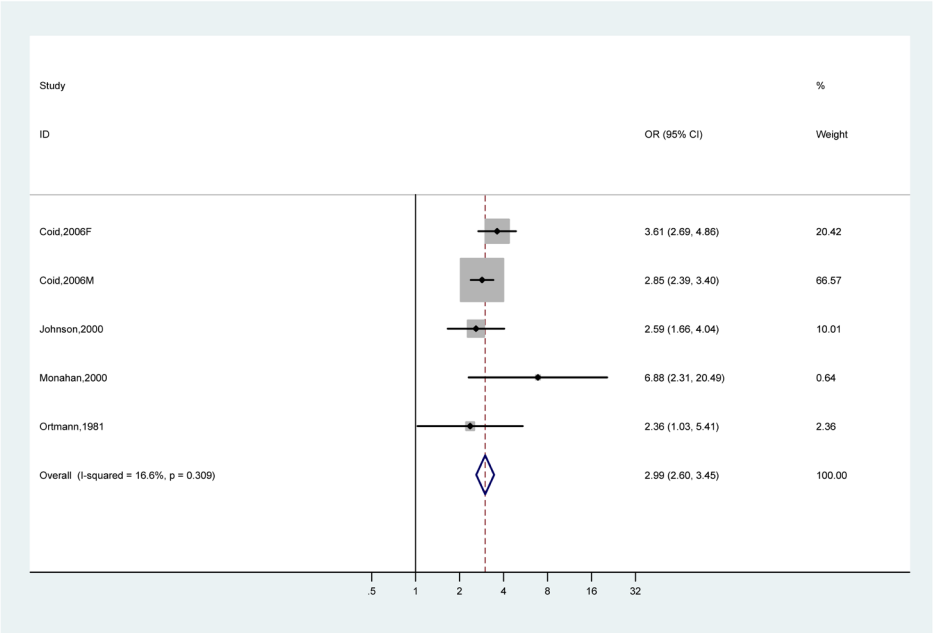

FIGURE 1. Risk estimate for violent outcomes in all personality disorders samples compared with general population controls. *Note*. Weights are from fixed-effect models; OR = odd ratio.

the equivalent of needing to detain seven individuals with ASPD to prevent one violent act, assuming a base rate of 7.5%.

Gender. Higher risk estimates were found in women with ASPD compared with men with ASPD, when violent outcomes were investigated. There was no significant difference in risk estimates by gender in studies with all PD samples or between studies investigating any antisocial behavior. Specifically, when violent outcomes were examined, in studies with ASPD samples, the OR was 13.1 (95% CI = 9.4 to 18.3) in women, which was significantly higher than an OR of 7.9 (95% CI = 7.1 to 9.0) in men. In studies with all PDs, the OR was 3.6 (95% CI = 2.7 to 4.9) in women compared with an OR of 3.0 (95% CI = 2.1 to 4.4) in men. When any antisocial outcomes were examined, in studies with all PD samples, the OR was 6.4 (95% CI = 3.9 to 10.5) in women compared with an OR of 6.3 (95% CI = 3.1 to 12.8) in men. In studies with ASPD samples, the OR was 7.3 (95% CI = 6.6 to 8.1) in women compared with an OR of 7.4 (95% CI = 6.8 to 8.0) in men.

Other Characteristics. There were no significant differences in risk estimates by other characteristics, including age, study period, region, study type, adjustment, comparison group, diagnostic criteria, and ascertainment of outcome (see Table 1 for details).

Meta-Regression. When investigating violent outcomes, meta-regression indicated that overall heterogeneity in risk estimates was partly due to the proportion with ASPD diagnoses (studies with ASPD-only samples reported higher risk estimates; $\beta = -0.89$, SE[β] = 0.31; $p = .01$). In addition, gender

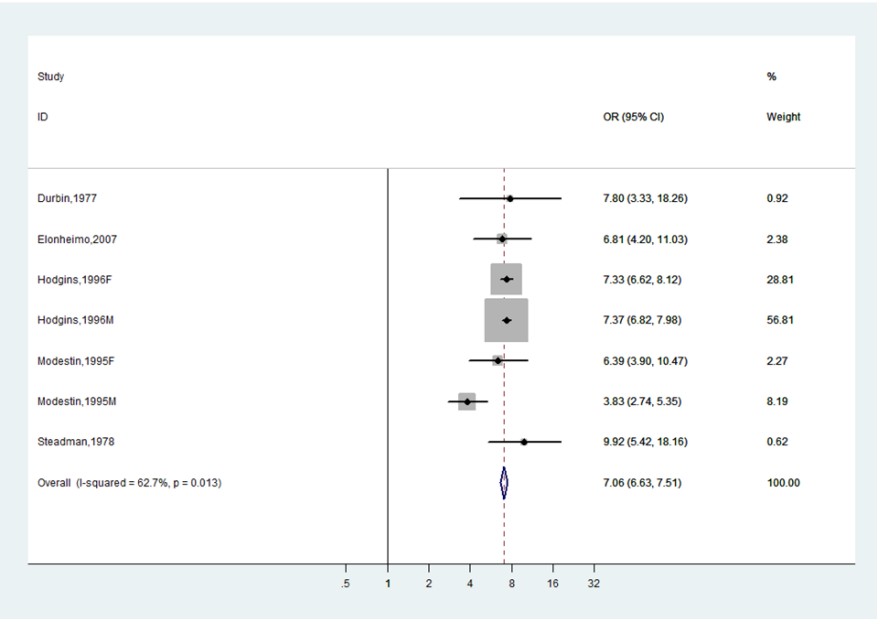

FIGURE 2. Risk estimate for any antisocial behavior in all personality disorders samples compared with general population controls.
Note. OR = odds ratio.

partly explained this heterogeneity (studies with females reported higher risk estimates; $\beta = 0.43$, SE[β] = 0.22; $p = .07$).

Publication Bias. There was no clear evidence of publication bias in studies of violent outcomes when using either the weighted regression method ($t = -.76$, $p = .48$) or the rank correlation method (Kendall tau = 0.13, $p = .88$). Similarly, there was no clear evidence of publication bias when any antisocial behavior was the outcome.

Population Attributable Risk. The population attributable risk was 3 per 1,000 population. In other words, there would be 3 fewer violent persons per 1,000 general population if all those with PD were detained indefinitely. The population attributable risk fraction for PD on violence was estimated at 18.8% (i.e., 19% of societal violence could be attributed to individuals with PD assuming there is a causal relationship).

STUDY 2: RISK OF REPEAT OFFENDING IN PERSONALITY DISORDERS

In investigations of repeat offending (or recidivism), 25 studies from 21 publications were included (Appendix Table 2). Four publications reported findings on multiple samples (Coid, Hickey, Kahtan, Zhang, & Yang, 2007; Ganzer & Sarason, 1973; Rice, Harris, Lang, & Bell, 1990; Singleton, Meltzer, & Gatward, 1998). The total number of offenders with PD in the included studies was 5,087. Of these, 2,428 (47.7%) were repeat offenders during a median follow-up of 6 years (with a range of 20 months to 22 years). These were compared with offenders with other psychiatric disorders ($n = 4,402$) or non–mentally disordered offenders ($n = 168$), of whom 1,242

TABLE 1. Risk Estimates for Antisocial Behavior in Personality Disorders by Sample or Study Characteristics

Sample or Study Characteristics	Number of Studies	Number of Cases with Personality Disorder	OR (95% CI)
Data from all studies			
Study period			
Study conducted in and before 1990	8	7290	7.4 (5.8 to 9.5)
Study conducted after 1990	6	2717	4.7 (3.0 to 7.4)
Study region			
USA	4	208	5.9 (2.7 to 12.8)
Scandinavia	6	7174	6.2 (5.1 to 7.4)
The rest of the world	4	2625	8.0 (3.1 to 20.7)
Design			
Case-control	12	9931	5.9 (4.4 to 7.9)
Cohort	2	76	9.1 (5.4 to 15.5)
Adjustment			
With adjustment	6	2969	6.7 (3.6 to 12.5)
Without adjustment	8	7038	6.2 (5.0 to 7.6)
Comparison group			
General population	8	791	6.3 (3.4 to 11.8)
General population without psychiatric disorders	6	9216	5.9 (4.1 to 8.4)
Age[a]			
30 years or younger	4	360	5.0 (2.2 to 11.1)
Older than 30 years	6	7126	8.0 (6.2 to 10.3)
Number of cases			
< 100 cases	5	227	8.9 (6.7 to 11.9)
100–1000 cases	5	686	5.5 (2.3 to 13.1)
> 1000 cases	4	14629	4.9 (3.2 to 7.5)
Data from studies of violent outcomes			
Diagnostic criteria[b]			
DSM criteria	5	2699	5.5 (2.6 to 11.5)
ICD criteria	4	6830	7.7 (5.0 to 11.9)
Data resource			
Register[c]	4	6830	7.7 (5.0 to 11.9)
Self-report	4	2625	8.0 (3.1 to 20.6)
Combination of sources	2	123	3.7 (1.5 to 9.4)

Notes. [a]Number of studies and cases differ in this analysis because five studies from three publications (Coid et al., 2006a; Durbin, Pasewark, & Albers, 1977; Monahan & Appelbaum, 2000) did not provide information on age. [b]Number of studies and cases differ in this analysis because one study (Stueve & Link, 1997) did not provide information on diagnostic criteria. [c]Register = police or other crime registers.

(27.2%) were recidivists. These studies were conducted in the United Stated, England and Wales, Brazil, Sweden, Italy, Germany, and France. Criminal recidivism data were obtained from register-based sources in all studies. All reports were conducted after 1974.

The overall fixed-effects pooled OR was 2.4 (95% CI = 2.2 to 2.7), with low to moderate heterogeneity between studies (χ^2_{25} = 34.6, p = .07, I^2 = 30.7%).

Risk Estimate by Comparison Groups. Of the included investigations, 23 compared the risk of criminal recidivism in offenders with PDs with the risk in offenders with other psychiatric disorders (Figure 3). Three studies provided comparison data from non–mentally disordered offenders (Grann, Danesh, & Fazel, 2008; Porporino & Motiuk, 1995; Stadtland & Nedopil, 2005). No significant differences in risk estimates were found between reports using different comparison groups: the OR was 2.5 (95% CI = 2.1

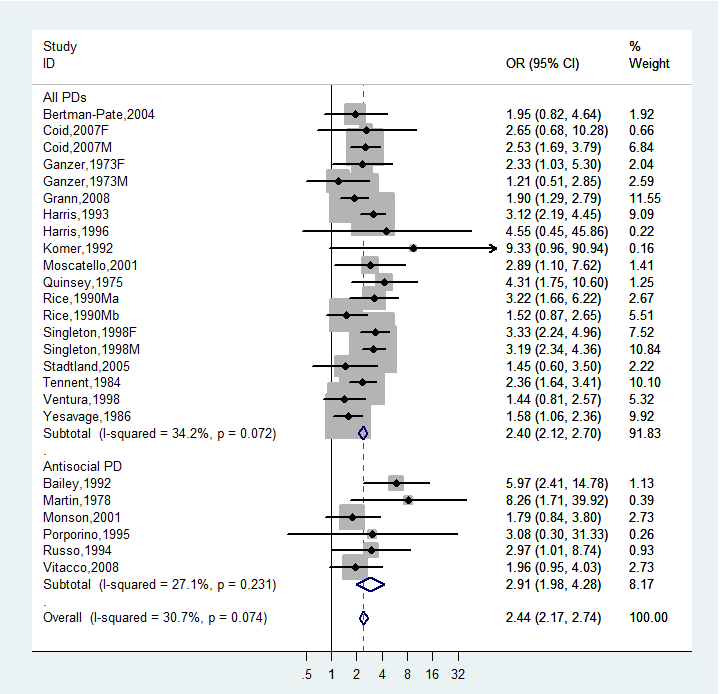

FIGURE 3. Risk estimates for repeat offending in offenders with personality disorder stratified by PD category.
Note. Weights are from fixed-effect models; OR = odds ratio.

to 2.9) when the comparison group was offenders with other psychiatric disorders, and the OR was 1.9 (95% CI = 1.3 to 2.8) when the comparison group was non–mentally disordered offenders. All subgroup analyses used fixed-effects models.

Antisocial Personality Disorder. Subgroup analysis of samples revealed no significant differences in risk estimates in those with only ASPD (OR = 2.9, 95% CI = 2.0 to 4.3) compared with all PDs (OR = 2.4, 95% CI = 2.1 to 2.7).

Other Characteristics. Subgroup analysis revealed that there was no significant difference in risk estimates by gender (including for only ASPD samples) or other tested characteristics: studies conducted in the United States versus the rest of the world, studies conducted in and before 1990 versus after, studies using *DSM* versus ICD criteria, studies with mean age of 30 and younger versus older, and sample size of fewer than 100 versus more than 100 (data not shown).

Meta-Regression and Publication Bias. On meta-regression, no tested factor was significantly associated with heterogeneity, neither when entered individually nor simultaneously. In addition, there was no clear evidence of publication bias when using the Egger (weighted regression) method ($t = -1.43$, $p = .17$) or the Begg test (rank correlation method; Kendall tau = .20, $p = .30$).

Population Attributable Risk. The population attributable risk was 108 per 1,000 population (i.e., there would be a reduction of 108 persons convicted of repeat crime per 1,000 population if all offenders with PD were indefinitely detained). The population attributable risk fraction for PD on repeat offending was estimated to be 29%. The positive predictive value for PD on reoffending is 66%—that is, 66% of offenders with PD were criminal recidivists. This is the equivalent of needing to detain 1.5 offenders with PD to prevent one repeat offense in the community.

DISCUSSION

MAIN FINDINGS

We have reported two related systematic reviews and meta-analyses that examine the association of PD and antisocial behavior, violence, and repeat offending. In the first review, we investigated the association between PD and antisocial outcomes compared with the general population and identified 14 studies. There were two main findings. First, there was a threefold increase in the odds of violent outcomes in individuals with all PDs compared with general population controls. Unsurprisingly, the risk in antisocial PD was substantially higher (reported as an odds ratio of 12.8). Second, there were high levels of heterogeneity in overall risk estimates, which was partly explained by higher risk estimates in samples with more female participants. Our second review focused on risk of repeat offending in PD offenders compared with other offenders, and 25 studies were included. We found that offenders with PDs had two to three times higher odds of being repeat offenders than mentally or non–mentally disordered offenders. In addition, we found that, unlike the situation with nonoffenders, a diagnosis of ASPD or gender did not materially alter risk estimates.

The risk of violence in people with any PD appears to be similar to the risk in individuals with schizophrenia (Fazel, Långström, Hjern, Grann, & Lichtenstein, 2009), bipolar disorder (Fazel, Lichtenstein, Grann, Goodwin, & Långström, 2010), or head injury (Fazel, Philipson, Gardiner, Merritt, & Grann, 2009). However, in those with ASPD, risk estimates are more similar to those who abuse drugs and alcohol (where it varies between 4 and 12 in a recent systematic review [Fazel, Gulati, Linsell, Geddes, & Grann, 2009]). In relation to offenders, our findings are consistent with a meta-analysis published more than a decade ago that found ASPD was a strong predictor of repeat offending (Bonta, Law, & Hanson, 1998). Other psychiatric diagnoses do not appear to be as strongly related to repeat offending (Grann et al., 2008). For example, a recent review reported increased odds in the form of an OR of 1.5 for psychosis on repeat offending (Fazel & Yu, 2011) whereas the OR for repeat offending in PD is reported as 2.4 in the current review.

IMPLICATIONS

The relationship of PD to violence and the quantification of the risk are important from public health and public policy perspectives. Mental health legislation over the past decade in some countries, such as that for dangerous

and severe personality disorder (DSPD) in England and Wales (Farnham & James, 2001; Buchanan & Leese, 2001), and proposals for detaining sexual offenders in secure hospitals in the United States (La Fond, 2008), Australia (Zdenkowski, 1997), France (Bénézech, Pham, & Le Bihan, 2009), and other countries, assume that PD is a significant risk factor for serious offending and that treatment in secure hospitals will provide some benefits. What this review highlights is that the relationship is not straightforward and varies by PD category substantially and possibly by gender. Although this supports the view that interventions that reduce violence in PD could potentially make a significant impact, it suggests that legislation might be more effective if it is tailored to subgroups. Although government initiatives aimed at the treatment of offenders and high-risk individuals with PD have been strongly criticized by some in the research community, such as the UK's DSPD Programme (Eastman, 1999; Farnham & James, 2001), this review implies that, in principle, if the link between PD and offending was modifiable, it could provide one approach to reduce crime. Because the evidence to date suggests that it is at most weakly modifiable (NICE, 2009), and because the risk estimates in ASPD were found to be similar to those in relation to alcohol and drug abuse, the particular emphasis on addressing severe PD as a means of crime reduction could be questioned. Furthermore, there is evidence of the efficacy of treatment for substance abuse (Brunette, Mueser, & Drake, 2004).

One unexpected finding in the review that bears on this issue is that offenders with ASPD were not associated with a higher risk of repeat offending compared with offenders with any PD. This may be because the studies of repeat offending examined risk of all crime (rather than violent offending), and any association with ASPD may be specific to violence. This was in contrast to ASPD being associated with high risk of violence in nonoffenders compared with the general population. Nevertheless, the positive predictive value of a diagnosis of ASPD for violence was 14% (in other words, typically 14% of those with a diagnosis of ASPD will commit violent acts), suggesting that targeting this high-risk group is unlikely to be an effective strategy in general psychiatry for reducing the risk of violence.

Furthermore, our meta-regression did not find young age as a risk factor for violence, unlike studies of general population samples (Loeber, Lacourse, & Homish, 2005). This may be due to the enduring and stable features of PD symptomatology over time (Lenzenweger, 1999).

One other implication is that the potential utility of the risk management of personality disordered individuals in forensic settings, including prisons and secure hospitals, is underscored by our results. Women with personality disorders may benefit from such risk management more than men, and research that addresses risk assessment and management for women with personality disorder is one area of worthwhile future research.

LIMITATIONS

There are a number of limitations in this report. First, the primary studies reported few potential confounders and so risk estimates could not take these into account. The most significant confounder is likely to be the comorbidity with other psychiatric disorders (Maier, Minges, Lichtermann, & Heun, 1995), particularly between substance use disorders and ASPD (Swanson et

al, 2002). None of the studies included in the reviews reported the rate of antisocial behavior for PDs with and without substance use disorder separately. Therefore, it is likely that the ORs overestimate the association between PD and antisocial outcomes because they have not been fully adjusted for confounding.

Second, more research on the association between different PD categories and types of antisocial behavior is required. In the current review, outcome data included both any antisocial behavior (which included violent and nonviolent outcomes) and violence. Subgroup analysis revealed that there was little difference in risk estimates between these two outcomes. Because these are overlapping, it would be preferable to compare violent with nonviolent outcomes, but this was not possible using the current data. It was not surprising that ASPD was associated with the highest risk estimates, because the criteria include antisocial acts. Only two studies (Coid et al., 2006a; Johnson et al., 2000) estimated risk in PDs excluding ASPD with ORs lower than the others. Further research on risk estimates in non-ASPD samples would be helpful because most individuals with PDs are not involved in antisocial behavior and feel unfairly stigmatized by the association with antisocial behavior (Blackburn, 1993; Stalker, Ferguson, & Barclay, 2005).

Third, the research base was of mixed quality. Further work that examines antisocial behavior in the general population with prospective cohort designs, investigations of criminal recidivism using non–mentally disordered comparisons, violent outcomes in repeat offenders, and studies in non-Western countries is needed. Of note, of the 14 studies included in the first review, only two investigations used a cohort design (Monahan & Appelbaum, 2000; Steadman, Cocozza, & Melick, 1978), one of which was prospective (Monahan & Appelbaum, 2000). A major advantage of longitudinal designs is that they can demonstrate a temporal sequence between disorder and outcome.

SUMMARY

We found higher risks of violence and criminality for individuals with PD than for general population controls, and for offenders with PD compared with other offenders. The utility of risk assessment and management may differ by PD category and gender.

APPENDIX Table 1. Characteristics of Included Studies on Risk of Antisocial Behavior in PDs

Study	Country	Study Type	PDs (*N*)	Controls (*N*)	Cases	Comparison Group	Gender
Durbin, 1977	USA	Cross-sectional	29	93818	All PDs	GP	Male
Steadman, 1978	USA	Cohort	56	12320540	All PDs	GP	Male
Ortmann, 1981	Denmark	Nested case control	135	10974	All PDs	GP	Male
Swanson, 1994	Canada	Cross-sectional	104	3154	ASPD	GP	Mixed
Modestin, 1995M	Switzerland	Cross-sectional	203	687	All PDs	GP	Male
Modestin, 1995F	Switzerland	Cross-sectional	141	578	All PDs	GP	Female
Hodgins, 1996M	Denmark	Cross-sectional	3069	155580	ASPD without comorbidity of major mental disorders	GP without psychiatric disorders	Male
Hodgins, 1996F	Denmark	Cross-sectional	3553	147367	ASPD without comorbidity of major mental disorders	GP without psychiatric disorders	Female
Stueve, 1997	Israel	Cross-sectional	49	1688	Only ASPD	GP without psychiatric disorders	Mixed
Monahan, 2000	USA	Cohort	20	519	All PDs without comorbidity of other psychiatric disorders	GP	Male
Johnson, 2000	USA	Nested case-control	103	614	All PDs (not including ASPD)	GP	Mixed
Coid, 2006aM	UK	Cross-sectional	1337	2365	All PDs	GP without psychiatric disorders	Male
Coid, 2006aF	UK	Cross-sectional	1135	2603	All PDs	GP without psychiatric disorders	Female
Elonheimo, 2007	Finland	Nested case-control	73	2429	ASPD	GP without psychiatric disorders	Male

Notes. GP = General Population; F = female; M = male; ASPD = (antisocial) personality disorder.

(continued)

APPENDIX Table 1. Continued

Mean Age	Diagnostic Criteria	Ascertainment of Outcomes	Adjustment	Definition of Antisocial Behavior
18-64	NA	Register	No	All crimes: public intoxication, driving while intoxicated, gambling, vagrancy, disorderly conduct, traffic violations, and suspicion.
35	NA	Register	No	Arrest
25	ICD-8	Register	No	Violent offenses excluding sexual offenses
NA	DSM-III	Self-report	Yes: adjusted for household size, age, and sex distribution	Physical violence
39.4	ICD-9	Register	Yes: matched sex, age, marital status, social class, and size of the community	All crimes
43.8	ICD-9	Register	Yes: matched sex, age, marital status, social class, and size of the community	All crimes
> 35	ICD-8	Register	No	All crimes: violent offenses, theft of all kinds, fraud, vandalism, traffic offenses included in the criminal code, all drug-related offenses, and all 'other' criminal offenses
> 35	ICD-8	Register	No	All crimes: violent offenses, theft of all kinds, fraud, vandalism, traffic offenses included in the criminal code, all drug-related offenses, and all 'other' criminal offenses
24-33	NA	Self-report	Yes: adjust for gender, age, ethnicity, education, and social desirability response	Violent behavior: recent fighting and weapon use in 5-year period
18-40	DSM-III-R	Register, self-report,and collateral report	No	Violent behavior: kick/bite/choke/hit/beat up and weapon use/weapon threat and acts that were coded as other aggressive acts were primarily throw objects/push/grab/shove
22	DSM-IV	Self-report and parental report	No	Violent acts: arson, assault resulting in injury to another person, breaking and entering, mugging, robbery, starting serious physical fights, threats to injure others, and vandalism
16-74	DSM-IV	Self-report	Yes: adjusted for sex, age, social classes III–V, marital status, employment, any affective/anxiety disorder, alcohol dependence, drug dependence, and psychosis-positive screen	Violent behavior: fight and weapon use
16-74	DSM-IV	Self-report	Yes: adjusted for sex, age, social classes III–V, marital status, employment, any affective/anxiety disorder, alcohol dependence, drug dependence, and psychosis-positive screen	Violent behavior: fight and weapon use
18-23	ICD-10	Register	No	All crimes: drug, violent, property, traffic, and drunk driving offense

Notes. Register = police or other crime registers; NA = information not available.

APPENDIX Table 2. Characteristics of the Included Studies Reporting on Risk of Recidivism in PDs

Study	Country	Study Type	PDs (*N*)	Controls (*N*)	Cases	Comparison Group	Diagnostic Criteria	Mean Age	Gender	Definition of Outcome
Ganzer,1973M	USA	Case-control	70	30	all PDs	Other psychiatric disorders	NA	15.3	Male	Recidivism
Ganzer, 1973F	USA	Case-control	60	40	all PDs	Other psychiatric disorders	NA	14.7	Female	Recidivism
Quinsey, 1975	Canada	Cohort	44	47	all PDs	Other psychiatric disorders	NA	32	Male	Recidivism
Martin,1978	USA	Cohort	42	22	ASPD	Other psychiatric disorders	NA	NA	Female	Recidivism
Tennent,1984	UK	Cohort	226	262	all PDs	Other psychiatric disorders	NA	NA	Male	Recidivism
Yesavage, 1986	France	Cohort	340	756	all PDs	Other psychiatric disorders	*DSM-III*	NA	Mixed	Recidivism
Rice, 1990	Canada	Cohort	47	206	all PDs	Other psychiatric disorders	*DSM-III*	30	Male	Recidivism
Rice, 1990	Canada	Cohort	84	131	all PDs	Other psychiatric disorders	*DSM-III*	29.6	Male	Recidivism
Komer, 1992	Canada	Cohort	15	15	all PDs	Other psychiatric disorders	NA	28.4	Mixed	Recidivism
Bailey, 1992	UK	Cohort	62	50	ASPD	Other psychiatric disorders	*DSM-III-R*	NA	Male	Recidivism
Harris, 1993	Canada	Cohort	225	393	all PDs	Other psychiatric disorders	*DSM-III*	27	Male	Violent recidivism
Russo, 1994	Italy	Cohort	22	70	ASPD	Other psychiatric disorders	NA	40	Male	Recidivism
Porporino, 1995	Canada	Cohort	18	9	ASPD	No psychiatric disorders	*DSM-III*	33.6	Male	Recidivism
Harris, 1996	USA	Cohort	6	21	all PDs	Other psychiatric disorders	NA	NA	Mixed	Recidivism
Ventura, 1998	USA	Cohort	94	167	all PDs	Other psychiatric disorders	*DSM-III-R*	28.7	Mixed	Recidivism
Singleton, 1998M	UK	Cohort	810	296	all PDs	Other psychiatric disorders	*DSM-IV*	NA	Male	Recidivism
Singleton, 1998F	UK	Cohort	416	153	all PDs	Other psychiatric disorders	*DSM-IV*	NA	Male	Recidivism
Monson, 2001	USA	Cohort	41	84	all PDs	Other psychiatric disorders	NA	37.7	Mixed	Recidivism
Moscatello, 2001	Brazil	Cross-sectional	29	71	all PDs	Other psychiatric disorders	*ICD-10*	38.9	Male	Recidivism
Bertman-Pate, 2004	USA	Cohort	28	91	all PDs	Other psychiatric disorders	*DSM-IV*	38	Mixed	Recidivism
Stadtland, 2005	Germany	Case-control	28	75	all PDs	Other psychiatric disorders	*ICD-10*	NA	Mixed	Recidivism
Coid, 2007M	UK	Cohort	132	980	all PDs	Other psychiatric disorders	*DSM-III-R*	31.6	Male	Recidivism
Coid, 2007F	UK	Cohort	56	112	all PDs	Other psychiatric disorders	*DSM-III-R*	31.6	Female	Recidivism
Grann, 2008	Sweden	Cohort	2159	159	all PDs	No psychiatric disorders	*DSM-III*	35.7	Mixed	Violent recidivism
Vitacco, 2008	USA	Cohort	33	330	ASPD	Other psychiatric disorders	*DSM-IV*	41	Mixed	Recidivism

Notes. M = male; F = female; NA = information not available; *DSM* = *Diagnostic and Statistical Manual of Mental Disorders*; ICD = International Classification of Diseases. Recidivism refers to any criminal recidivism unless otherwise stated.

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