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The Heritability of Cluster B Personality Disorders Assessed both by Personal Interview and Questionnaire

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Abstract

Whereas the heritability of common personality traits has been firmly established, the results of the few published studies on personality disorders (PDs) are highly divergent, with some studies finding high heredity and others very low. A problem with assessing personality disorders by means of interview is errors connected with interviewer bias. A way to overcome the problem is to use self-report questionnaires in addition to interviews. This study used both interview and questionnaire for assessing DSM-IV Cluster B personality disorders: antisocial personality disorder (APD), borderline (BPD), narcissistic (NPD), and histrionic (HPD).

We assessed close to 2,800 twins from the Norwegian Institute of Public Health Twin Panel using a self-report questionnaire and, a few years later, the Structured Interview for DSM-IV Personality (SIDP-IV). Items from the self-report questionnaire that best predicted the PDs captured by the interview were then selected. Measurement models combining questionnaire and interview information were applied and were fitted using Mx.

Whereas the heritability of Cluster B PDs assessed by interview was around .30, and around .40–.50 when assessed by self-report questionnaire, the heritability of the convergent latent factor, including information from both interview and self-report questionnaire was .69 for APD, .67 for BPD, .71 for NPD, and .63 for HPD. As is usually found for personality, the effect of shared-in families (familial) environment was zero.

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In conclusion, when both interview and self-report questionnaire are taken into account, the heritability of Cluster B PD appears to be in the upper range of previous findings for mental disorders.

A number of family, twin, and adoption studies have established the effects of heritability on common personality traits and dimensions (Johnson, Vernon, & Feiler, 2008, Torgersen, 2005). The effects are around .40–.50. Relatively few studies have investigated the heritability of personality disorders (PDs) (Livesley & Jang, 2008). Two studies have published results for the entire range of PDs assessed by structured interviews, finding heritability around .50–.60 (Torgersen et al., 2000) or around .30 (Kendler et al., 2008). The studies of PDs (or similar dysfunctional personality traits) measured by self-rate questionnaire have yielded somewhat higher heritabilities, around .50 (Jang, Livesley, Vernon, & Jackson, 1996a) and around .70–.80 (Coolidge, Thede, & Jang, 2001). Generally, the shared-in-families (familial) environmental effect is small or zero.

However, there are only moderate correlations between the assessment of PDs measured by interview and the assessment of PDs measured by self-report questionnaire (Zimmermann, 1994), or between interview assessed PDs and Big Five dimensions and facets (Samuels & Widiger, 2008; Saulsman & Page, 2004, 2005). This suggests that the two methods assess partly the same concept, but also partly different concepts. The specific variance measured by each method includes valid variance as well as measurement error variance. This measurement error variance is a problem in behavioral genetic studies, as the not-shared-in-families (unique) environmental variance are inseparable from error variance. As the sum of heritability, shared-in-families (familial) environmental variance and not-shared-in-families (unique) environmental variance (including error variance) is unity, the error variance will imply an underestimation of heritability and familial environmental variance, when this environmental variance exists.

By applying both methods in a twin model analysis, a latent factor is obtained, estimating more correctly the heritability and environmental effects of this convergent concept of PDs, as the latent factor is relatively free of error variance.

In addition, the analysis will estimate how much of the heritability effect of the assessments of each method is shared by the common, convergent latent factor, and how much is specific for the method applied. The same is true for an eventual familial environmental effect, and the unique environmental effect (included error variance). However, for the calculated unique environmental effect, the method specific part will be overestimated due to error variance.

The aim of this study was to assess the familial transmission (genetic and/or environmental) of the method convergent latent factor for cluster B PDs, including borderline (BPD), antisocial (APD), histrionic (HPD), and narcissistic (NPD) PDs. In addition, the relative size of the genetic and environmental effects of the common convergent factor and the method specific assessment has been investigated.

Previous twin studies have shown that the heritability are considerably higher when self-report and reports by peers (Rieman, Angleitner, & Strelau, 1997; Wolf, Angleitner, Spinath, Riemann, & Strelau, 2004) or interviews and other information (Krueger et al., 2002) are combined in a convergent latent factor, compared by using only one method. The present report comes from the Norwegian Institute of Public Health Twin Panel (NIPHTP). In a recent report from the Twin Panel, including both questionnaire and interview, the heritability increased noteworthy for Cluster A PDs (Kendler, Myers, Torgersen, Neale, & Reichborn-Kjennerud, 2007), compared to using only the interview (Kendler et al., 2006).

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Previously, we reported to have obtained relatively modest estimates of heritability of Cluster B PDs using only interview (Torgersen et al., 2008). We hypothesized that the heritability would increase for Cluster B PDs just like for Cluster A PDs.

Method

Participants

The twin sample and attrition is described elsewhere (Tambs et al., 2009; Torgersen et al., 2008). In brief, the point of departure was the Norwegian Medical Birth Registry, which receives mandatory notification of all live births. The twin panel started with 15,370 like-sexed and unlike-sexed twins born between 1967 and 1979. During that time period, the proportion of pairs that survived to age 3 ranged from 82% to 89%. After two previous questionnaire waves, 3,221 complete pairs were still in the panel. Of these, 2,794 (44%) twins participated in the study, completing both questionnaire and interview. The main reason for attrition was lack of response from eligible participants (38%); only a few actively declined to participate, and for a very few (3%) we were not able to find the correct address.

Approval was received from the Norwegian Data Inspectorate and the regional Ethical Committee, and written informed consent was obtained from all participants after they were given a complete description of the study.

Questionnaire

The Dysfunctional Personality Questionnaire (DFPQ) was selected by one of us (S.T.) to assess dysfunctional personality traits. The items were either selected from one of three prior established personality instruments (Conte, Plutchik, Karasu, & Jerrett, 1980; Foulds, 1965; Lazare, Klerman, & Armor, 1966), or developed and subsequently validated by S.T. (Torgersen, 1980a, b). The questionnaire has been applied in a number of studies of patients (Alnaes & Torgersen, 1991, 1997; Torgersen & Alnaes, 1989) and nonpatients (Lau, Hem, Berg, Ekeberg, & Torgersen, 2006; Vollrath & Torgersen, 2002) for instance.

Interview

A Norwegian version of the SIDP-IV (Pfohl, Blum, & Zimmerman, 1995) was used to assess PD. The SIDP was used previously in a DSM-III-R version (Torgersen, Kringlen, & Cramer, 2001) and a DSM-IV version (Helgeland, Kjelsberg, & Torgersen, 2005). The SIDP is a comprehensive semi-structured diagnostic interview for the assessment of all DSM-IV Axis II diagnoses. The interview is comprised of non-pejorative questions organized into topical sections covering natural everyday situations and behaviors. The answers are the basis for DSM-IV criterion scores (0 = absent, 1 = subthreshold, 2 = present, 3 = strongly present).

The SIDP uses the 5-year rule, meaning that behaviors, cognitions, and feelings that have been predominant for most of the past 5 years are considered to be representative of the individual's long-term personality functioning.

The interviewers (mostly experienced psychology students and psychiatric nurses) were trained by one psychiatrist and two psychologists with previous extensive experience with the instrument. The interviews, largely conducted face-to-face, were carried out between June 1999 and May 2004. For practical reasons, 231 interviews (8.3%) were conducted over the telephone. Members of the twin pair were assessed by different interviewers.

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Interrater reliability was assessed by two raters scoring 70 audio-taped interviews. The obtained high intra-class (and polychoric) correlations for the number of endorsed criteria at the subthreshold level was 0.91 for APD, 0.93 for BPD, 0.85 for HPD, and 0.86 for NPD.

Zygosity

Zygosity was determined by standard questionnaire items used in a discriminant analysis with results of 24 microsatellite markers available on 676 of the like-sexed pairs in the sample. From these data, we estimated that in our entire sample zygosity misclassification rates are less than 1% (Neale, 2003).

Analyses of the Relationship Between Questionnaire and Interview

A central aspect of the study was to find the items from the questionnaire that were the most strongly related to the PDs measured by interview. First, participants missing scores on 10% or more of their questionnaire items were excluded from the analysis (3%). For participants included who were missing some but fewer than 10%, the missing values were imputed using IVEware (Raghunathan, Solenberger, & Van Hoewyk, 2000). Separately for the four Cluster B PDs, we then conducted step-wise ordinal logistic regression analysis using PROC LOGISTIC in SAS (SAS Publishing, 2006) in twin 1 from each twin pair, attempting to predict—from the responses on the Dysfunctional Personality Questionnaire—the number of criteria endorsed with a score of 1 or higher. The significance level for entry and exit into this regression analysis was 0.20. We then took these resulting items and repeated the analysis in the second twin in each pair, this time using an entry and exit criteria of 0.05.

Model Fitting

A liability-threshold model is applied to estimate the genetic and environmental contributions to twin resemblance for PDs. This liability is indexed by the number of items responded to in the positive direction on the DPQ questionnaire. For the SIDP interview, the liability is indexed by the number of DSM-IV criteria endorsed at the subthreshold level. In this way, the number of criteria endorsed is regarded as a severity indication on an assumed single normally distributed continuum of liability, as in previous papers from the study (Kendler et al., 2006, 2007; Reichborn-Kjennerud et al., 2007; Torgersen et al., 2008).

The model-fitting used here divides the variation in liability to PDs into three classes: (i) additive genetic, heritability (A), which contributes twice as much to the correlation in monozygotic (MZ) twins as in dizygotic (DZ) twins; (ii) shared-in-families, familial environment (C), which contributes equally to the correlation in MZ and DZ twins; and (iii) not-shared-in families, unique environment (E), which reflects environmental experiences not shared by both members of a twin pair and therefore contributes to differences between them in their liability to PDs.

Our model for PDs, previously referred to as a measurement model (Foley, Neale, & Kendler, 1998) utilizes simultaneously both the questionnaire and interview data from our twin sample. As illustrated in Figure 1, the model assumes that there is a true latent liability to each PD. The latent liability to the PD is indexed by both items from the questionnaire and DSM-IV criteria assessed by interview. The magnitude of this relationship is reflected in the paths λ_S and λ_I, where, respectively, S and I refer to self-report and interviewed-based assessments, respectively. Genetic (A), shared, familial environmental (C), and not-shared, unique environmental effects (E) are included in the model for the latent liability to the PD (indicated by the subscript $_L$), specific to the self-report questionnaire (indicated by the subscript $_S$), and specific to the interview (indicated by the subscript $_I$).

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In our measurement model (Figure 1), if there are no shared environmental effects, the two λ paths are unconstrained, and genetic effects exist that are specific to one occasion of measurement; models that assign the specific genetic effect to one or the other time of measurement will typically have identical fits. To avoid this confound, we added the following constraint to our models: $\lambda_I \geq \lambda_S$. Given that the interview was specifically designed to operationalize the DSM PD criteria, we made the plausible assumption that latent liability to the individual PDs would be indexed at least as well by the interview as by the questionnaire.

To maximize power, we fitted models in the software program Mx (Neale, Boker, Xie, & Maes, 2003) to the raw data from all twins, including those without a co-twin and twins who had completed the questionnaire but not the interview. Alternative models are evaluated by comparing the difference in their chi-squares relative to the difference in their degrees of freedom (*df*); according to the principle of parsimony models with fewer parameters are preferable if they do not provide significantly worse fit. We operationalize this balance between explanatory power and parsimony by the use of Akaike's information criterion (AIC) (Aikake, 1987; Williams & Holahan, 1994) which is calculated as $X^2 - 2df$ equals the difference in the number of degrees of freedom between the two models being compared. The lower (or more negative) the value of the AIC the better is the balance between explanatory power and parsimony.

Results

Questionnaire

Table 1 presents the items best picking the various DSM-IV Cluster B personality disorders. The antisocial items present a rather impulsive person, who does not plan well, and is egocentric, unstable, and not very attached to other people. The borderline items express strong feelings, anger, unstable emotions, impulsivity, social problems, and unreality. The histrionic items are also impulsive and unstable but in addition also exhibitionistic, histrionic (watch myself put on an act), and extraverted. Finally, the narcissistic items are also exhibitionistic, sociable, impulsive, and instable but in addition also aggressive and self-confident. One item, “My emotions are fairly well balanced” (reversed) is common to all Cluster B personality disorders. Histrionic and narcissistic PDs have three items together: covering, exhibitionism, acting, and fantasy. Antisocial and borderline PDs have egocentrism and unreality together, and antisocial and narcissistic share the dare-devil aspect.

The structure of common items is in accordance with the comorbidity within Cluster B personality disorders (Deary, Peter, Austin, & Gibson, 1998; Durrett & Westen, 2005; Fossati et al., 2000; Hyler & Lyons, 1988; Kass, Skodol, Charles, Spitzer, & Williams, 1985; Yang, Bagby, Costa, Ryder, & Herbst, 2002). It is also in accordance with the common genetic and environmental causality within cluster B, with the highest common causality between antisocial and borderline PDs, and between histrionic and narcissistic PDs (Torgersen et al., 2008). What they do not share of items also expresses their unique nature, the irresponsibility of antisocial PD, the anger and relation problems of borderline PD, the extraversion and intensity of histrionic PD, and the self-confident aspect in contrast to social insensitivity in narcissistic PD.

Table 2 presents the psychometric aspects of the questionnaire and the interview. The Chronbach's Alpha is not high. This must be viewed on the background of the post hoc method to create the scales, based on a regression method to obtain the maximum prediction value in relation to the interview. Hence, the items are picked to represent a broad association to the interview, not because they fit together.

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Model Fitting

Tables 3a and 3b present the model fitting for the four Cluster B PDs. Figures 2–5 present the heritability effects (A) and the not-shared-in-families environmental effects (E) for the latent liability factors and the separate questionnaire and interview variables. The effects are broken down into common and specific effects for questionnaire and interview in Table 2, and the coefficients are squared to show the effects.

Antisocial Personality Disorder

The results in model fitting for antisocial PD (APD) will be described in detail (see Table 3a). Model I, the full model, allowed for qualitative and quantitative sex effects and genetic, shared, and unique environmental effects for the latent index to APD as well as the APD measurements obtained by self-report questionnaire and interview. In models II and III, the qualitative and quantitative sex effects are dropped, respectively. An improvement in the quality of fit was produced both times, as indexed by the AIC. Working from model III, all familial environmental effects in model IV and all genetic effects in model V, were omitted. The quality of fit improved with model IV but deteriorated substantially with model V. Working from model IV, we then dropped one at a time, in models VI through VIII, additive genetic effects for the latent liability to APD and then the same for the APD measurements obtained by questionnaire and finally by interview. Of these three models, by far the best fit was obtained by model VIII, which dropped the specific genetic effects for the interview. The model was simplified further by dropping the specific genetic effect for the interview (model IX) and for the latent liability (model X), but the fit deteriorated substantially in both cases, indicating that model VIII was the best fit.

Figure 2 shows the parameter estimates for this best-fit model for APD. The latent liability to APD is indexed equally well by the questionnaire ($\lambda_S = +0.67$) and the interview ($\lambda_I = +0.67$). We did not constrain these two parameters to equality, but we did constrain the estimates of λ_I to be greater than or equal to λ_Q.

The parameter estimates are squared in Table 4 to show the additive genetic and environmental estimates. As the best model state, there are no shared, familial environmental effects and no genetic effects for the interview. The heritability of the latent liability to APD is quite high, 69%. The heritability for the questionnaire is .46, .31 from the latent liability and .15 specific to the questionnaire. The nonshared environmental effects, including errors, for the interview are quite high, .55, suggesting considerable reliability deficiency. It thus seems that there only exists a familiarity, totally genetic, for APD as assessed by interview, to the extent that the antisociality is corroborated by self-report questionnaire information. The questionnaire, on the other hand, displays genetic effects outside the realm of interview APD.

Borderline Personality Disorder

Model fitting results for borderline PD (BPD) were identical to those seen for APD producing model VIII as the best fit model (Table 3a), with no shared, familial environmental effects and no specific genetic effect for the interview. Figure 3 shows the parameter estimates of this model for BPD, and Table 4 presents the genetic and environmental effects. As with APD, the latent liability to BPD was equally well indexed by the questionnaire ($\lambda_S = +0.69$) and the interview ($\lambda_I = +0.69$). The heritability of the latent liability to BPD is estimated at 67%, slightly lower than that seen for APD. The heritability for the questionnaire is .46, .32 from the latent liability factor and .14 specific to the questionnaire. There are high non-shared, unique environmental effects, including errors, as found for APD.

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Histrionic Personality Disorder

Model fitting for histrionic PD (HPD) is also very similar to the model fittings for APD and BPD. Model VIII (Table 3b) is even better for HPD than for APD and BPD. The latent liability to BPD is equally well indexed by the questionnaire (λ_Q = +0.64) and the interview (λ_I = +0.64) (Figure 4). The heritability of the latent liability is 63% (Figure 4, Table 4). The heritability for the questionnaire is 46% (.26 from the latent liability and .20 from the questionnaire). As was found for the other PDs, the nonshared, unique environmental/error effects are high for the interview.

Narcissistic Personality Disorder

The results for Narcissistic PD (NPD) are also similar to that of the three other PDs in Cluster B. The latent liability to NPD is equally well indexed by the questionnaire (λ_S = +0.57) and the interview (λ_I = +0.57) (Figure 5). Model VIII is the best model with no shared, familial environment and no specific genetic effects for the interview (Table 3b). NPD has the highest heritability of the four Cluster B PDs, .71 (Figure 5, Table 4). The heritability for the questionnaire is .41 (.23 from the latent liability and .18 questionnaire-specific). The interview-specific nonshared, unique environmental/error effects is very high, .67.

Discussion

Our study showed that models with shared-in-families, familial environmental effects were never among the two best models. This is relatively common among twin studies of adults. Even with a very high number of twins, shared environment does not appear to explain the familial transmission of, for instance, neuroticism (Lake, Eaves, Maes, Heath, & Martin, 2000).

The heritability of the common PD factors is relatively high. We find a high specific nonshared in families, unique environment/error effect for the interview. One reason may be measurement variance related to differences between interviewers. Different interviewers differ in their ability to establish rapport with the twins; they stress different aspects of behavior, etc. That type of interviewer measurement variance will not be detected by our reliability analyses. On the other hand, using the same rater to interview both twins may make the twins too similar of the same reason. The threshold for scoring behavior as pathological, for instance, may create a too high correlation between the assessment of the twins. MZ twins may also be assessed too similar compared to DZ twins when the same rater rates both twins in a twin pair, because of appearance stereotypes differing from rater to rater. Two studies of PDs used the same raters for both twins (Coolidge et al. 2001- mothers); Torgersen et al., 2000 - interviewers), those two studies yielded, however, results very similar to this study. Coolidge et al. (2001) found a heredity estimate of .61 for conduct disorder (the twins were children and adolescents), which is not much different from .69 for APD in the present study. For BPD Coolidge et al. obtained .76 and Torgersen .69, close to .67 in the present study. The heritability for HPD was .79 in the study by Coolidge et al., .67 in the study by Torgersen et al., and .62 in the present study. For NPD, the heritability was .66 in the study by Coolidge et al., .77 in the study of Torgersen et al., and .71 in the present study. All the three studies display a heritability around .70 on average for the Cluster B PDs.

Whereas the heritability for the interview was low, around .30, the heritability for the questionnaire scales was moderate, .41 for the NPD scale and .46 for the three others. These estimates are very similar to the heritability estimates for the Big Five (Jang, Livesley, & Vernon, 1996b), the Revised Eysenck Personality Inventory (Wolf et al., 2004), for

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Cloninger's Temerament and Character Inventory (Ando et al., 2004), and for Multidimensional Personality Questionnaire (Pedersen et al., 1991), as well as ego-development (Newman, Tellegen, & Bouchard, 1998). Scales measuring dysfunctional traits and dimensions, such as the Dimensional Assessment of Personality Pathology (DAPP), also show heritability estimates of similar magnitudes (Jang et al., 1996a).

This study implies that using both interview and self-report questionnaire may be worthwhile in studies of PDs, as method specific measurement error deflates the correlations obtained. This has also been taken into account in large-scale studies of PDs. Gunderson et al. (2000), in their multi-center follow-up study of personality disorder, applied interview as well as questionnaire to secure the best possible assessment of PDs. Also Zanarini, Frankenburg, Hennen, Reich, and Silk (2006) found that Big Five, especially Neuroticism and Non-Agreeableness was strongly related to stability of BPD diagnosis. To apply both questionnaire and interview seems to be a sound approach, increasing reliability and hence make it possible to establish the true strength of causal effects.

Limitations

There are a number of limitations of this study. A relatively low percentage of the total national twin population took part in the study. However, the attrition analyses (Tambs et al., 2009) showed that there were no systematic tendencies toward differences in relevant variables between those who dropped out of the study and those who participated. Even so, the low prevalence of personality disorders compared to what is found in population studies (Torgersen et al., 2001) may be a problem. Personality disorders are a clinical concept. To study a sample from the common population may make statistical modeling easier, but may reduce generalization to those really suffering from the disorder. This limitation is highlighted by the necessity of applying subclinical criteria of PD in our study. On the other hand, the results of this study are very similar to the results of a twin study among psychiatric patients (Torgersen et al., 2000). The relative young age of the twin sample may also be a problem, even if Cluster B disorders are relatively typical for younger individuals (Torgersen et al., 2001).

Furthermore, the questionnaire that we used in this study is not a standard questionnaire in the scientific literature. However, variants of the questionnaire have been used in a number of studies (Alnaes & Torgersen, 1991, 1997; Lau et al., 2006; Torgersen & Alnaes, 1989; Vollrath & Torgersen, 2002), and the heritability for the questionnaire scales was very similar to standard personality or personality dysfunction questionnaires.

Conclusion

When Cluster B PDs are assessed by interview as well as by questionnaire, the heritability is high, just as high as it is for schizophrenia (Kendler, 2001) and for bipolar disorder (Edvardsen et al., 2008). The results indicate that in studies on PDs it is recommendable to use both interview and self-report questionnaire.

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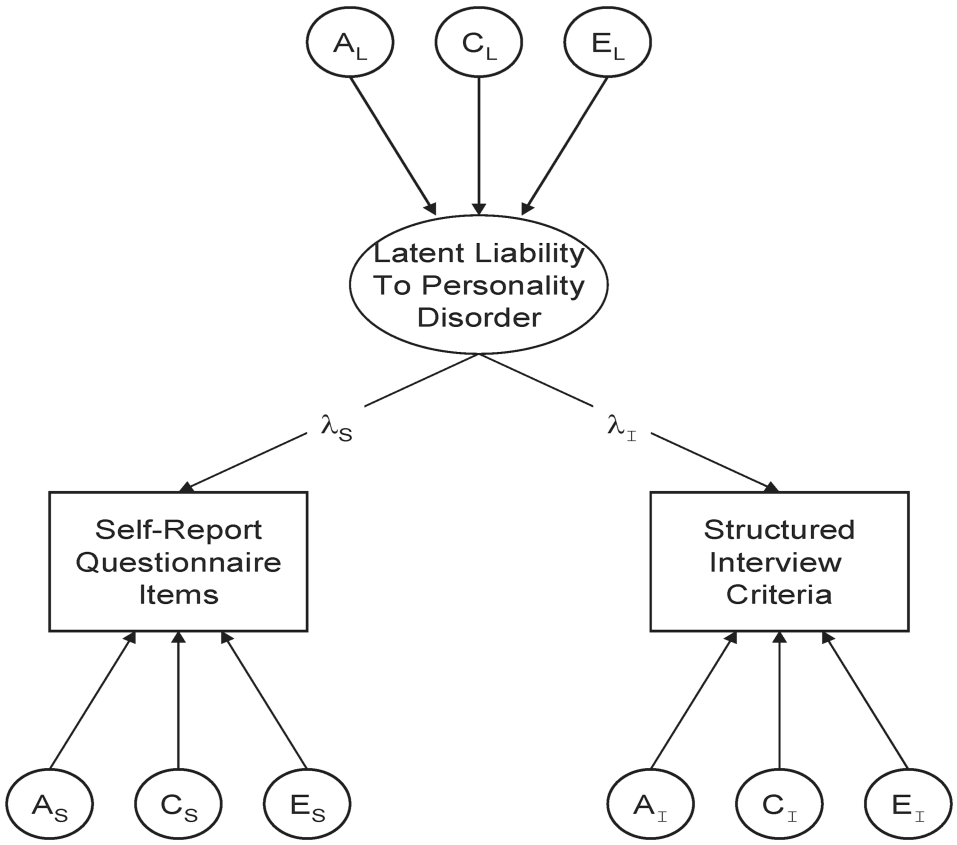

Figure 1.
The Measurement Model used in this report. The latent liability to personality disorder is indexed by both items from the self-report questionnaire and DSM-IV criteria as assessed by structured interview. The magnitude of this relationship is reflected in the paths λ_S and λ_I, respectively, where S and I refer to self-report questionnaire and interviewed based assessment. Genetic (A), shared-in-family environmental (C), and not-shared-in-family environmental effects (E) are included in the model for the latent liability to personality disorder (indicated by the subscript $_L$), specific to the self-report questionnaire (indicated by the subscript $_S$), and specific to the self-report structured interview (indicated by the subscript $_I$).

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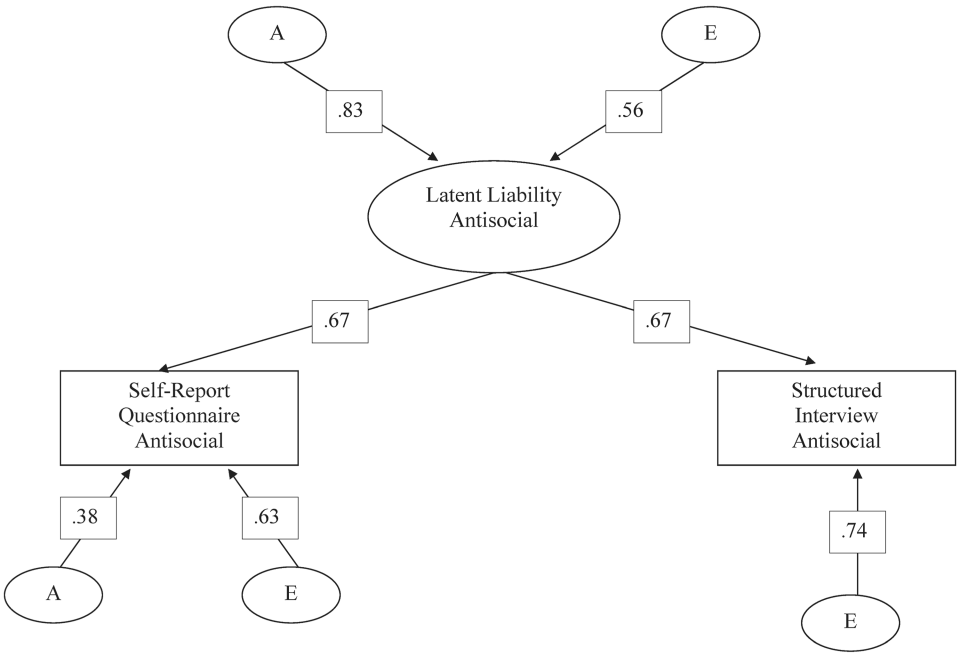

Figure 2.
Parameter estimates from the best-fit model VIII for antisocial personality disorder. A stands for additive genetic and E for nonshared environmental effects.

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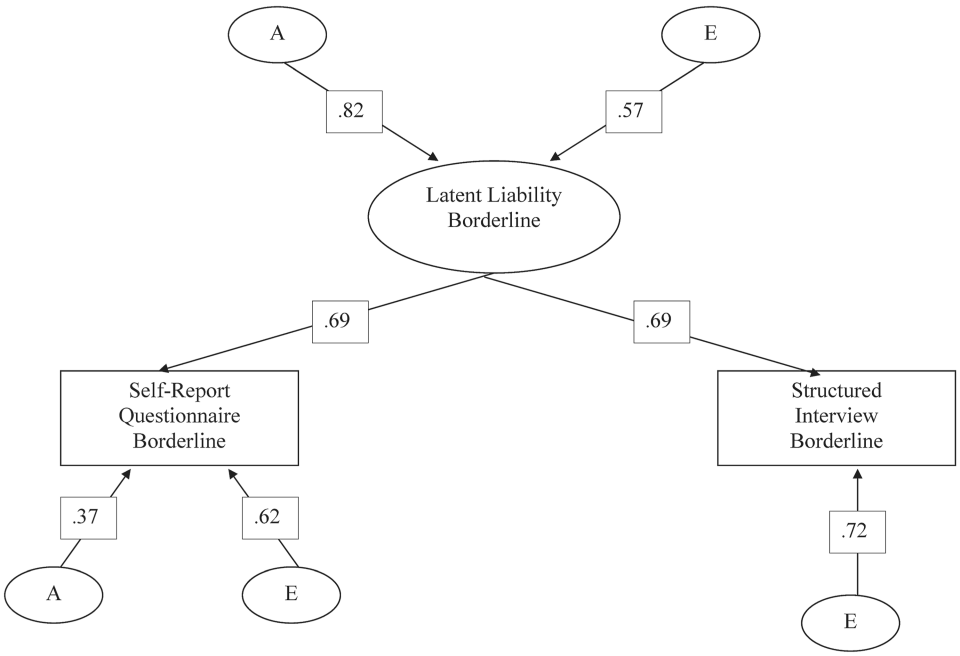

Figure 3.
Parameter estimates from the best-fit model VIII for borderline personality disorder. A stands for additive genetic and E for nonshared environmental effects.

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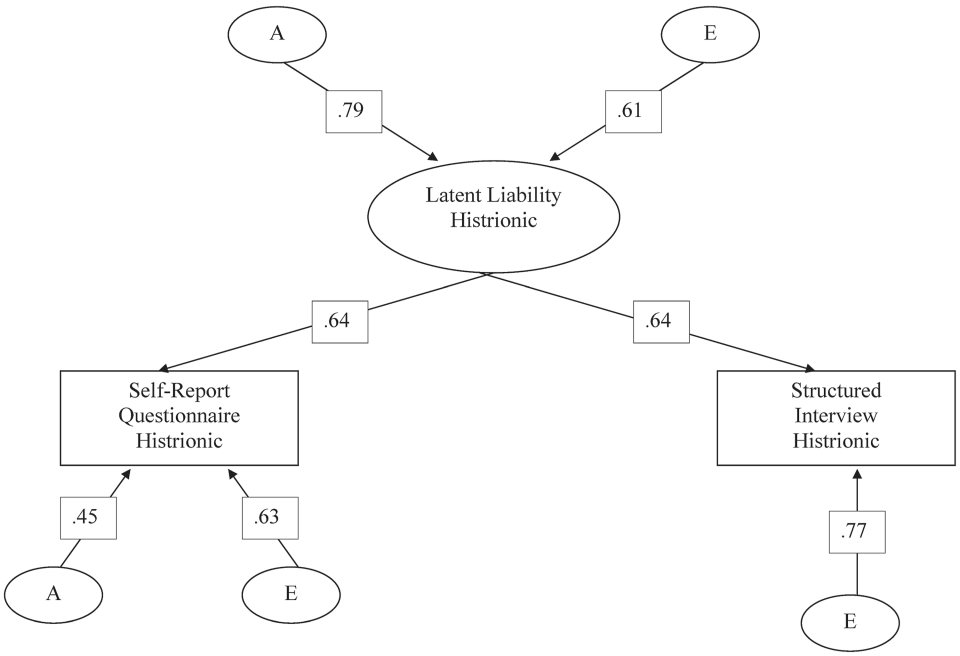

Figure 4.
Parameter estimates from the best-fit model VIII for histrionic personality disorder. A stands for additive genetic and E for nonshared environmental effects.

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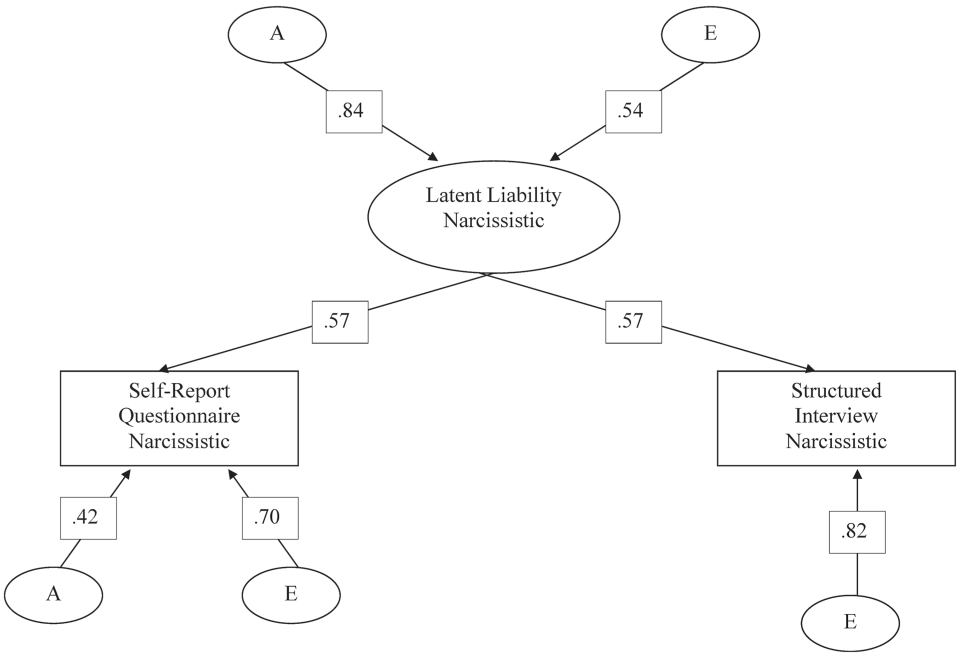

Figure 5.
Parameter estimates from the best-fit model VIII for narcissistic personality disorder. A stands for additive genetic and E for nonshared environmental effects.

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Table 1

Items from the Self-Report Questionnaire Selected to Assess Antisocial, Borderline, Histrionic, and Schizotypal PD Traits.

Item number	Item Content
Antisocial Personality Disorder	
−91	My emotions are fairly well balanced
−97	I do not like to waste money
112	Some people might think I am daring, but I like to take chances, throw myself into things, and finally take whatever comes
130	Some people have said, and they may be right, that I am unable to handle money
138	I have seen or heard things that have no logical explanation
141	I am not sure what people think about me, even if they know me very well
163	I feel that my needs are not met
Borderline Personality Disorder	
−91	My emotions are fairly well balanced
93	I express my feelings freely when I am angry
−99	On average, I am calm and even-tempered
116	My mood will easily change in accordance with the environment
117	In social settings I feel tense and inhibited almost all the time
123	Because my emotions change rapidly, it is often difficult for me to keep a steady course
−125	I do not get angry easily
138	I have seen or heard things that have no logical explanation
−143	It is very hard for me to stick to my personal conviction, when other people insist on sticking to theirs
163	I feel that my needs are not met
167	Sometimes I get strange ideas in my head that I cannot get rid of
169	I sometimes feel that nobody wants to have anything to do with me
170	It seems that other people manage to make money last longer than I do, even though they do not have more to spend than I do
Histrionic Personality Disorder	
−91	My emotions are fairly well balanced
−110	I keep both feet on the ground. I stick to what is tangible rather than become lost in reverie
112	Some people might think I am daring, but I like to take chances, throw myself into things, and finally take whatever comes
119	I often get too agitated, even when it comes to trivial matters
120	I would really like to be in show business
145	I am very intense in my emotional life
148	Many people regard me as a lively person
−156	I am quite reserved and withdrawn, except among close friends
159	I do things that I find are OK at the moment, but later I can hardly understand how I possibly could do such things at all
168	I feel as if I watch myself put on an act
Narcissistic Personality Disorder	
−91	My emotions are fairly well balanced
−94	I do not brood over other people's remarks
96	Normally I feel confident and secure, even in new and unfamiliar situations
−110	I keep both feet on the ground. I stick to what is tangible rather than become lost in reverie

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Item number	Item Content
120	I would really like to be in show business
149	Some of the people that know me think that I am rather aggressive
168	I feel as if I watch myself put on an act

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Table 2

Descriptive Statistics

Instrument	Variable	Number of Twins	Mean	Standard deviation
Self Report Questionnaire	Antisocial	7814	2.13	1.57
	Borderline	7814	3.58	2.19
	Histrionic	7814	3.49	1.91
	Narcissism	7814	2.00	1.34
Structured Interview	Antisocial	2731	0.30	0.76
	Borderline	2731	1.00	1.46
	Histrionic	2731	1.04	1.35
	Narcissism	2731	0.88	1.24

Cronbach Coefficient Alpha

Instrument	Variable	Number of Twins	Number of Items	Cronbach Coefficient Alpha (raw)	Cronbach Coefficient alpha (standardized)
Self Report Questionnaire	Antisocial	7814	8	0.46	0.48
	Borderline	7814	13	0.62	0.64
	Histrionic	7814	10	0.54	0.55
	Narcissism	7814	8	0.26	0.30

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Table 3

Model Fitting Results for Antisocial, Borderline, Histrionic, and Narcissistic Personality Disorders

Antisocial

Model	Sex		Latent			self-report			Interview						
#	Qual	Quan	A	C	E	A	C	E	A	C	E	$\Delta\chi^2$	Δdf	p	ΔAIC
I	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—
II	−	+	+	+	+	+	+	+	+	+	+	0.38	1	0.54	−1.62
III	−	−	+	+	+	+	+	+	+	+	+	11.10	10	0.35	−8.90
IV	−	−	+	−	+	+	−	+	+	−	+	11.13	13	0.60	−14.87
V	−	−	−	+	+	−	+	+	−	+	+	64.23	13	0.00	38.23
VI	−	−	−	−	+	+	−	+	+	−	+	79.76	14	0.00	51.76
VII	−	−	+	−	+	−	−	+	+	−	+	28.06	14	0.01	0.06
VIII	−	−	+	−	+	+	−	+	−	−	+	11.63	14	0.64	−16.37*
IX	−	−	+	−	+	−	−	+	−	−	+	28.12	15	0.02	−1.88
X	−	−	−	−	+	+	−	+	−	−	+	85.01	15	0.00	55.01

Notes. Model I fit statistics: $X^2 = 25766.552$, $df = 10514$, AIC = 4738.552.
Model II-X fit statistics are given in differences from Model I.
*Best fit model.

Borderline

Model	Sex		Latent			Self-report			Interview						
#	Qual	Quan	A	C	E	A	C	E	A	C	E	$\Delta\chi^2$	Δdf	p	ΔAIC
I	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—
II	−	+	+	+	+	+	+	+	+	+	+	0.02	1	0.88	−1.98
III	−	−	+	+	+	+	+	+	+	+	+	11.86	10	0.29	−8.14
IV	−	−	+	−	+	+	−	+	+	−	+	11.86	13	0.54	−14.14
V	−	−	−	+	+	−	+	+	−	+	+	67.01	13	0.00	41.01
VI	−	−	−	−	+	+	−	+	+	−	+	124.70	14	0.00	96.70
VII	−	−	+	−	+	−	−	+	+	−	+	31.54	14	0.00	3.54
VIII	−	−	+	−	+	+	−	+	−	−	+	12.09	14	0.60	−15.91*

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Antisocial

Model	Sex		Latent			self-report			Interview						
#	Qual	Quan	A	C	E	A	C	E	A	C	E	$\Delta\chi^2$	Δdf	*p*	ΔAIC
IX	−	−	+	−	+	−	−	+	−	−	+	31.54	15	0.01	1.54
X	−	−	−	−	+	+	−	+	−	−	+	132.85	15	0.00	102.85

Notes. Model I fit statistics: X^2 = 25285.760, *df* = 10516, AIC = 4253.760.
Model II-X fit statistics are given in differences from Model I.
*Best fit model.

Histrionic

Model	Sex		Latent			Self-report			Interview						
#	Qual	Quan	A	C	E	A	C	E	A	C	E	$\Delta\chi^2$	Δdf	*p*	ΔAIC
I	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—
II	−	+	+	+	+	+	+	+	+	+	+	0.72	1	0.39	−1.28
III	−	−	+	+	+	+	+	+	+	+	+	6.02	10	0.81	−13.98
IV	−	−	+	−	+	+	−	+	+	−	+	6.04	13	0.94	−19.96
V	−	−	−	+	+	−	+	+	−	+	+	61.12	13	0.00	35.12
VI	−	−	−	−	+	+	−	+	+	−	+	86.24	14	0.00	58.24
VII	−	−	+	−	+	−	−	+	+	−	+	55.83	14	0.00	27.83
VIII	−	−	+	−	+	+	−	+	−	−	+	6.79	14	0.94	−21.21*
IX	−	−	+	−	+	−	−	+	−	−	+	55.83	15	0.00	25.83
X	−	−	−	−	+	+	−	+	−	−	+	98.06	15	0.00	68.06

Notes. Model I fit statistics: X^2 = 35870.307, *df* = 10506, AIC = 14858.307.
Model II-X fit statistics are given in differences from *Model* I.
*Best fit model

Narcissiam

Model	Sex		Latent			Self-report			Interview						
#	Qual	Quan	A	C	E	A	C	E	A	C	E	$\Delta\chi^2$	Δdf	*p*	ΔAIC
I	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—

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II	−	+	+	+	+	+	+	+	+	+	+	−0.84	1	•	−2.84
III	−	−	+	+	+	+	+	+	+	+	+	15.51	10	0.11	−4.48
IV	−	−	+	−	+	+	−	+	+	−	+	15.50	13	0.28	−10.49
V	−	−	−	+	+	−	+	+	−	+	+	64.91	13	0.00	38.91
VI	−	−	−	−	+	+	−	+	+	−	+	73.87	14	0.00	45.88
VII	−	−	+	−	+	−	−	+	+	−	+	47.43	14	0.00	19.44
VIII	−	−	+	−	+	+	−	+	−	−	+	15.68	14	0.33	−12.32*
IX	−	−	+	−	+	−	−	+	−	−	+	47.43	15	0.00	17.43
X	−	−	−	−	+	+	−	+	−	−	+	83.90	15	0.00	53.91

Notes. Model I fit statistics: X^2 = 29776.563, *df* = 10510, AIC = 8756.563.

Model II-X fit statistics are given in differences from Model I.

*Best fit model.

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Table 4

Genetic and Environmental Effects for the Latent Factor, Common Effects, and Method-Specific Effects for the Questionnaire and the Interview

					Questionnaire				Interview			
	Latent Factor		Common Effects		Method Specific		Total		Method Specific		Total	
Personality Disorder	a^2	e^2	a^2	e^2	a^2	e^2	a^2	e^2	a^2	e^2	a^2	e^2
Antisocial	.69	.31	.31	.14	.15	.40	.46	.54	.00	.55	.31	.69
Borderline	.67	.33	.32	.16	.14	.38	.46	.54	.00	.52	.32	.68
Histrionic	.63	.37	.26	.15	.20	.40	.46	.55	.00	.59	.26	.74
Narcissistic	.71	.29	.23	.09	.18	.49	.41	.58	.00	.67	.23	.76

Notes. a^2: Squared genetic effects = heritability.

e^2: Squared individual-specific environmental effects = % variance resulting from these environmental effects.