**Twin Research and Human Genetics**

**Supplementary Materials**

**Testing Genetic and Environmental Associations Between Personality Disorders and Cocaine Use: A Population-Based Twin Study**

Nathan A. Gillespie, Steven H. Aggen, Amanda E. Gentry, Michael C. Neale, Gun P. Knudsen, Robert F. Krueger, Susan C. South, Nikolai Czajkowski, Ragnar Nesvåg, Eivind Ystrom, Tom H. Rosenström, Fartein A. Torvik, Ted Reichborn-Kjennerud, and Kenneth S. Kendler

Figure S1. Path diagram illustrating a trivariate Cholesky Decomposition to estimate the genetic covariance between the two PD traits and lifetime cocaine use.

****

Note: A1, A2, and A3 denote the unobserved or latent additive genetic risk factors responsible for variation in the observed PD traits and lifetime cocaine use respectively. The model estimates pathway coefficients (a11-a33) while assuming an underlying multivariate normal liability. Latent shared or common (C1-3) and non-shared (E1-3) environmental sources of variance are not shown.

Figure S2. Path diagram illustrating a trivariate Cholesky Decomposition to estimate the genetic covariance between a PD trait and lifetime cocaine use. Cocaine use is contingent upon the response to, “Are you prepared to speak openly about this subject?”



Note: Cocaine use is contingent upon the response to the openness question, modelled via the beta (b32) regression pathway coefficient. A1, A2, and A3 denote the unobserved or latent additive genetic risk factors responsible for variation in the observed PD traits and lifetime cocaine use respectively. This model estimates pathway coefficients (a11-a33) while assuming an underlying multivariate normal liability. Latent shared or common (C1-3) and non-shared (E1-3) environmental sources of variance are not shown.

Table S1. Distributions of ordinal recoded measures of lifetime cocaine use, normative and maladaptive personality domains and the DSM-IV personality disorder criteria counts.

|  |  |
| --- | --- |
|  | Score |
|  | 0 | 1 | 2 |
| Cocaine Use1 | 1362 | 57 | - |
| Paranoid | 1599 | 920 | 274 |
| Schizoid  | 2055 | 669 | 69 |
| Schizotypal | 2037 | 666 | 90 |
| Antisocial | 2069 | 584 | 140 |
| Antisocial (trimmed) | 2128 | 576 | 89 |
| Borderline | 1451 | 946 | 396 |
| Borderline (trimmed) | 1657 | 825 | 311 |
| Histrionic | 1340 | 1038 | 415 |
| Narcissistic  | 1473 | 1017 | 303 |
| Avoidant | 1536 | 884 | 373 |
| Dependent | 1613 | 936 | 244 |
| Obsessive Compulsive | 633 | 1233 | 927 |

Note: 1 Cocaine Use where 0 = never tried, 1 = tried; DSM-IV PDs = DSM-IV Axis-II personality disorders where 0 = 0 criteria, 1 = 1-2 criteria, 2 = 3 or more criteria; trimmed = Borderline trait excluded ‘*Failure to conform to social norms with respect to lawful behavior as indicated by repeatedly performing acts that are grounds for arrest*’, Antisocial trait excluded ‘*Impulsivity in at least two areas that are potentially self-damaging (e.g., spending, sex, substance abuse, reckless driving, binge eating)*’

Table S2. Beta regression coefficients, uncorrected standard errors, and standard errors (SEs) corrected for clustering in the best fitting multiple linear regression.

|  |  |  |  |
| --- | --- | --- | --- |
|  | *β* | Uncorrected SEs | Corrected SEs |
| Sex |  |  |  |
| Age at interview | -0.12 | 1.21 | 1.19 |
| Paranoid | - |  |  |
| Schizoid  | -0.46 | 0.31 | 0.30 |
| Schizotypal | - |  |  |
| Antisocial | 1.47 | 0.24 | 0.27 |
| Borderline | 0.68 | 0.25 | 0.25 |
| Histrionic | - |  |  |
| Narcissistic  | **-** |  |  |
| Avoidant | **-** |  |  |
| Dependent | **-** |  |  |
| Obsessive Compulsive | - |  |  |

Note: Failure to account for non-independence or clustered samples such as twin data, does not affect parameter estimates, but may slightly decrease confidence intervals. Non-independence is rarely problematic when group or cluster sizes are small, and in the case of the twin pairs, the cluster size was at most two.

Table S3. Bivariate model fitting results and comparisons between all significant personality covariates and personality disorder criteria counts dimensions and lifetime cocaine use.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Predictor | Model | Parameters | -2LL | df | AIC |
| Antisocial | ACE | 16 | 4032.50 | 4202 | -4371.50 |
| AE | 13 | 4034.62 | 4205 | -4375.38 |
| CE | 13 | 4042.09 | 4205 | -4367.91 |
| Borderline | ACE | 16 | 5810.75 | 4202 | -2593.25 |
| AE | 13 | 5813.28 | 4205 | -2596.72 |
| CE | 13 | 5815.45 | 4205 | -2594.55 |
| Histrionic | ACE | 16 | 5969.74 | 4202 | -2434.26 |
| AE | 13 | 5971.36 | 4205 | -2438.64 |
| CE | 13 | 5979.71 | 4205 | -2430.29 |
| Antisocial (trimmed) | ACE | 16 | 3773.82 | 4202 | -4630.18 |
| AE | 13 | 3775.81 | 4205 | -4634.19 |
| CE | 13 | 3780.57 | 4205 | -4629.43 |
| Borderline (trimmed) | ACE | 16 | 5454.71 | 4202 | -2949.29 |
| AE | 13 | 5457.02 | 4205 | -2952.98 |
| CE | 13 | 5461.36 | 4205 | -2948.64 |

Note: ACE model = additive genetic (A) + shared environment (C) + unique environmental (E) risks; -2LL = -2 X Log Likelihood; AIC = Akaike Information Criteria; trimmed = Antisocial score excluded ‘*Impulsivity in at least two areas that are potentially self-damaging (e.g., spending, sex, substance abuse, reckless driving, binge eating)*’, Borderline score excluded ‘*Failure to conform to social norms with respect to lawful behavior as indicated by repeatedly performing acts that are grounds for arrest*’. Each ACE bivariate Cholesky decomposition has 16 parameters = 3 A pathway coefficients + 3 C pathway coefficients + 3 E pathway coefficients + 3 thresholds + 4 Age and Sex regression coefficients.