**Supplemental/Online-only Materials.**

**Supplemental Table 1.** Twin-pair correlations (and 95% confidence intervals) for conduct disorder, nicotine dependence, alcohol dependence, and cannabis abuse/dependence, shown separately for all five zygosity groups.

**Supplemental Table 2.** Model fit statistics for twin models examining familial influences on conduct disorder, nicotine dependence, alcohol dependence, and cannabis abuse/dependence

**Supplemental Figure 1.** Full Cholesky (lower triangular) parameterization for familial influences on conduct disorder, nicotine dependence, alcohol dependence, and cannabis abuse/dependence.

**Supplemental Table 1.** Twin-pair correlations (and 95% confidence intervals) for conduct disorder, nicotine dependence, alcohol dependence, and cannabis abuse/dependence, shown separately for all five zygosity groups.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Conduct Disorder | Nicotine Dependence | Alcohol Dependence | Cannabis Abuse/Dependence |
| rMZF | 0.60\* (0.47 – 0.73) | 0.63\* (0.55 – 0.71) | 0.51\* (0.41 – 0.62) | 0.57\* (0.45 – 0.69) |
| rMZM | 0.46\* (0.32 – 0.60) | 0.62\* (0.52 – 0.72) | 0.48\* (0.37 – 0.59) | 0.67\* (0.57 – 0.78) |
| rDZF | 0.47\* (0.30 – 0.64) | 0.40\* (0.29 – 0.51) | 0.22\* (0.06 – 0.37) | 0.45\* (0.28 – 0.62) |
| rDZM | 0.48\* (0.34 – 0.63) | 0.30\* (0.15 – 0.44) | 0.28\* (0.14 – 0.42) | 0.44\* (0.28 – 0.60) |
| rDZO | 0.25\* (0.09 – 0.42) | 0.24\* (0.13 – 0.35) | 0.11 (-0.02 – 0.24) | 0.35\* (0.20 – 0.51) |
| \* significant at  Data from n=9577 individuals; n=9501 individuals for conduct disorder, n=8470 for nicotine dependence, n=8544 for alcohol dependence, and n=6017 for cannabis abuse/dependence. | | | | |

**Supplemental Table 2.** Model fit statistics for twin models examining familial influences on conduct disorder, nicotine dependence, alcohol dependence, and cannabis abuse/dependence

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Model | -2 \* Log-likelihood | # Est. Para. | Compared with Model |  |  |  |
|  |  |  |  |  |  |  |  |
| 1 | Full Cholesky ACE parameterization a |  | 42 | --- | --- | --- | --- |
| 2 | Drop c43 |  | 41 | 1 |  | 1 |  |
| 3 | Drop c33 in addition to c43 |  | 40 | 2 |  | 1 |  |
| 4 | Drop c42 (and c43, c33) b |  | 39 | 3  2 |  | 1  2 |  |
| 5 | Drop c32 (and c42, c33, c43) |  | 38 | 4 |  | 1 |  |
| 6 | Drop c22 (and c32, c42, c33, c43) |  | 37 | 5 |  | 1 |  |
| 7 | Drop c31 (and c22, c32, c42, c33, c43) |  | 36 | 6 |  | 1 |  |
| 8 | Drop c21 (and c31, c22, c32, c42, c33, c43) |  | 35 | 7 |  | 1 |  |
| 9 | Drop c41 (and c21, c31, c22, c32, c42, c33, c43) |  | 34 | 8 |  | 1 |  |
| 10 | Drop a43 (and c41, c21, c31, c22, c32, c42, c33, c43) |  | 33 | 9 |  | 1 |  |
| 11 | Drop a42 (and a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 32 | 10 |  | 1 |  |
| 12 | Drop a32 (and a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 31 | 11 |  | 1 |  |
| **13** | **Drop c44 (and a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) c** |  | **30** | **12** |  | **1** |  |
| 14 | Drop a44 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 15 | Drop a33 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 16 | Drop a22 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 17 | Drop a41 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 18 | Drop a31 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 19 | Drop a21 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 20 | Drop e43 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 21 | Drop e42 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 22 | Drop e32 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 23 | Drop e41 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 24 | Drop e31 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| 25 | Drop e21 (and c44, a32, a33, a43, c41, c21, c31, c22, c32, c42, c33, c43) |  | 29 | 13 |  | 1 |  |
| NOTE: Cohort and gender included as covariates in all models. A=additive genetic influences, C=shared environmental influences, E=non-shared environmental influences. Models with had a significantly poorer fit and were rejected.  a See Supplemental Figure 1 for a diagram depicting the Cholesky parameterization for familial influences (A and C); the full model also included a similar parameterization for individual-specific influences (E).  b model instability, in which fit had “improved” in the preceding model (Model 3) resulted in a significant decrement of fit in Model 4 compared to Model 3 (1-df test), but a non-significant change in fit compared to Model 2. Given the lack of evidence for C on ND, this path was deleted, with C44 retained to account for the C on CAD.  c Final model was ACE for conduct disorder and AE for nicotine dependence, alcohol dependence, and cannabis abuse/dependence. The lower bound of the confidence interval for C44 (based on Model 12) hit 0.00 and confirmed that path C44 was not significant. | | | | | | | |

**Supplemental Figure 1.** Full Cholesky (lower triangular) parameterization for familial influences on conduct disorder, nicotine dependence, alcohol dependence, and cannabis abuse/dependence.

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|  | NOTES: Only one twin shown.  Latent variables are indicated by circles; observed variables by rectangles. A=additive genetic influences, C=shared environmental influences, nonshared environmental influences not shown. The subscript 1 indicates factors related to conduct disorder; 2 is factors related to nicotine dependence; 3 is factors related to alcohol dependence; 4 is factors related to cannabis abuse/dependence. Diagonal lines indicate paths from one measure that load onto other measures. |  |