Online Supplementary Material for “Overlapping Genetic and Environmental Influences Among Men’s Alcohol Consumption and Problems, Romantic Quality, and Social Support”

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**Representativeness Analyses**

Twins from incomplete and complete pairs did not significantly differ in alcohol consumption [*t*(2463) = 1.37, *p* = 0.17], romantic conflict [*t*(1840) = -0.30, *p* = 0.76], romantic warmth [*t*(1840) = 0.52, *p* = 0.60], friend problems [*t*(2547) = -1.09, *p* = 0.28], friend support [*t*(2547) = 1.55, *p* = 0.12], or relative problems [*t*(2564) = -0.31, *p* = 0.76]. Twins from complete pairs did, however, have fewer alcohol problems [*t*(2575) = 2.39, *p* = 0.02, Cohen’s *d* = 0.16] and lower relative support [*t*(2564) = 2.10, p = 0.04, Cohen’s *d* = 0.16] compared to twins from incomplete pairs. The effect sizes for these differences were small.

**Transformation of Skewed Variables**

Preliminary descriptive statistics indicated that the alcohol consumption, alcohol problems, relationship warmth, and relative support variables were skewed (skew > |1|). We transformed them to reduce skew using the following procedures:

We applied a logarithmic transformation to the alcohol consumption variable in view of its positive skew (skew = 5.70). The logarithm of 0 is undefined, and in order to retain individuals who reported no alcohol consumption in the past year in our analyses, we added 1 to each participant’s alcohol consumption product and took the logarithm of this sum [i.e., log(frequency x quantity + 1). The alcohol problems variable was also positively skewed (skew = 1.23) and we applied a similar logarithmic transformation [i.e., log(alcohol problems + 1)].

The relationship warmth and relative support variables were negatively skewed (skew = -1.92 and -1.81, respectively). We rescaled this for each variable separately by first subtracting each participant’s score from the maximum observed value in the sample, creating a new variable whereby low scores indicated high warmth and relative support. We then added 1 to this difference in order to retain individuals who had difference scores of 0, and took the logarithm of this sum. Finally, we multiplied this logarithm by (-1) to retain the original direction of the variable, such that high scores indicated high warmth and relative support [e.g., log(maximum warmth – participant warmth + 1)\*(-1). Following these transformations, the alcohol consumption, alcohol problems, relationship warmth, and relative support variables (along with all other variables used in the twin models) had skew < |1|.

**Evaluating Causal Associations Between Alcohol Consumption and Romantic Conflict, and Between Alcohol Problems and Friend Problems**

We found significant covariation that is attributable to individual-specific sources of unique environmental variation (E) in the alcohol consumption and romantic conflict bivariate model (Table 4, Model 1) and in the alcohol problems and friend problems bivariate model (Table 4, Model 9). This pattern of unique environmental covariation could be consistent with causal relationships among the variables (e.g., high levels of alcohol consumption cause romantic conflict, or vice versa) ([Prescott and Kendler, 1999](#_ENREF_2)). We probed this possibility in supplemental analyses using a “direction of causation” twin model ([Heath et al., 1993](#_ENREF_1)), which uses the pattern of cross-twin cross-trait correlations measured at a single time point to test hypotheses about the direction of causation between two variables. A direction of causation model for romantic conflict and alcohol consumption is shown in Figure S1. In this model, the latent genetic, common environmental, and unique environmental correlations (i.e., rA, rC, and rE) from the bivariate Cholesky model (see Figure S1) are set to zero, and the covariance between romantic conflict and alcohol consumption are modeled as reciprocal direct effects, denoted by b21 and b12. We infer that romantic conflict causes alcohol consumption if the model fit is worsened when the b21 parameter is removed, and that alcohol consumption causes romantic conflict if the model fit is worsened when the b12 parameter is removed.

**Evaluating causal associations between alcohol consumption and romantic conflict.** The results from the reciprocal causation model for alcohol consumption and romantic conflict are summarized in Table S1 (Model 1). The sub-model where the causal pathway from alcohol consumption to romantic conflict (b12) was set to zero fit worse than the reciprocal causation model (Model 1/ drop b12 - χ2 = 7.87, *p* < 0.01), indicating that we cannot rule out the hypothesis that alcohol consumption causes romantic conflict. The sub-model in which the causal pathway from romantic conflict to alcohol consumption (b21) was set to zero did not fit worst than the reciprocal causation model (Model 1/ drop b21 - χ2 = 1.33, *p* > 0.05), suggesting that romantic conflict does not cause alcohol consumption.

**Evaluating causal associations between alcohol problems and friend problems.** The results from the reciprocal causation model for alcohol problems and friend problems are summarized in Table S1 (Model 2). The sub-models where the causal pathways from alcohol problems to friend problems (b12) and friend problems to alcohol problems (b21) were set to zero did not fit worse than the reciprocal causation model (Model 2/ drop b12 - χ2 = 1.52, *p* > 0.05; drop b21 - χ2 = 0.19, *p* > 0.05), suggesting that friend problems do not cause alcohol problems or vice versa. We note that these findings should be interpreted with caution because we used a lifetime alcohol problems measure, and therefore it is possible that some participants’ alcohol problems could have predated (and been resolved) prior to involvement with their current friends.

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| Table S1 |
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| *Model fitting results examining direction of causation models for alcohol consumption and romantic conflict, and alcohol problems and friend problems* |
| Model | Baseline Model (Reciprocal Causation) | Drop b21 | Drop b12 |
|  | -2 LL | AIC |  | -2 LL | AIC | ΔAIC | χ2 |  | -2 LL | AIC | ΔAIC | χ2 |
|  | Alcohol Consumption |
| 1-Romantic Conflict | 10174.09 | 1580.09 |  | 10175.42 | 1579.42 | -0.67 | 1.33 |  | 10181.96 | 1585.96 | 5.87 | 7.87\*\* |
|   | Alcohol Problems |
| 2- Friend Problems | 1099.78 | 867.78 |  | 11099.96 | 865.96 | -1.82 | 0.19 | 11101.3 | 867.3 | -0.48 | 1.52 |
| *Note.* \*\* denotes *p* < 0.01. Abbreviations: -2LL, -2 log likelihood model fit; AIC, Akaike Information Criterion; ΔAIC, change in AIC (AICreduced model – AICbaseline model); *χ***2**,chi-square test statistic (1 degree of freedom) evaluating the loss in -2LL model fit (i.e., -2LLreduced model – -2LLbaseline model) as a result of dropping the respective parameter.  |

*Figure S1.* Illustrative twin model depicting the direction of causation model for romantic conflict (RC) and alcohol consumption (AC). A, additive genetic factors; C, common environmental factors; E, unique environmental factors; T1, twin one; T2, twin two. We infer that romantic conflict causes alcohol consumption if the model fit is worsened when the b21 parameter is removed, and that alcohol consumption causes romantic conflict if the model fit is worsened when the b12 parameter is removed. Mean values were estimated but are not shown.

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References

**Heath, A. C., Kessler, R. C., Neale, M. C., Hewitt, J. K., Eaves, L. J. & Kendler, K. S.** (1993). Testing hypotheses about direction of causation using cross-sectional family data. *Behavior Genetics* 23**,** 29-50.

**Prescott, C. A. & Kendler, K. S.** (1999). Age at first drink and risk for alcoholism: A noncausal association. *Alcoholism-Clinical and Experimental Research* 23**,** 101-107.