ASHES, Vol. 1(6) – Sibling rivalry: Genetic and environmental influences on sibling smoking behaviors

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According to a common saying, the apple doesn't fall far from the tree. With respect to smoking, it might be that the ash doesn't fall far from the cigarette. As with many addictive behaviors, smoking initiation and persistence are more likely among people whose parents or siblings also smoke (though the extent of that relationship is still debated –see Avenevoli & Merikangas, 2003, for a review). Studies have shown that genes contribute to this commonality – risk factors for smoking are to some extent inherited (Li, Cheng, Ma, & Swan, 2003; Maes et al., 2004). However, recent research has found that siblings influence deviant behavior in each other to a greater extent than predicted by genetic models, and in some cases to a greater extent than parents do (Avenevoli & Merikangas, 2003). This week, ASHES reviews a study by Slomkowski and her colleagues that uses a "genetically informed design" (p. 430) to examine the influence of siblings on smoking frequency (Slomkowski, Rende, Novak, Lloyd-Richardson, & Niaura, 2005).

Slomkowski et al. included data from 2,842 siblings (1,421 pairs) participating in the National Longitudinal Study of Adolescent Health (ref), a nationally representative study of more than 20,000 middle school and high school adolescents that began in 1995. Based on participant and parent report, this subsample included 141 monozygotic twin pairs (100% genetic relatedness), 262 dizygotic twin pairs and 672 full sibling pairs (50% genetic relatedness), 165 half-sibling pairs (25% genetic relatedness), and 181 unrelated sibling pairs (0% genetic relatedness). The study measures included: (a) social connectedness — a reliable three item measure of affection, time spent together, and mutual friends between siblings; and (b) self-reported smoking frequency assessed at two time points one year apart (wave 1 and wave 2). For some analyses, the researchers split social connectedness into "high" and "low" levels by grouping scores above ("high") and below ("low") the sample median.

Slomkowski et al. used a version of the DeFries-Fulker regression model (DeFries & Fulker, 1985), predicting one sibling's smoking from the other sibling's smoking, the siblings' relatedness, sibling social connectedness, and the interactions between these variables. This model provides estimates of genetic and environmental influences, as well as the moderating effects of sibling social connectedness on these influences.

The researchers found that the correlational patterns of smoking by sibling relatedness (e.g., MZ twins, DZ twins) differed by the social connectedness of sibling pairs. As Figure 1 shows, for siblings who displayed low levels of high social connectedness, correlations between sibling smoking frequencies varied somewhat according to level of relatedness, indicating some genetic influence. However, these correlations were lower than in socially connected siblings, indicating the influence of connectedness on sibling smoking patterns. In socially connected siblings, the correlations also did not vary as much by genetic relatedness. As can be seen in Figure 1, for socially connected siblings, the correlation between sibling smoking behaviors was similar for full siblings and unrelated siblings.

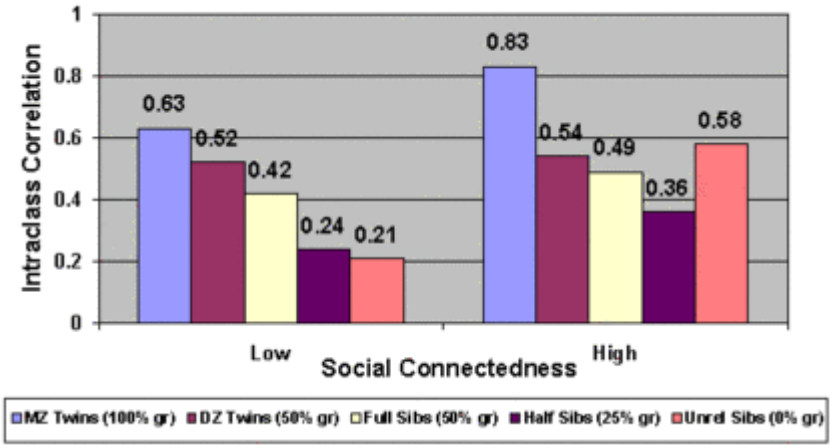

Figure. Intraclass correlations between sibling smoking frequencies at Wave 2 as a function of genetic relatedness and social connectedness (adapted from Slomkowski et al., 2005). Click image to enlarge.

Note: Patterns of correlations were identical for Wave 1 and Wave 2 smoking frequencies. Wave 2 data are plotted because more participants had initiated smoking behavior by that time point (50% vs. 43%). The smoking frequency variable was transformed to approximate a normal distribution. gr = genetic relatedness.

When they applied the regression model (run separately for low and high socially

connected siblings), Slomkowski et al. found that, at both waves of data, siblings who were highly socially connected demonstrated both genetic and shared environmental effects on their smoking behavior, whereas those who were low on social connectedness exhibited only genetic effects. This pattern of effects, which held in models that controlled for parental and peer smoking behavior and models that included social connectedness as an interaction term, demonstrates a moderating effect of social connectedness on the shared environmental factors influencing the relationship between sibling smoking behaviors. In other words, though there is some hereditary influence on smoking behaviors, siblings also exert significant influence on each other's smoking behaviors related to the amount of social contact they have with each other.

This study did not report mean levels of social connectedness by sibling type and did not measure the construct at multiple time points. It is possible that connectedness varies by sibling type, in which case it would be a proxy for genetic relatedness, complicating the gene-environment model proposed. It is also possible that social connectedness follows from rather than leads to deviant behaviors. If siblings begin smoking together, that shared behavior might lead to shared peer groups and more time spent together. It would be interesting to see how social connectedness and smoking behaviors influence each other across time in siblings.

Slomkowski et al.'s results demonstrate the importance of considering sibling contexts in the study and prevention of substance use initiation. Though much work has been devoted to parental and peer influences, sibling influences are often overlooked. As this study shows, sibling relationships have unique effects on substance using behaviors in adolescence that ought to be investigated concurrent with parental and peer influences.

–Sarah Nelson.

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