

## **Title: Modeling the Diffusion of Prevention in School Contexts: Methods for Strengthening Causal Inference**

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### **Background/Context:**

Using techniques from social network analysis, prevention researchers have recently begun to conceptualize how to study the diffusion of effects of prevention programs from participants to nonparticipants (Rulison, Gest, & Osgood, 2015). This approach suggests that prevention programs offered in schools do not have to reach everyone in a community in order to effect change at a population level.

Family-based prevention programs are often offered in a school context, but the effects are usually assumed to be limited to those who participated. Family-based programs target risk factors at both the family and individual level, which can work together to change how adolescents approach their peer relationships (Liddle, 2004). When these programs are offered in schools, participants and nonparticipants coexist in the same social networks, which suggests that there is the potential for diffusion of knowledge in skills from those who attended the programs to those who did not (Rulison et al., 2015). Understanding whether this happens is important for schools who are considering what kinds of prevention programs should be offered to their students.

However, there has been little research on the potential diffusion of prevention programs beyond their direct recipients. Part of the difficulty in studying these effects is the lack of access researchers have to the social networks of the people targeted in their studies. By using data from the PROSPER project, a longitudinal study in which an evidence-based family intervention was delivered with fidelity under real world conditions, we have the opportunity to test the diffusion of effects through adolescent social networks.

### **Research Question:**

The purpose of this study was to assess whether the effects of a family-based prevention program can spread beyond the people directly receiving the program and if those effects are sustained across time. We focused on initiation of cigarette use due to its peer-driven nature and the links tobacco use has with later illicit drug use (Dierker, Braymiller, Rose, Goodwin, & Selya, 2018).

### **Setting and Participants:**

The participants in this study (N = 5,083, 50% male, 34% free/reduced lunch) were middle school students in thirteen treatment communities of the PROSPER (Promoting School-community-university Partnerships to Enhance Resilience) project, a community-randomized

trial of an intervention delivery system in two rural Midwestern states (Spoth, Greenberg, Bierman, & Redmond, 2004). The sample was representative of the communities it was drawn from (85% White, 5% Latino/Hispanic, 3% African-American, 2% Native American, 1% Asian, and 4% Other).

### **Intervention:**

Each community chose both a family-based (offered in 6<sup>th</sup> grade) and school-based (offered in 7<sup>th</sup> grade) substance use prevention program to offer to the participants. The school-based interventions were Life Skills Training, Project ALERT, and All Stars. All communities used the Strengthening Families Program 10-14 (SFP 10-14) as the family-based program. All students received the school program chosen by their community during school hours, and 17% of eligible families (N = 803) attended at least one session of the family-based program (Spoth, Clair, Greenberg, Redmond, & Shin, 2007).

### **Research Design:**

Propensity models have been used extensively to deal with issues of confounding and selection in observational data where randomization was not possible (Rosenbaum & Rubin, 1983). Using the potential outcomes framework, we employed a propensity modeling approach to account for any potential confounding effects that could affect both peer selection (which is not randomizable) and adolescent cigarette use (Austin, 2011). We used a propensity model to estimate the probability of an adolescent having friends who received SFP 10-14 and used that to weight the outcome model.

### **Data Collection and Analysis:**

Students completed a survey at the start of sixth grade, before the family program was offered. A follow-up survey was given end of high school. Students nominated up to seven friends in a survey of peer relationships, which were matched against the list of students who received SFP 10-14. The total number of friends was calculated by counting the number of friends who received SFP 10-14 for each student at the start of sixth grade. All confounders were measured at the start of sixth grade, and the outcome (smoking initiation) was measured at the end of twelfth grade.

### **Results:**

The mean number of friends who received SFP 10-14 was 0.66 ( $SD = 0.92$ , range 0-6). 44% of the sample had at least one friend who received SFP 10-14. 63% of the sample had ever smoked a cigarette by the end of high school. The number of friends an individual had who received SFP 10-14 in early middle school was significantly and negatively associated with the odds of an adolescent ever having smoked by the end of high school (OR = .90, 95% CI: 0.84, 0.97). Each additional friend who received SFP 10-14 represented a 2.45% decrease in the absolute likelihood of smoking by the end of high school.

### **Conclusions:**

While only 17% of students in this sample attended SFP 10-14 (comparable to recruitment rates for family programs in other studies), nearly half of the sample had at least one friend in sixth grade who attended SFP 10-14. These findings indicate that diffusion of family programs is likely greater than simply those who directly received the program.

These findings also suggest that family-based prevention programs are a promising option for schools to offer to their students and families. Even though all students in this sample received a school-based substance use prevention program in middle school, the rate of lifetime smoking at the end of high school was higher than the national average (63% vs. 46% nationwide in 2013; Arrazola et al., 2014). SFP 10-14, delivered with the school program, resulted in significantly lower rates of cigarette use for those who had more exposure to it through their friends. However, implementation of these programs should be done thoughtfully, taking into consideration how peer networks change throughout adolescence. In order to leverage the diffusion effects of family-based programs, these programs should be offered strategically based on existing social networks in schools.

## References

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