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## Peer influence processes as mediators of effects of a middle school substance use prevention program

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### HIGHLIGHTS

- We evaluated whether cooperative learning can reduce deviant peer influence.
- We conducted a cluster randomized trial using 15 middle schools and 1460 students.
- Students in intervention schools report reductions in alcohol and tobacco use.
- These outcomes are mediated by reductions in alcohol and tobacco use among friends.

### ARTICLE INFO

#### Keywords:

Alcohol  
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### ABSTRACT

**Background:** Peer influence processes have been linked to escalation in substance use during the middle school years, particularly among at-risk youth. In this study, we report on an approach to prevention that attempts to counteract peer influence by interrupting the process of *deviant peer clustering*, in which socially marginalized youth self-aggregate and reinforce delinquent behavior, including substance use. We aimed to interrupt this process by implementing collaborative, group-based learning activities in school (i.e., cooperative learning).

**Methods:** In a cluster randomized trial in the Pacific Northwest ( $N = 1460$  7th-grade students in 15 schools), we tested whether cooperative learning can reduce alcohol and tobacco use, and whether these effects are mediated by reductions in the amount of alcohol and tobacco use among one's friends. Intervention schools were provided with training in cooperative learning, and data were collected in September/October 2016 (baseline) and March 2017 (follow-up).

**Results:** Results indicated that cooperative learning significantly lowered rates of growth in alcohol ( $\beta = -0.60$  [ $-0.36$  |  $-0.84$ ];  $p < .001$ ) and tobacco use ( $\beta = -0.58$  [ $-0.21$  |  $-0.94$ ];  $p = .01$ ) between baseline and follow-up in intervention schools as compared to control schools. These effects were mediated by reductions in the prevalence of alcohol and tobacco use, respectively, among self-selected friends.

**Conclusions:** Cooperative learning was able to significantly reduce the prevalence of both alcohol and tobacco use in friendship networks during the school year. The lower prevalence of alcohol and tobacco use among friends, in turn, reduced individual use at follow-up.

This study was registered as trial NCT03119415 in [ClinicalTrials.gov](https://clinicaltrials.gov).

### 1. Introduction

Adolescence is a developmental period during which many youth begin to experiment with alcohol and tobacco (Johnston, O'Malley, Bachman, & Schulenberg, 2010). Those who initiate use in early adolescence can be at elevated risk for substance abuse and dependence later in adolescence or adulthood (Grant, Stinson, & Harford, 2001; Hingson & Zha, 2009; Pitkänen, Lyyra, & Pulkkinen, 2005; Van Ryzin & Dishion, 2014). Specifically, initiation of alcohol use before age 14 or

15 (i.e., the middle school years) has been linked to elevated risk for later alcohol abuse and dependence (Dawson, Goldstein, Chou, Ruan, & Grant, 2008; Hingson, Heeren, & Winter, 2006), and similar results have been found for tobacco (Behrendt, Wittchen, Höfler, Lieb, & Beesdo, 2009; Vega & Gil, 2005). Abuse and dependence, in turn, are linked to a variety of maladaptive outcomes, including academic failure and dropout, high-risk sexual behavior, greater likelihood of psychiatric disorders, and involvement in violent crime (Ary et al., 1999; Barrera, Biglan, Ary, & Li, 2001; Lennings, Copeland, & Howard, 2003; Soyka,

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2000; Tapert, Aarons, Sedlar, & Brown, 2001).

Research finds that peer influence is one of the most important predictors of alcohol and tobacco use in adolescence (Dishion & Patterson, 2006; Fergusson, Swain-Campbell, & Horwood, 2002; Van Ryzin, Fosco, & Dishion, 2012). As a result, school-based substance use prevention programs have attempted to alter peer influence processes in order to engender greater behavioral health (Gifford-Smith, Dodge, Dishion, & McCord, 2005). One strategy that has received attention recently is the use of “peer leaders” as agents of positive behavioral change, although results of such programs have been mixed (e.g., Tobler et al., 2000; Valente et al., 2007), and it can be difficult to identify, recruit, and retain peer leaders (Valente & Pumpuang, 2007).

In this study, we report on a different approach to prevention that attempts to counteract peer influence in favor of substance use by interrupting the process of *deviant peer clustering*, in which socially marginalized youth self-aggregate and reinforce delinquent behavior through modeling, facilitation, and expressions of support (Dishion, Patterson, Stoolmiller, & Skinner, 1991; Patterson, DeBaryshe, & Ramsey, 1989). Specifically, we aimed to reduce substance use by exposing at-risk youth to a broader cross-section of the school social network through collaborative, peer-based learning activities in school. By creating positive social interactions among youth with different levels of risk and belonging to different social groups, we hypothesized that peer learning activities could slow or halt the self-aggregation process among marginalized youth and reduce the prevalence of negative, antisocial peer influences, which in turn would reduce social reinforcement for delinquent behavior, including substance use.

In order for peer learning activities to promote genuine social integration, however, they must establish a social context that reduces biases and prejudices among students who belong to different social groups (Pettigrew, 1998; Pettigrew & Tropp, 2008). A key ingredient of such a social context is “positive interdependence”, i.e., when goals are structured such that individuals can attain their goals if (and only if) others in their group also reach their goals (Deutsch, 1949, 1962). Under positive interdependence, patterns of peer interaction change. Instead of competing with or ignoring one another, peers are more likely to promote the success of one another through mutual assistance, support, and sharing of resources; these positive social interactions, in turn, increase interpersonal acceptance and reduce social marginalization (Johnson, Johnson, Roseth, & Shin, 2014; Mikami, Boucher, & Humphreys, 2005; Roseth, Johnson, & Johnson, 2008).

*Cooperative learning* is one of the few empirically supported instructional approaches that establishes positive interdependence. Cooperative learning is an umbrella term that includes reciprocal teaching, peer tutoring, and other group-based activities in which peers work together to maximize one another's learning (Johnson, Johnson, & Holubec, 2013). By structuring positive interdependence between students, cooperative learning contrasts with competitive and individualistic learning activities in which students compete against each other or work by themselves. When compared to these competitive and individualistic approaches to instruction, cooperative learning has been found to have robust positive effects on interpersonal attraction, social acceptance, and academic achievement (Ginsburg-Block, Rohrbeck, & Fantuzzo, 2006; Johnson & Johnson, 1989, 2005). In a recent meta-analysis, Roseth et al. (2008) demonstrated that cooperative learning associated with greater academic achievement ( $ES = 0.46$  to  $0.65$ ) and more positive peer relationships ( $ES = 0.42$  to  $0.56$ ) as compared to competitive or individualistic instructional approaches. These peer relationship outcomes are hypothesized to grow out of the positive social interactions that occur during cooperative learning activities, supporting our premise that these activities could also have salutary effects on socially marginalized or at-risk youth and, potentially, interrupt the process of deviant peer clustering.

To ensure that at-risk youth have the opportunity to work with (and develop positive relationships with) a variety of lower-risk youth, cooperative learning specifies that students be grouped using random

assignment, potentially with the assistance of specialized software (e.g., GRumbler; <https://sites.hks.harvard.edu/fs/msparrow/GRumbler-main.html>). This stands in contrast to prevention programs centered on peer leaders, where network-based assignment to groups has been found to be most effective (Valente, Hoffman, Ritt-Olson, Lichtman, & Johnson, 2003).

In previous research, cooperative learning has been found to reduce alcohol use among middle school students (Van Ryzin & Roseth, 2017). In this study, we evaluated whether changes in peer influence can mediate this effect. Specifically, we evaluated whether changes in the amount of alcohol use among self-reported friends can serve as a mediator. We also evaluated similar effects and pathways for tobacco use. We hypothesized that cooperative learning would reduce both types of substance use, and that the effects would be mediated by reduced use among friends.

## 2. Method

All aspects of this study were approved by the Institutional Review Board (IRB) at the Oregon Research Institute. This study was registered as trial NCT03119415 in [ClinicalTrials.gov](https://clinicaltrials.gov) under Section 801 of the Food and Drug Administration Amendments Act.

### 2.1. Sample

The sample was derived from a small-scale randomized trial of cooperative learning in 15 rural middle schools in the Pacific Northwest. Schools were matched based upon demographics (i.e., size, free/reduced lunch percentage) and randomized to condition (i.e., intervention vs. waitlist control). We were concerned about the likelihood of losing schools assigned as controls, so we randomized an extra school to this condition (i.e., 8 waitlist control vs. 7 intervention schools).

Our analytic sample included  $N = 1460$  7th grade students who enrolled in the project in the fall of 2016 (see Fig. 1). We achieved > 80% student participation at each school. Student demographics by school are reported in Table 1. Overall, the sample was 48.2% female ( $N = 703$ ) and 76.4% White ( $N = 1116$ ). Other racial/ethnic groups included Hispanic/Latino (14.3%,  $N = 209$ ), multi-racial (4.2%,  $N = 61$ ), and American Indian/Alaska Native (3.5%,  $N = 51$ ); our sample included < 1% Asian, African-American, and Native Hawaiian/Pacific Islander. Overall, 13.9% ( $N = 203$ ) were reported as having Special Ed status, 79.6% ( $N = 1162$ ) did not have Special Ed status, and 6.5% ( $N = 95$ ) were missing this designation. Free and reduced price lunch (FRPL) status was not made available by the schools, although school-level FRPL figures (obtained from state records) are reported in Table 1.

### 2.2. Procedure

We used D. W. and R. T. Johnsons' approach to cooperative learning (Johnson et al., 2013). Training for intervention school staff began in the fall of 2016 and continued throughout the 2016–2017 school year, consisting of 3 half-day in-person sessions, periodic check-ins via videoconference, and access to resources (e.g., newsletters). A copy of *Cooperation in the Classroom, 9th Edition* by Johnson et al. (2013) was provided to each staff member attending the training. The three in-person training sessions per school were conducted by the Johnsons and supported by the authors in (1) late September and early October, (2) late October through early December, and (3) late January through late March. Due to the geographic dispersal of the schools, each school received training individually according to their own schedule for professional development.

Under the Johnsons' approach, cooperative learning includes reciprocal teaching, peer tutoring, jigsaw, collaborative reading, and other methods in which peers help each other learn in small groups under conditions of positive interdependence. Teachers create positive interdependence in a variety of ways. For example, teachers may

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