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Peer Influence Processes as Mediators of Effects of a Middle School Substance Use Prevention Program

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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 = 1,460 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 best 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 (β = −.60 [−.36 | −.84]; p < .001) and tobacco use (β = −.58 [−.21 | −.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.

Keywords

alcohol; tobacco; early adolescence; prevention; peer influence

1. Introduction

Adolescence is a developmental period during which many youth begin to experiment with alcohol and tobacco (Johnston et al., 2010). Those who initiate use in early adolescence can

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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 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 et al., 2001; Lennings et al., 2003; Soyka, 2000; Tapert et al., 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 et al., 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; Roseth, Johnson & Johnson, 2008; Mikami et al., 2005).

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 et al., 2006; Johnson & Johnson, 1989, 2005). In a recent meta-analysis, Roseth et al. (2008) demonstrated that cooperative learning associated with greater academic achievement (ES = .46 to .65) and more positive peer relationships (ES = .42 to .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 et al., 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 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 $N = 1{,}460$ 7th grade students who enrolled in the project in the fall of 2016 (see Figure 1). We achieved greater than 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 ($N = 1{,}116$). 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 less than 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, Johnson, and Holubec (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 Johnson's 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 require a single deliverable for a group (goal interdependence) and may offer a reward to the group if everyone achieves above a certain threshold on an end-of-unit quiz or test (reward interdependence). The lesson plan may require that each member of the group be issued different materials that they must share in order to complete the lesson (resource interdependence), each member of the team may have a different role to play (e.g., reader, note-taker), or students may take turns performing an activity (role interdependence). The group may have their own name (identity interdependence), and each group member may have a unique task that must be completed sequentially, like an assembly line, in order for the lesson to be completed successfully (task interdependence). These varied forms of positive interdependence can be layered upon one another in a single lesson, increasing the incentive for students to collaborate.

The Johnsons' approach also emphasizes individual accountability (to ensure that each student contributes to the outcome), explicit coaching in collaborative skills (to support a smoothly functioning group), a high degree of face-to-face interaction (ensuring the group can collaborate), and guided processing of group performance (to ensure that students

improve their group skills over time). Rather than being a manualized approach, cooperative learning is viewed as a conceptual framework within which teachers can apply the principle of positive interdependence to design their own group-based activities. There is no specific curriculum offered; cooperative learning can be adapted to existing curricula in any subject to the degree that suits the individual teacher.

2.3 Measures

Student data collection was conducted in September/October 2016 (baseline) and March 2017 (follow-up) using on-line surveys (Qualtrics). The time between data collection points varied across schools but averaged five and a half months. To assess fidelity of implementation, we also conducted teacher observations. A Certificate of Confidentiality was obtained for these data from NIAAA (#CC-AA-17–011).

2.3.1. Alcohol and tobacco use.—Students reported on their use of alcohol and tobacco in the last month using the following scale: *No use* = 1, *Occasionally (1–3 times)* = 2, *Fairly often (4–6 times)* = 3, *Regularly (7–9 times)* = 4, and *All the time (10+ times)* = 5. At baseline, 93.4% of students (N = 1,392) reported no alcohol use, but at follow-up that had declined to 82.8% (N = 1,234). Similarly, 96.5% (N = 1,409) of students reported no tobacco use at baseline, but by follow-up that had declined to 87.0% (N = 1,270).

2.3.2. Alcohol and tobacco use among friends.—Students reported on their friendship networks by selecting the names of up to 6 “close friends” from a list of all eligible students in their grade. From this, we calculated the average of the self-reported alcohol and tobacco use (separately) for each student’s friendship network. Higher numbers indicate more alcohol and tobacco use among friends, respectively, representing a stronger degree of social influence in favor of use.

2.3.3. Observed intervention fidelity.—Research staff blind to intervention assignment observed teaching practices in intervention and control schools. We trained our observers to adequate reliability using simulated data before they were permitted to conduct observations in actual classrooms, and we used an established observation protocol for key aspects of cooperative learning (e.g., positive interdependence; Veenman et al., 2002). Observations were conducted once in the late fall/early winter and again in the spring. Observers remained in a classroom for an entire class period. In smaller schools, observers were generally able to observe all 7th grade teachers within a single day; for large schools, observers randomly selected a subset of all 7th grade teachers.

2.4. Analysis Plan

The multilevel nature of our data (i.e., students within schools) required an analytical approach that addressed statistical dependencies created by nesting. Thus, we evaluated our hypotheses with nested random coefficients analysis, which allocates variance either “within” or “between” groups, accounting for dependencies (Fitzmaurice et al., 2004). In this model, student data (i.e., alcohol and tobacco use, peer influences) were at Level 1 (“within”) and school data (i.e., intervention condition) were at Level 2 (“between”). All predictors were uncentered.

A test of mediation traditionally includes an initial direct-effects model that tests the path between the predictor and outcome, followed by a mediation model in which the following paths are tested: (a) the predictor to the presumed mediator, (b) the mediator to the distal outcome, and (c) the combined indirect effect between the predictor and the outcome via the mediator, while controlling for the direct effect (commonly referred to as c'; Judd, Kenny, & McClelland, 2001; MacKinnon & Dwyer, 1993). Thus, we initially tested a direct-effects model that included both alcohol and tobacco use; following this, we fit a model for each outcome that simultaneously tested the effects of the intervention on the mediator, the mediator on the outcome, and the indirect effect (i.e., the "full" model). This model is represented in Figure 2; since we were testing change over time in both our mediator and outcome, baseline levels were controlled in each case. Given the complexity of these models and our relatively small sample (i.e., only 15 schools at Level 2), the "full" model was fit separately for alcohol and tobacco use.

All modeling was conducted using Mplus 7.1 (Muthén & Muthén, 2012). Since our outcome variables demonstrated a degree of skew, all models were fit using Robust Maximum Likelihood (RML), which provides so-called "sandwich" or Huber-White standard errors. RML can provide unbiased estimates in the presence of missing and/or non-normal data. Standard measures of fit are reported, including the chi-square value (χ^2), comparative fit index (CFI), non-normed or Tucker-Lewis index (TLI), and root-mean squared error of approximation (RMSEA). CFI/TLI values greater than .95, RMSEA values less than .05, and a non-significant χ^2 (or a ratio of χ^2/df < 3.0) indicate good fit (Bentler, 1990; Bentler & Bonett, 1980; Hu & Bentler, 1999).

3. Results

Descriptive data for all variables and correlations are presented in Table 2. To assess intervention fidelity, we conducted an ANOVA analysis, which indicated significantly higher levels of observed positive interdependence during learning activities in intervention schools as compared to control schools, $F(1,98) = 10.79$, $p < .01$, $R^2 = .10$.

To establish mediation, we first evaluated direct effects of cooperative learning on alcohol and tobacco use at follow-up, controlling for baseline measures. Model fit was good, CFI = .99, TLI = .99, RMSEA = .02, $\chi^2(1) = 1.39$, *ns*. Results indicated that cooperative learning significantly lowered rates of growth in alcohol ($\beta = -.60$ [−.36 | −.84]; $p < .001$) and tobacco use ($\beta = -.58$ [−.21 | −.94]; $p = .01$) between baseline (fall) and follow-up (spring) in intervention schools as compared to control schools.

We next fit the full model for alcohol use, and results are presented in Table 3, including 95% confidence intervals. Model fit was good, CFI = .99, TLI = .98, RMSEA = .02, $\chi^2(4) = 6.35$, *ns*. Results indicated that (a) cooperative learning resulted in significantly lower rates of alcohol use in friendship networks at follow-up, (b) alcohol use in friendship networks significantly predicted change in individual alcohol use during the school year, and (c) the indirect effect of cooperative learning on change in alcohol use via change in friend use was significant ($\beta = -.48$ [−.80 | −.16]; $p = .003$). Since the direct effect of cooperative learning

alcohol use at follow-up was no longer significant in the full model, we can consider the direct effect to be fully mediated.

Finally, we fit the full model for tobacco use, and results are presented in Table 4, including 95% confidence intervals. Model fit was good, CFI = .97, TLI = .94, RMSEA = .03, $\chi^2(4) = 8.29$, *ns*. Results indicated that (a) cooperative learning resulted in significantly lower rates of tobacco use in friendship networks at follow-up, (b) tobacco use in friendship networks significantly predicted change in individual alcohol use during the school year, and (c) the indirect effect of cooperative learning change in tobacco use via change in friend use was significant ($\beta = -.46$ [−.91 | −.01]; $p = .044$). As with alcohol use, the direct effect of cooperative learning on tobacco use at follow-up was no longer significant in the full model, so we can consider the direct effect to be fully mediated.

4. Discussion

In this study, we found that cooperative learning was able to significantly reduce the prevalence of both alcohol and tobacco use among self-reported friends during the school year. The lower prevalence of alcohol and tobacco use, in turn, predicted lower levels of individual use at follow-up. When evaluating the model pathways, the effects of alcohol and tobacco use among friends were particularly strong predictors of individual use, which echoes previous research finding that “close” friends (as measured in this study) are a powerful predictor of individual use, even more powerful than the larger peer group (Urberg, Değirmencioğlu, & Pilgrim, 1997).

These findings suggest that the group-based learning activities that are implemented as a part of cooperative learning were reducing social influence in favor of tobacco and alcohol use. Although we might presume that these results are due to *selection effects* (i.e., youth altering their friendship networks as increased social opportunities arose as a result of the implementation of group-based learning activities), it is possible (or even likely) that *socialization effects* may also have played a role. For example, the increase in positive peer relations that have been found to arise from cooperative learning (Van Ryzin & Roseth, in press) could have resulted in a more positive school climate and, in turn, less peer support for substance use (Henry et al., 2009). Future research using social network analysis (i.e., RSiena; Ripley et al., 2012) could help to disentangle selection and socialization effects.

This study is limited in several ways. First, it is based upon a relatively homogeneous sample of rural students that was about three-quarters White, which limits the external validity or generalizability of the results. Future research should include more diverse urban populations. Second, all measures were self-report, which limits internal validity. Future research should consider additional data sources, such as teachers and/or parents. Third, the small number of schools in our sample (i.e., 15) and the small number of time points (i.e., 2) restricted the complexity of the models that we were able to fit to the data. Peer processes are exceedingly complex, and, as suggested above, modeling a process as complex as deviant peer clustering will require social network analysis, which ideally would have more than two waves of data. Thus, the findings reported in the paper are not able to completely support the hypothesized causal mechanism (i.e., collaborative learning activities

interrupting the process of deviant peer clustering); however, they do provide strongly suggestive findings that can be extended in future research.

5. Conclusion

Our findings indicate that cooperative learning reduced the degree of social influence in favor of alcohol and tobacco use during the school year. As a result, youth demonstrated lower levels of growth in individual alcohol and tobacco use during the school year in intervention schools as compared to control schools. Our findings emphasize both (a) the power of peer influence on alcohol and tobacco use; and (b) the potential of cooperative learning as a mechanism to alter these influence processes in a salutary manner.

From a policy perspective, cooperative learning has demonstrated its ability to enhance academic achievement in previous research (Roseth et al., 2008), and it possesses many other strengths that differentiate it from existing approaches to substance use prevention, such as curriculum-based approaches that focus on changing attitudes, normative beliefs, and/or resistance skills related to substance use (Tobler et al., 2000; Wilson et al., 2001). For example, the implementation of cooperative learning can augment teacher skillsets and provide new opportunities for improving instruction. Cooperative learning also possesses a significant degree of sustainability; once implemented, these techniques can be shared among staff members, and new teachers can be taught by existing staff. Finally, the social processes targeted by cooperative learning (i.e., social marginalization and rejection) have been implicated in the development of a wide variety of behavioral and emotional problems, suggesting that cooperative learning could have wide-ranging positive effects on student behavior and emotional health; indeed, cooperative learning has recently been found to reduce bullying, victimization, stress, and emotional problems (Van Ryzin & Roseth, in press). Thus, our hope is that the results reported here contribute to a re-kindling of interest in cooperative learning as a permanent, sustainable component of teacher training and educational practice.

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References

Ary DV, Duncan TE, Biglan A, Metzler CW, Noell JW, & Smolkowski K (1999). Development of adolescent problem behavior. Journal of Abnormal Child Psychology, 27, 141–150. [PubMed: 10400060]

Barrera M, Biglan A, Ary D, & Li F (2001). Replication of a problem behavior model with American Indian, Hispanic, and Caucasian youth. Journal of Early Adolescence, 21, 133–157.

Behrendt S, Wittchen HU, Höfler M, Lieb R, & Beesdo K (2009). Transitions from first substance use to substance use disorders in adolescence: Is early onset associated with a rapid escalation? Drug and Alcohol Dependence, 99, 68–78. [PubMed: 18768267]

Bentler PM (1990). Comparative fit indexes in structural models. Psychological Bulletin, 107, 238–246. [PubMed: 2320703]

Bentler PM, & Bonett DG (1980). Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin, 88, 588–606.

Dawson DA, Goldstein RB, Chou SP, Ruan WJ, & Grant BF (2008). Age at first drink and the first incidence of adult-onset DSM-IV alcohol use disorders. Alcoholism: Clinical and Experimental Research, 32, 2149–2160.

Deutsch M (1949). A theory of cooperation and competition. Human Relations, 2, 129–151.

Deutsch M (1962). Cooperation and trust: Some theoretical notes In Jones M (Ed.), Nebraska symposium on motivation (pp. 275–319). Lincoln, NE: University of Nebraska Press.

Dishion TJ, & Patterson GR (2006). The development and ecology of antisocial behavior in children and adolescents In Cicchetti D & Cohen DJ (Eds.), Developmental psychopathology: Vol. 3. Risk, disorder, and adaptation (pp. 503–541). New York: Wiley.

Dishion TJ, Patterson GR, Stoolmiller M, & Skinner ML (1991). Family, school, and behavioral antecedents to early adolescent involvement with antisocial peers. Developmental Psychology, 27, 172–180.

Fergusson DM, Swain-Campbell NR, & Horwood LJ (2002). Deviant peer affiliations, crime and substance use: A fixed effects regression analysis. Journal of Abnormal Child Psychology, 30, 419–430. [PubMed: 12108769]

Fitzmaurice GM, Laird NM, & Ware JH (2004). Applied longitudinal analysis. Hoboken, NJ: Wiley.

Gifford-Smith M, Dodge KA, Dishion TJ, & McCord J (2005). Peer influence in children and adolescents: Crossing the bridge from developmental to intervention science. Journal of Abnormal Child Psychology, 33, 255–265. [PubMed: 15957555]

Ginsburg-Block MD, Rohrbeck CA, & Fantuzzo JW (2006). A meta-analytic review of social, self-concept, and behavioral outcomes of peer-assisted learning. Journal of Educational Psychology, 98, 732–749.

Grant BF, Stinson FS, & Harford TC (2001). Age at onset of alcohol use and DSM-IV alcohol abuse and dependence: A 12-year follow-up. Journal of Substance Abuse, 13, 493–504. [PubMed: 11775078]

Henry KL, Stanley LR, Edwards RW, Harkabus LC, & Chapin LA (2009). Individual and contextual effects of school adjustment on adolescent alcohol use. Prevention Science, 10, 236–247. [PubMed: 19242802]

Hingson RW, Heeren T, & Winter MR (2006). Age at drinking onset and alcohol dependence: Age at onset, duration, and severity. Archives of Pediatrics & Adolescent Medicine, 160, 739–746. [PubMed: 16818840]

Hingson RW, & Zha W (2009). Age of drinking onset, alcohol use disorders, frequent heavy drinking, and unintentionally injuring oneself and others after drinking. Pediatrics, 123, 1477–1484. [PubMed: 19482757]

Hu L, & Bentler PM (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1–55.

Johnson DW, & Johnson R (1989). Cooperation and competition: Theory and research. Edina, MN: Interaction Book Company.

Johnson DW, & Johnson R (2005). New developments in social interdependence theory. Psychology Monographs, 131, 285–358.

Johnson DW, Johnson R, & Holubec E (2013). Cooperation in the classroom (9th ed.) Edina, MN: Interaction Book Company.

Johnson DW, Johnson RT, Roseth CJ, & Shin T-S. (2014). The relationship between motivation and achievement in interdependent situations. Journal of Applied Social Psychology, 44, 622–633.

Johnston LD, O'Malley PM, Bachman JG, & Schulenberg JE (2010). Monitoring the Future national results on adolescent drug use: Overview of key findings, 2009 (NIH Publication No. 10–7583). Bethesda, MD: National Institute on Drug Abuse.

Judd CM, Kenny DA, & McClelland GH (2001). Estimating and testing mediation and moderation in within-subject designs. Psychological Methods, 6, 115–134. [PubMed: 11411437]

Lennings CJ, Copeland J, & Howard J (2003). Substance use patterns of young offenders and violent crime. Aggressive Behavior, 29, 414–422.

MacKinnon DP, & Dwyer JH (1993). Estimating mediated effects in prevention studies. Evaluation Review, 17, 144–158.

Mikami AY, Boucher MA, & Humphreys K (2005). Prevention of peer rejection through a classroom-level intervention in middle school. Journal of Primary Prevention, 26, 5–23. [PubMed: 15976927]

Muthén LK, & Muthén BO (2012). MPlus: Statistical Analysis with Latent Variables User's Guide (7th ed.). Los Angeles, CA: StatModel.

Patterson GR, DeBaryshe BD, & Ramsey E (1989). A developmental perspective on antisocial behavior. American Psychologist, 44, 329–335. [PubMed: 2653143]

Pettigrew TF (1998). Intergroup contact theory. Annual Review of Psychology, 49, 65–85.

Pettigrew TF, & Tropp LR (2008). How does intergroup contact reduce prejudice? Meta-analytic tests of three mediators. European Journal of Social Psychology, 38, 922–934.

Pitkänen T, Lyyra A-L, & Pulkkinen L (2005). Age of onset of drinking and the use of alcohol in adulthood: A follow-up study from age 8–42 for females and males. Addiction, 100, 652–661. [PubMed: 15847623]

Ripley RM, Snijders TAB, & Preciado P (2012). Manual for SIENA version 4.0. Oxford: University of Oxford, Department of Statistics; Nuffield College.

Roseth CJ, Johnson DW, & Johnson RT (2008). Promoting early adolescents' achievement and peer relationships: The effects of cooperative, competitive, and individualistic goal structures. Psychological Bulletin, 134, 223–246. [PubMed: 18298270]

Soyka M (2000). Substance misuse, psychiatric disorder and violent and disturbed behavior. British Journal of Psychiatry, 176, 345–350. [PubMed: 10827882]

Tapert SF, Aarons GA, Sedlar GR, & Brown SA (2001). Adolescent substance use and sexual risk-taking behavior. Journal of Adolescent Health, 28, 181–189. [PubMed: 11226840]

Tobler NS, Roona MR, Ochshorn P, Marshall DG, Streke AV, & Stackpole KM (2000). School-based adolescent drug prevention programs: 1998 meta-analysis. Journal of Primary Prevention, 20, 275–336.

Urberg KA, Değirmencioğlu SM, & Pilgrim C (1997). Close friend and group influence on adolescent cigarette smoking and alcohol use. Developmental Psychology, 33, 834–844. [PubMed: 9300216]

Valente TW, Hoffman BR, Ritt-Olson A, Lichtman K, & Johnson CA (2003). Effects of a social-network method for group assignment strategies on peer-led tobacco prevention programs in schools. American Journal of Public Health, 93, 1837–1843. [PubMed: 14600050]

Valente TW, & Pumpuang P (2007). Identifying opinion leaders to promote behavior change. Health Education & Behavior, 34, 881–896. [PubMed: 17602096]

Valente TW, Ritt-Olson A, Stacy A, Unger JB, Okamoto J, & Sussman S (2007). Peer acceleration: Effects of a social network tailored substance abuse prevention program among high-risk adolescents. Addiction, 102, 1804–1815. [PubMed: 17784893]

Van Ryzin MJ, & Dishion TJ (2014). Adolescent deviant peer clustering as an amplifying mechanism underlying the progression from early substance use to late adolescent dependence. Journal of Child Psychology and Psychiatry, 55, 1153–1161. [PubMed: 24673521]

Van Ryzin MJ, Fosco GM, & Dishion TJ (2012). Family and peer predictors of substance use from early adolescence to early adulthood: An 11-year prospective analysis. Addictive Behaviors, 37, 1314–1324. [PubMed: 22958864]

Van Ryzin MJ, & Roseth CJ (2017). Enlisting peer cooperation in the service of alcohol use prevention in middle school. Child Development.

Van Ryzin MJ, & Roseth CJ (in press). Cooperative learning in middle school: A means to improve peer relations and reduce victimization, bullying, and related outcomes. Journal of Educational Psychology.

Veenman S, van Benthum N, Bootsma D, van Dieren J, & van der Kemp N (2002). Cooperative learning and teacher education. Teaching and Teacher Education, 18, 87–103.

Vega WA, & Gil AG (2005). Revisiting drug progression: Long-range effects of early tobacco use. Addiction, 100, 1358–1369. [PubMed: 16128725]

Wilson DB, Gottfredson DC, & Najaka SS (2001). School-based prevention of problem behaviors: A meta-analysis. Journal of Quantitative Criminology, 17, 247–272.

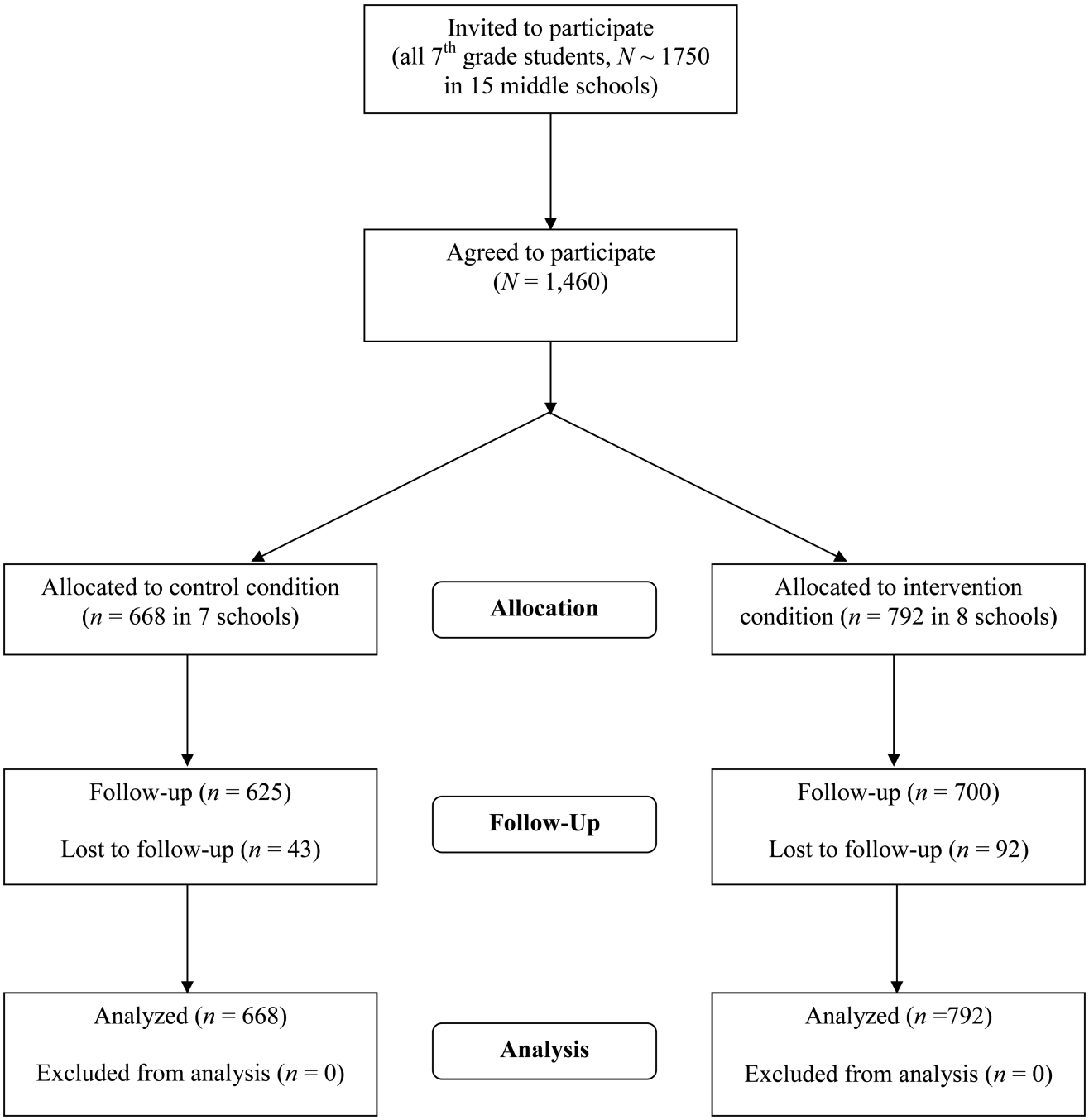

Figure 1.
CONSORT Diagram.

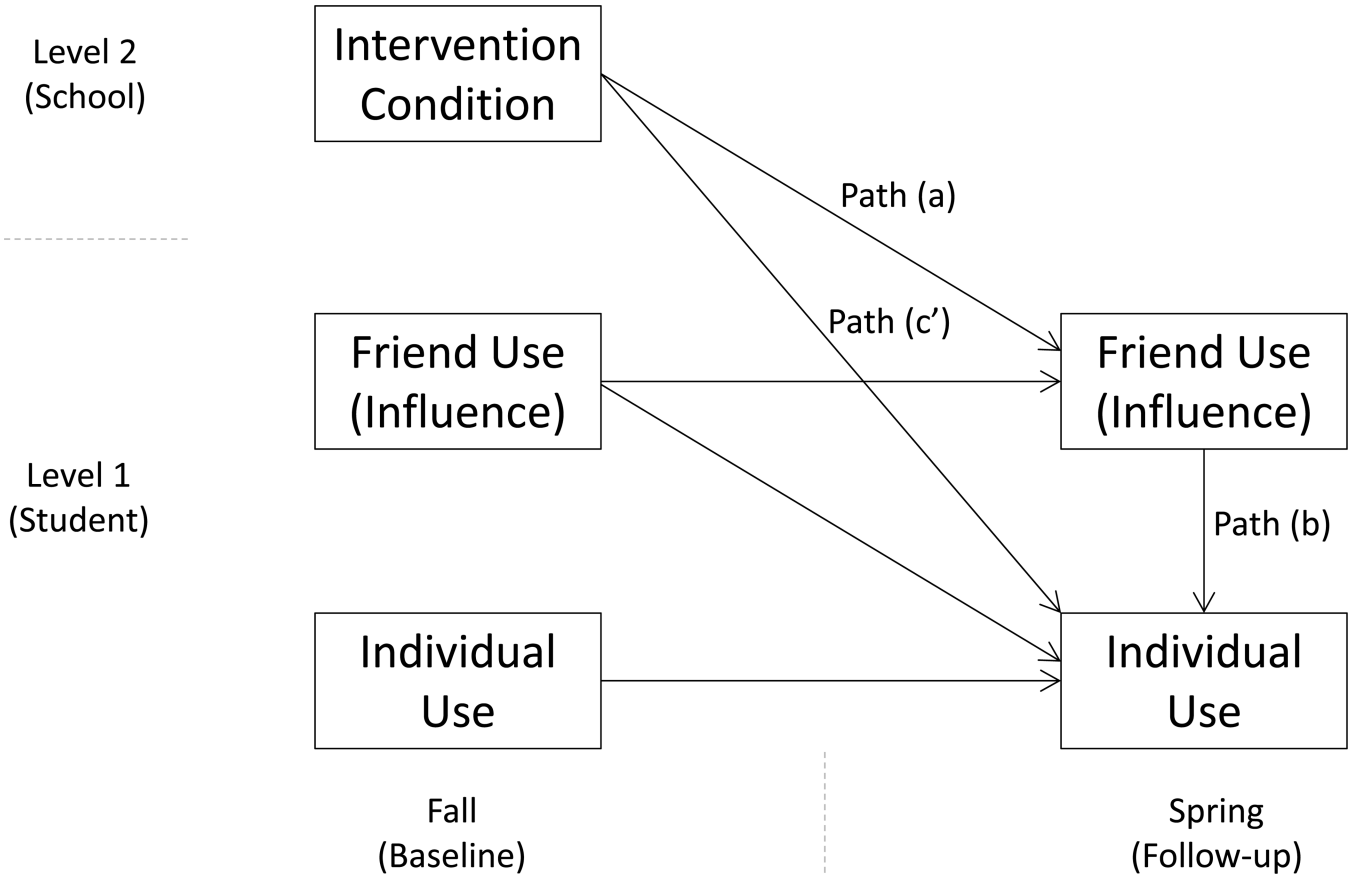

Figure 2.
Conceptual Model

Table 1.

Descriptive Data by School

School	Intervention	N	% female	% White	% Special Ed	% FRPL[a]
1	Yes	211	48.8	74.4	13.3	53
2	Yes	47	55.3	78.7	12.8	66
3	Yes	94	39.4	62.8	n/a	62
4	No	80	50.0	92.5	26.3	65
5	Yes	89	47.2	85.4	18.0	72
6	Yes	93	46.2	90.3	18.3	71
7	No	44	45.5	93.2	18.2	33
8	Yes	70	51.4	80.0	12.9	57
9	No	63	42.6	84.1	19.0	45
10	Yes	64	31.3	71.9	4.7	95
11	No	144	47.2	66.7	16.7	61
12	No	170	54.1	48.8	11.8	84
13	No	158	50.6	89.9	11.4	66
14	No	43	48.8	88.4	16.3	39
15	No	90	53.3	82.2	15.6	46

[a]State records.

Note. One school did not provide Special Ed status.

Table 2.

Correlations and Descriptive Data

	1	2	3	4	5	6	7	8
1. Alcohol Use (baseline)	—							
2. Alcohol Use (follow-up)	.49***	—						
3. Tobacco Use (baseline)	.78***	.44***	—					
4. Tobacco Use (follow-up)	.41***	.79***	.40***	—				
5. Friend Use/Alcohol (baseline)	.06*	.02	.05	.02	—			
6. Friend Use/Alcohol (follow-up)	.07*	.15***	.07*	.13***	.11***	—		
7. Friend Use/Tobacco (baseline)	.06*	.04	.06*	.02	.80***	.11***	—	
8. Friend Use/Tobacco (follow-up)	.02	.12***	.03	.18***	.18***	.70***	.18***	—
N	1453	1325	1453	1325	1424	1244	1424	1244
M	1.07	1.15	1.07	1.12	1.09	1.19	1.08	1.14
SD	.41	.59	.44	.56	.25	.35	.25	.33

*$p < .05$.

**$p < .01$.

***$p < .001$.

Table 3.

Full Model (alcohol)

Predictor	β	95% C.I.	*p*
Friend Use (baseline) -> Friend Use (follow-up)	.21	[.12 | .31]	< .001
Friend Use (baseline) -> Individual Use (follow-up)	.02	[−.05 | .09]	.55
Friend Use (follow-up) -> Individual Use (follow-up)	.72	[.63 | .81]	< .001
Individual Use (baseline) -> Individual Use (follow-up)	.46	[.36 | .56]	< .001
Intervention condition -> Friend Use (follow-up)	−.49	[−.80 | −.19]	.002
Intervention condition -> Individual Use (follow-up)	−.03	[−.25 | .20]	.83

Table 4.

Full Model (tobacco)

Predictor	β	95% C.I.	*p*
Friend Use (baseline) -> Friend Use (follow-up)	.23	[.11 | .35]	< .001
Friend Use (baseline) -> Individual Use (follow-up)	.00	[−.07 | .08]	.91
Friend Use (follow-up) -> Individual Use (follow-up)	.89	[.67 | 1.12]	< .001
Individual Use (baseline) -> Individual Use (follow-up)	.39	[.23 | .56]	< .001
Intervention condition -> Friend Use (follow-up)	−.47	[−.91 | −.04]	.032
Intervention condition -> Individual Use (follow-up)	−.03	[−.34 | .27]	.83