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Changing friend selection in middle school: A social network analysis of a randomized intervention study designed to prevent adolescent problem behavior

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Abstract

Adolescent friendships that promote problem behavior are often chosen in middle school. The current study examines the unintended impact of a randomized school based intervention on the selection of friends in middle school, as well as on observations of deviant talk with friends five years later. Participants included 998 middle school students (526 boys and 472 girls) recruited at the onset of middle school (age 11-12 years) from three public middle schools participating in the Family Check-up model intervention. The current study focuses only on the effects of the SHAPE curriculum—one level of the Family Check-up model—on friendship choices. Participants nominated friends and completed measures of deviant peer affiliation. Approximately half of the sample ($n=500$) was randomly assigned to the intervention and the other half ($n=498$) comprised the control group within each school. The results indicate that the SHAPE curriculum affected friend selection within School 1, but not within Schools 2 or 3. The effects of friend selection in School 1 translated into reductions in observed deviancy training five years later (age 16-17 years). By coupling longitudinal social network analysis with a randomized intervention study the current findings provide initial evidence that a randomized public middle school intervention can disrupt the formation of deviant peer groups and diminish levels of adolescent deviance five years later.

Keywords

Adolescence; Friend Selection; Deviancy training; Deviant Peers; Intervention Effects

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The increase in various forms of adolescent problem behavior is embedded in friendship cliques that encourage a process often called ‘deviancy training’ (Dishion & Tipsord, 2011). Empirical evidence suggests that adolescent problem behavior leads to the selection of middle school friends that are similar on these same, potentially problematic, characteristics (Dishion, Patterson, Stoolmiller & Skinner, 1991). The self-organization of youth into deviant peer clusters is one of the strongest predictors of multiple forms of problem behavior during later adolescence (e.g., Elliot & Menard, 1996; Haynie & Osgood, 2005). These findings demonstrate the need to better understand how deviant behaviors emerge within peer networks. The current study targets the adolescent peer network by examining the malleability of friend selection in middle school. If friendship choices can prevent the onset and escalation of adolescent problem behaviors this is of critical importance to prevention science.

Friend selection in early adolescence is based on similarity in attitudes or behaviors (Hartup, 1996). Similar attitudes toward deviant behaviors, for example, are one of the most salient features of deviant friendship cliques in early adolescence (Kandel, 1978). Mutual reinforcement of problem behaviors, or peer contagion, within deviant friendship groups is a powerful group dynamic during adolescence (Agnew, 1991; Brown, Clasen, Eicher, 1986). Empirical evidence suggests that adolescent deviant peer affiliation is ultimately associated with substance abuse, violent criminal activity, and even criminal incarceration, after controlling for past behavior (Arum & Beattie, 1999; Fergusson, Horwood, & Swain-Campbell, 2002; Van Ryzin & Dishion, 2013). Unfortunately, often it is unknown how to redirect adolescents from deviant friendship groups. To address this gap in the literature, the current study examines whether a school-based intervention can affect middle school friendship choices and, in turn, have a lasting impact on deviant talk with friends.

The Challenge of Understanding Friendship Choices

Adolescents may appear to be similar to their friends for two reasons. First, they may select friends based on some feature they share in common (selection effects). Second, they may become similar to friends after spending time with them (influence effects). Disentangling the friendship similarity that should be attributed to friend selection from the friendship similarity that should be attributed to friend influence is a challenge. Furthermore, having selected a friend, there is opportunity for influence to occur. Thus, it may be that *shopping for friends* during the selection process sets the stage for both deviant peer group formation and increases in deviant behaviors across time (Dishion, Spracklen, Andrews, & Patterson, 1996). The implication is that the initial friendship selection process may have a long-term effect on adolescent outcomes.

Only recently have methods become available to allow for the simultaneous investigation of friend selection and friend influence. To adequately disentangle the effect of friend selection from friend influence requires the longitudinal and simultaneous assessment of friend selection and friend influence (Burk, Steglich, & Snijders, 2007). In the current study a longitudinal social network approach within RSiena was used to simultaneously account for and disentangle selection from influence effects (Steglich, Snijders, & Pearson, 2010). RSiena requires complete behavioral assessments from adolescents in the school (e.g.,

adolescent deviant peer affiliation) and complete social relationship assessments from the same adolescents in the school (e.g., adolescent friendships) assessed longitudinally and at the same point in time in order to build predictive models that consider how deviant behaviors affect friendship formation and how friendships affect deviant behaviors. The ability of the RSiena program to simultaneously assess friend selection (change in friendships as a function of behaviors) and friend influence (change in behaviors as a function of friendships), while accounting for endogenous features of an adolescent's social network (described later in more detail) that may also impact the estimation of both selection and influence effects has lead RSiena to become increasingly popular as a tool for studying peer relationship dynamics at school (for a more complete review, see Veenstra, Dijkstra, Steglich, & Van Zalk, 2013).

The Present Study

To investigate intervention effects on friend selection at the outset of middle school, the current study pulled data from a randomized trial of the Family Check-up model designed for delivery in public middle schools (Dishion, Kavanagh, Schneiger, Nelson, & Kaufman, 2002; Dishion & Kavanagh, 2003). This trial was designed to prevent early adolescent problem behavior (e.g., substance use, antisocial behavior, violence). Records of juvenile arrests were available for the high school catchment areas in this metropolitan community. Middle schools were approached within the catchment area of the highest juvenile arrests rates to be included in this study. The intervention was randomized for each individual student, so students participating in the randomized intervention represented approximately half of the middle school students within each of the 3 participating public middle schools.

The details of the intervention protocol are provided in Dishion and Kavanagh (2003), and are briefly outlined in the Method section of this manuscript. Using the randomized intervention framework, our primary research goal was to determine if assignment to the intervention compared to the control condition within public middle schools would affect friendship choices (selection). It was only because of the within school random assignment that the current research question could be addressed because all children (both intervention and control students) regularly interacted with one another at school and, thus, had an opportunity to either consciously select one another as friends or consciously not select one another as friends. This intervention design allowed for a determination of if the intervention had an impact on friendship choices within the school.

Another innovative aspect of the current approach is the ability to examine the association between middle school friendship choices and their lasting impact on deviancy training with friends five years later, as revealed in videotaped direct observations. Adolescent deviancy training has been associated with a host of problematic adolescent outcomes, such as escalating levels of substance use, violent behavior, and illegal activities (Dishion, Nelson, Winter, Bullock, 2004; Dishion & Van Ryzin, 2011; Van Ryzin & Dishion, 2013). Although deviancy training with friends may critically predict longer-term problematic adolescent outcomes, to our knowledge, this is the first study to use a social network approach to explore how a school-based intervention might alter friendship choices and, in turn, impact longer-term deviancy training with friends.

Method

Participants

Participants were adolescents ($n = 998$; 526 male, 472 female) recruited during 6th grade from three middle schools participating in the Family Check-up model intervention study. To recruit youth for the study, three middle schools were selected within a high crime neighborhood within a metropolitan community. Parent consent rates were 90% at recruitment. Among study participants the annual family income ranged from less than \$5,000 to more than \$90,000, with the median being \$30,000 - \$40,000, and 34.7% were from single-parent families. A total of 85% of the students recruited participated in the 3 waves of data collection during middle school (6th grade (wave 1) – 9th grade (wave 3)) and approximately 80% of the original 6th grade sample of participants provided data during high school in 11th grade (wave 6). Data collection was completed in two cohorts from 1997 to 2001 (1997-1998 Cohort 1; 1999-2000 Cohort 2).

Procedure

Study Design—During the first wave of data collection (Grade 6) adolescents were randomly assigned to participate in the intervention. To assess early adolescent friend selection, this study focused on the first two waves of data collected during middle school (Grades 6 and 7). Of the 998 adolescents participating in the middle school intervention, approximately half ($n=500$) of the adolescents within each participating middle school were assigned to the intervention condition and the other half of the adolescents within the participating middle school were assigned to the control condition.

Intervention Protocol—The Family Check-up model was integrated into the public school system at three levels (for a complete description, see Dishion and Kavanagh, 2003). The universal level involved a six week curriculum called SHAPe, designed to engage both parents and students at the beginning of the 7th grade in a variety of exercises to promote school success, healthy adolescent choices, healthy adolescent relationships, positive peer group functioning, as well as diminish problem behaviors and violence during the adolescent years. The control students were not offered the SHAPe curriculum and instead received middle school as usual. The second level of the intervention was the Family Check-up (FCU), which was offered at the end of the 7th grade year to families of students identified as at risk. The FCU is a brief, 2-3 session intervention that uses motivational interviewing to support parents in positively changing family management practices. Approximately 25% of the families engaged in the FCU after the seventh grade spring assessment and at anytime during the 8th and 9th grade (see Dishion, Kavanagh et al, 2002). The third level of the intervention followed the FCU, and involved an evidence based parent management curriculum called Everyday Parenting (Dishion, Stormshak and Kavanagh, 2011). Approximately 75% of the families who engaged in FCU received at least one parent management session, with an average of 6 sessions. The current investigation focuses only on the effects of the SHAPe curriculum. The selected (FCU) and indicated (Everyday Parenting) were implemented following the sociometric assessments in the 6th and 7th grade.

Adolescent Friendship Interactions—Finally, adolescents completed a videotaped observation task with a same-sex, self-identified friend (Peer Interaction Task) during 11th grade. In total, 721 (359 male, 362 female) adolescents participated in the Peer Interaction Task. However, only observational data from the 601 participants who could be longitudinally followed from Grade 6 to Grade 11 were used in longitudinal analyses.

Measures

Deviant Peer Affiliation in Grade 6 and Grade 7—Deviant peer affiliation was measured with 4 items assessing the number of times in the past week an adolescent spent time with peers (a) getting into trouble, (b) fighting, (c) taking things that didn't belong to them, and (d) smoking cigarettes or chewing tobacco. Responses ranged from 1 (*never*) to 7 (*more than 7 times*) and were averaged ($\alpha=0.80$). To use this scale as an outcome within RSiena, the deviant peer affiliation variable was transformed into a categorical variable using 0.5 SD divisions. This created 8 distinct categorical levels of the deviant peer affiliation scale.

Middle School Friendship Nominations in Grade 6 and Grade 7—Participants completed sociometric nominations from which peer networks were created. Each student was asked to freely nominate up to three same-grade schoolmates who were considered “best friends” within the school. Nominations were not restricted by sex.

Friendship Interaction Observations at Grade 11—For the observational task participants took part in a videotaped interaction with a same-sex, self-identified friend. Adolescents were instructed to bring a close friend to the research office who was between 14 and 21 years old and had no familial relationship to the adolescent.

The Peer Interaction Task was designed to elicit a wide range of interactive behaviors within the dyad. Eight different topics were discussed for 5 minutes each in the following fixed order for all dyads, (a) planning an activity together (something they could potentially do together in the next week), (b) a currently nominated problem of the adolescent, (c) a currently nominated problem of the peer, (d) drug and alcohol use, (e) goals for the next year, (f) friends and peer groups, (g) dating, and (h) planning a party. An interviewer entered the room to end each topic of discussion and to provide the next topic. All topics were presented in a nonjudgmental manner, and participants were encouraged to openly discuss their ideas. On average, each adolescent and his or her friend engaged in a 45 minute videotaped discussion.

Deviancy Training: Deviancy training was assessed as the presence of deviant talk in the Peer Interaction Task using the Topic Code coding system (Dishion et al., 1996). The Topic Code was implemented using the Observer Pro version 5.0 (2003) coding program, which enabled real time measurements of durations of deviant content during the Peer Interaction Task. Deviant talk was coded for all verbal and nonverbal behavior that was not appropriate to the setting or task or that violated community or societal rules (e.g., “We stole 5 dollars from her purse”) (see Piehler & Dishion, 2007 for more details).

Fifteen percent of the data was coded twice to assess reliability. Coders maintained adequate reliability using the Topic Code ($\kappa = 0.79$; 82% agreement), allowing for a sufficient duration of deviant talk to be recorded within a 6-second margin of error. The 6-second margin of error used in the current study and the reliability were acceptable and consistent with other studies in this area using real time measurements of observational codes (Ha, Dishion, Overbeek, Burk, & Engels, 2014; Pepler & Craig, 1995). Both the Peer Interaction Task and the Deviant Talk Coding system have been empirically validated and demonstrated to have predictive validity on adolescent delinquency (Dishion Spracklen, Andrews, Patterson, 1996; Dishion & Owen, 2002; Granic & Dishion, 2003).

Socioeconomic Status—Socioeconomic status was assessed using a combination of parents' reports about employment status, education, income, housing, and financial aid. The highest score from both primary caregivers was used for parental employment and education. One global score was used for the other indicators (e.g., family housing, household income, and financial aid). These variables were standardized and averaged ($\alpha = 0.71$). This measure was based on data collected in high school, because only a small subset of at-risk participants had answered such questions in middle school. A strong correlation ($r = 0.72$) existed between middle school and high school socioeconomic status (Dishion, Ha, & Véronneau, 2012).

Analytic Plan

Longitudinal social network analyses were conducted using the RSiena program (Ripley, Snijders, & Preciado, 2012). These analyses were run as a multi-group analysis in which cohorts within each school (2 cohorts within School 1, 2 cohorts within School 2, 1 cohort within School 3) were first modeled separately, and then the cohorts within each school were nested within a single school network for analysis. This resulted in three social network models (e.g., nested models for School 1 and School 2; single social network model for School 3) to obtain separate estimates for each of the three participating middle schools. From this analytic design, an omnibus estimate of friend selection and friend influence within each participating middle school was obtained.

Disentangling friend selection from influence is a critical advantage of the RSiena program. To do this, RSiena requires longitudinally assessed complete network (e.g., friendship nomination) and complete behavioral (e.g., deviant peer affiliation) data from study participants. The longitudinal network and behavioral assessments in the current study allowed us to determine how friendships affect deviant peer affiliation behaviors (influence effects) and how deviant peer affiliation behaviors affect friendship choices (selection effects). RSiena also has the flexibility to add important control (e.g., sex, ethnicity) and moderator (e.g., intervention status) variables to both selection and influence effects to assess the impacts of each on both longitudinal change in friendship choices (network change) and longitudinal change in deviant peer affiliation behaviors (behavior change). Finally, the ability to simultaneously and longitudinally account for friendships within the school and student behaviors within the school allows for any interdependence (i.e., nonindependence), or the mutual influence that may lead relationship partners within a school to be more similar or more different than a randomly selected sample, to be

controlled. Relational interdependence is accounted for because RSiena simultaneously estimates the effect of deviant peer affiliation on friendships and friendships on deviant peer affiliation (see Snijders et al., 2010).

Structural Controls—In addition to the simultaneous estimation of selection and influence, RSiena is also able to account for the often overlooked endogenous structural features of social networks within schools in order to provide estimates of selection and influence over and above these endogenous features of the peer network. This is important because endogenous, contextual, features of peer networks within schools may lead to a similar pattern of results and, therefore, when left unaccounted for, may bias the estimation of hypothesized effects (Raudenbush & Bryk, 1986). Therefore, in the current study several theoretically relevant structural control parameters were accounted for. First, the *outdegree* parameter was controlled, which accounts for the degree to which children are selective in friendship choices. In general, a positive outdegree parameter would indicate a lack of selectivity in friendship choices, an unlikely occurrence given that adolescents likely make a conscious choice when it comes to their friends (Steglich, Snijders, & Pearson, 2010). If children were not selective of friends, there would be little reason to continue with the current study. Second, the *reciprocity* parameter was controlled, which accounts for the tendency for mutuality in friendships, or the idea that friendship nominations have a tendency to be reciprocated (Block, 2015). In this way, it can be determined that friends are indeed selected for similarity over and above more general trends toward relational reciprocity that may also lead to similar adolescents becoming friends. Third, the *transitive triplets* parameter was controlled, which accounts for the tendency for friendships to form when individuals share a common friendship, that is, the idea that a friend of friends may be more likely to become a friend (Davis, 1970). In this way, it can be determined that friendship choices are not simply a consequence of this type of structural tendency for transitivity in relationships. Put another way, friendship formation is more likely to be based on hypothesized similarities and not simply a relational outcome that results because a particular adolescent nominates new friends because they are already in relationship with that same adolescents' current friends. Next, *linear tendency* and *quadratic shape* was estimated, both of which provide information on the distribution of deviant peer affiliation in these schools and prevents an overestimation of influence effects. Specifically, the linear tendency parameter indicates if there is a tendency for adolescents to stay above or below the midpoint on levels of deviant peer affiliation. The quadratic shape parameter provided information on if there is regression to the mean, or over-dispersion, on levels of deviant peer affiliation. The need to account for linear and quadratic tendencies, or the normality of the distribution of dependent variables, has long been recommended as best practice with applied multiple regression models (Cohen, Cohen, West, & Aiken, 2003) and are also considered necessary controls when modeling non-dichotomous outcome variables using RSiena (Ripley, Snijders, & Preciado, 2012).

Network and Behavioral Controls—There are disproportionate middle school referrals for deviant behavior as a function of sex, ethnicity, and socioeconomic status (Gifford-Smith, Dodge, Dishion, & McCord, 2005; Skiba, Peterson, & Williams, 1997). Therefore, each of these effects is controlled for in the estimation of both friendship choices and

changes in deviant peer affiliation. This also provided confidence that intervention effects observed in the current study were not confounded with the effects of sex, ethnicity, or socioeconomic status on deviant peer affiliation during middle school.

Friend Selection—Intervention effects on friend selection were of primary interest. Below the practical interpretation of each intervention effect on friend selection is described (for a more complete review, see Ripley, Snijders, & Preciado, 2012).

First, the *selection of intervention status friends* parameter reflects the longitudinal process by which friends were selected based on similarity in intervention status from Grade 6 to Grade 7. A positive selection of intervention status friends parameter indicates that friendships were chosen based on similarity in intervention status, or that the students participating in the intervention were more likely to befriend students within the school who were also participating in the intervention than to befriend control adolescents within the school.

Selection for deviant peer affiliation was also estimated. The *selection of similarly deviant peer affiliated friends* parameter reflects the process by which friends were selected based on similarity in deviant peer affiliation. A positive selection of similarly deviant peer affiliated friends parameter indicates that friendships were chosen based on similarity in deviant peer affiliation, or that students were more likely to befriend students who reported levels of deviant peer affiliation similar to their own reported levels of deviant peer affiliation.

Finally, whether intervention status moderates selection of similarly deviant peer affiliated friends was estimated. The interaction *selection of similarly deviant peer affiliated friends* $\times$ *intervention status* parameter reflects the process by which intervention status moderates friend selection of similarly deviant peer affiliated friends. Thus, the intervention's impact on adolescents choosing friends based on similarity in deviant peer affiliation was estimated.

Friend Influence—Although friend selection was of primary interest, friend influence was simultaneously modeled to account for the fact that the intervention may impact friend influence effects (Dishion, McCord and Poulin, 1999). The *deviant peer affiliation influence* parameter reflects the process by which friends influence one another on deviant peer affiliation. A positive deviant peer affiliation influence parameter indicates that an adolescent changes his or her level of deviant peer affiliation to resemble that of his or her friends.

It was also determined if intervention status moderates influence on deviant peer affiliation. The interaction *deviant peer affiliation influence* $\times$ *intervention status* parameter reflects the process by which intervention status moderates friend influence on deviant peer affiliation, or that participation in the intervention may actually make some adolescents less susceptible to friend influence over deviant peer affiliation.

Follow-up Analyses—Finally, a series of follow-up analyses, in the form of independent *t*-tests on observations of deviant talk between friends during high school, were conducted to

examine the association between middle school friendship choices and their lasting impact on deviant talk with friends five years later. Follow-up analyses were restricted to a longitudinal subsample of adolescents from School 1, School 2, and School 3 ($n=601$ adolescents) who remained within the same peer cohort from middle school (wave 1) through high school (wave 6). These analyses were conducted to compare mean level differences between the 11th grade deviant talk of intervention and control students five years after intervention effects on friendship choices were assessed.

Results

Descriptive Data

Table 1 provides descriptive statistics for the current friendship structure and deviant peer affiliation behaviors across the three public middle schools. Friendship nominations made by each adolescent ranged from 2.39 to 3.84 on average across the two waves, demonstrating that adolescents nominate 2-4 “best friends” in their school during Grades 6 and 7. The total number of friendships within the schools ranged from 505 to 1067 across the two waves of data collection. With the exception of School 2, average levels of deviant peer affiliation increased across time. Across the 2 waves, at any one time, no more than 40 adolescents left the school and no more than 90 adolescents joined the school. The Jaccard index was 0.23 in School 1, 0.13 in School 2, and 0.21, in School 3 providing an indication of the relative stability of friendships across time, or an indication of the proportion of Grade 6 friendships that existed at Grade 7. The network stability in School 2 did not meet the criterion for typically recommended values between 0.20 and 0.60 for the reliable assessment of friend influence effects (Snijders, van de Bunt, & Steglich, 2010), so the friend influence effects in School 2 should be interpreted with caution. In School 1 approximately 29% of students increased their deviant peer affiliation and 22% decreased their deviant peer affiliation from Grade 6 to Grade 7. In School 2 approximately 30% of students increased their deviant peer affiliation and 28% decreased their deviant peer affiliation from Grade 6 to Grade 7. In School 3 approximately 25% of students increased their deviant peer affiliation and 22% decreased their deviant peer affiliation from Grade 6 to Grade 7. There was sufficient stability in deviant peer affiliation to consider this a reliable assessment across these three schools (School 1: $r=0.47$, $p<.001$; School 2: $r=0.25$, $p<.001$; School 3: $r=0.45$, $p<.001$). These descriptive analyses indicated that it was reliable to proceed with longitudinal social network analyses.

Middle School Analyses of Friend Selection

Structural Controls—Table 2 summarizes the results of the current study. In School 1 and School 3, the results are consistent with our theoretical expectations, indicating low network density, or conscious choice of friendships (outdegree); a tendency toward mutual friendships (reciprocity); friends of friends tended to be selected as friends (transitive triplets); adolescents remained toward lower levels of deviant peer affiliation (linear tendency); and there was some evidence of dispersion in deviant peer affiliations, so that most adolescents were either high or low on levels of deviant peer affiliation with fewer adolescents falling somewhere in between (quadratic shape). In School 2, the effect of outdegree and reciprocity held, however, there was no evidence of network transitivity

(transitive triplets) or identifiable trends in deviant peer affiliation (i.e., linear tendency, quadratic shape).

Network and Behavioral Controls—In all three schools, adolescents were more likely to nominate same-sex friends, but neither boys nor girls made or received more friend nominations. In School 1 and 3, adolescents were more likely to nominate same-ethnic than other-ethnic friends, but neither European-American adolescents nor minority adolescents made or received more friend nominations. In School 1, adolescents were more likely to nominate similar-socioeconomic status friends, but neither high nor low socioeconomic status adolescents made or received more friend nominations. There was no evidence that intervention status or level of deviant peer affiliation had an effect on the number of friend nominations made or received. Finally, there was no evidence that sex, ethnicity, socioeconomic status, or intervention status had an effect on change in deviant peer affiliation across time in any participating school.

Friend Selection—There was evidence for intervention effects on friend selection in School 1, but not Schools 2 and 3. In School 1, the results indicated that adolescents tend to select friends on the basis of intervention status similarity (selection of intervention status friends). The significant selection of intervention status friends effect provides longitudinal evidence that intervention adolescents are more likely to select intervention adolescents as friends and control adolescents are more likely to select control adolescents as friends from Grade 6 to Grade 7 within School 1.

Adolescents did not select friends on the basis of deviant peer affiliation similarity (selection of similarly deviant peer affiliated friends) in any school. The nonsignificant selection of similarly deviant peer affiliated friends effect indicates that there is no main effect (e.g., an effect that exists across both intervention and control adolescents) evidence that similarity on deviant peer affiliation is a significant criterion for friend selection within all three participating middle schools.

There was evidence in School 1 that the intervention moderated friend selection for similarity in deviant peer affiliation (selection of similarly deviant peer affiliated friends $\times$ intervention status). The significant selection of similarly deviant peer affiliated friends $\times$ intervention status effect provides evidence that adolescents participating in the intervention were less likely to use similarity on deviant peer affiliation as a criteria for friend selection than the control adolescents within School 1. This is an indication that the intervention not only affected friendship selection, but that it specifically affected the selection of friends based on deviant peer affiliation within School 1.

Friend Influence—There was no evidence of influence on deviant peer affiliation (deviant peer affiliation influence), nor was there evidence that the intervention moderated friend influence on deviant peer affiliation (deviant peer affiliation influence $\times$ intervention status).

Follow-up Analyses—To test if the intervention effects on middle school friend selection had a lasting impact on high school deviancy training with friends, a series of independent *t*-

tests were conducted to compare levels of observed deviant talk, a measure of deviancy training, during high school friendship interactions in the intervention and the control group.

In School 1, independent *t*-tests revealed that the intervention adolescents showed significantly lower levels of deviancy training with friends as compared to control adolescents, $t(237)=2.12, p < .05$ ($M_{\text{intervention}}=0.12, SD_{\text{intervention}}=0.16; M_{\text{control}}=0.17, SD_{\text{control}}=0.23$) ($d=0.25$). These findings demonstrate significant mean level differences on deviancy training between friends five years after the intervention effects on middle school friend selection were observed in School 1. In Schools 2 and 3 no intervention effects on friend selection were found and independent *t*-tests revealed no differences between the intervention and the control adolescents on levels of deviancy training with friends five years later.

Discussion

The current findings suggest that a public middle school intervention can change middle school friendship choices and have a lasting impact on adolescent deviancy training within friendships. Although the precise mechanism behind the present intervention effects is unknown, it may be that friendship choices were impacted by the intervention in one of two ways. First, friendship choices may have been impacted by propinquity during the one hour of the school day in which students were provided the SHAPe curriculum within a shared homeroom classroom. Thus, propinquity may have lead to friendship formation because of a greater opportunity for peer interaction and relationship building to occur during shared class time. Second, friendship choices may have been impacted by the efforts of the SHAPe curriculum to promote non-deviant peer values. The SHAPe curriculum may have fostered similarity in non-deviant values among intervention participants, making intervention participants more likely to choose a similarly non-deviant intervention participant as a friend than to choose a less similar control participant as a friend. Although the precise mechanism is not yet clear, there appears to be something critical to the co-occurrence of disrupting deviant friendship formation via classroom assignment and changing deviancy norms via the SHAPe curriculum that lead to a change in friendship choices and a lasting impact on deviancy training among these same adolescents five years later.

The current findings also demonstrate that, as predicted by the cascade models for the development of problem behaviors (Dishion et al., 2010; Dodge & McCourt, 2010), selection of deviant friends in early adolescence is associated with learning and practicing deviancy training in later adolescent friendship interactions. Previous research also demonstrates considerable stability in deviant talk from age 13 to 18 (Dishion & Owen, 2002), a further indication that the effect of early friendship choices may have a critical and lasting impact on the patterns of relating within friendships that either perpetuate or inhibit deviant behaviors and normative deviant beliefs. Although the longitudinal follow-up analyses in the current study offer support for these ideas in only one school out of three, this inconsistent pattern of findings is similar to the inconsistent patterns often detected in other randomized intervention studies using social network analyses (Osgood et al, 2013). Furthermore, the present impact of the SHAPe curriculum on friendship choices was detected without an intentional effort of the investigators to change friendship choices,

suggesting that an intentional effort to support healthy relationship formation during adolescence may have an even greater impact on later adolescent deviancy.

Understanding How Interventions Affect Friendship Choices

The current study demonstrates that, when interventions affect friend selection, a door may be opened to simultaneously impact later deviancy training within friendships. An intervention's lasting impact on adolescent deviancy training is not a trivial matter. Adolescent deviancy training with friends is predictive of a host of significant later adolescent and early adult outcomes, including escalating drug use, criminal behavior, and escalating violence (Dishion & Owen, 2002; Granic & Dishion, 2003; Van Ryzin & Dishion, 2013). If interventions can have a lasting impact on adolescent deviance, via earlier friendship choices, greater consideration of friendship choices may need to be considered in conjunction with efforts to diminish peer influence on adolescent deviance.

This is a first step in understanding how intervention effects on friendship choices might significantly alter later adolescent deviance and several important questions remain to be answered. First, perhaps there are particular features of interventions that are most likely to affect friend selection. One possibility is that the intervention's school-based curriculum provided to the students positively impacted adolescent friendship choices. For example, as suggested earlier, it may be that friend selection for intervention status occurred because adolescents participating in the intervention are more similar as a result of their adoption of the tenants of the SHAPe curriculum. However, an alternative explanation is that friendships may have been more likely to form within the intervention group simply because the adolescents within the intervention group spent more time (e.g., homeroom time) together. The current findings could also be explained by broader contextual changes associated with the intervention. For example, a third possibility is that changes at the school itself (e.g., decisions of teachers and staff) lead to intervention effects on friend selection within School 1 compared to Schools 2 and 3. It could also be the quality of intervention implementation (e.g., preparation and dedication of school staff) that lead to intervention effects on friend selection in School 1 compared to Schools 2 and 3. Finally, it is not yet known if these effects will similarly hold in the absence of intervention effects on parenting. However, because the Family Check-up parent component of the intervention was not implemented until the end of the 7th Grade academic year, it is unlikely that the current findings were operating in conjunction with intervention effects on parenting. A better understanding of each of these possible explanations for the current findings will allow us to better understand how interventions might positively impact friendship dynamics during middle school and diminish longer-term risks for adolescent deviance.

Because the mechanisms for why the SHAPe curriculum affected friend selection can only be speculated upon, a promising direction for future research is a more systematic investigation of intervention effects on friend selection. By coupling innovative analytic techniques with innovative school based intervention designs this can be done. Perhaps future research and intervention efforts will be able to build upon these findings to begin to develop recommendations for how to redirect adolescent problem behaviors by fostering healthy friendship choices.

Limitations and Conclusions

Several limitations exist in the current investigation. First, the longitudinal social network models remained quite simple, given the complexity that is possible in this type of analytic assessment. An alternative approach would have been to expand the current model specification to include additional structural control variables that may have been relevant to the current sample within our longitudinal social network models. However, due to the complexity of these models coupled with the complexity of analyzing a randomized intervention sample, a more simplistic model specification was used. Concerning some of the specific complexities of the sample used, there was a great deal of turnover in the friendships present in these three schools. This led to lowered Jaccard indices. Thus, although friend selection across the first two years of middle school could be assessed, friend selection across all 3 years could not. Furthermore, the social network within School 2 was even unstable enough across 2 years to bring the interpretation of friend influence results within School 2 under question. Thus, although comparable in demographic composition, these three schools were variable in size and the stability of the friendships within the school. Friend influence effects were not the primary focus of the current investigation, however, and confidence remains in the estimation of friend selection effects. The number of Grade 6 friendships that remained stable until eleventh grade is also unknown. Previous research indicates that most friendships will change over a five year period, however, there is also a significant and high level of stability in deviancy training across this same amount of time, even as friendships change (Dishion & Owen, 2002). Later adolescent patterns of connecting with friends by deviant talk may have also been attributed to the relationships that form during middle school (Dishion, Nelson, Winter, Bullock, 2004). This suggests that it may be more important to focus on the processes within friendships than the stability of specific friendships. The current investigation is also limited by its inability to determine why the SHAPe curriculum had an impact on friend selection in School 1, but not Schools 2 or 3. Future research is needed to determine the mechanisms behind this intervention effect on friendship choice. It should also be noted that this study was not originally designed to test the current hypotheses. Rather, a unique randomized public middle school intervention design was coupled with an innovative analytic approach to determine *if* a school-based intervention can positively impact friendship choices. The fact that the current intervention had this kind of inadvertent effect speaks to the strong potential for changing early adolescent friendship choices for the better if given a priori consideration.

Despite these limitations, our findings provide initial support for the notion that a public middle school intervention can impact adolescent friendship choices. Unlike previous research, a unique randomized public middle school intervention population coupled with an innovative analytic approach was able to provide less biased, but still preliminary, evidence that public middle school interventions can affect friendship choices. Given the longitudinal nature of the present investigation, there is now preliminary evidence that if interventions can change friend selection processes in middle school it can have a lasting impact on deviant talk with friends. A more complete understanding of how school based interventions can impact adolescent friendship choices may inform cost effective and successful intervention designs to reduce adolescent problem behavior.

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Table 1

Network Descriptive Data During Grade 6 and Grade 7

	School 1 (<i>n</i> =398)		School 2 (<i>n</i> =336)		School 3 (<i>n</i> =283)	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Friendship nominations made	2.73	2.58	2.73	2.39	2.79	3.84
Number of friendships	1067	856	896	608	745	505
Mean levels of deviant peer affiliation	2.25	2.37	2.47	2.47	2.34	2.44
	Wave 1 to 2		Wave 1 to 2		Wave 1 to 2	
Change in network membership						
Number of adolescents leaving the school	40		5		8	
Number of adolescents joining the school	35		90		90	
Change in friendships						
Stability of friendships over time (Jaccard index)	0.23		0.13		0.21	
Change in behavior						
Percentage of children who increased deviant peer affiliation	29%		30%		25%	
Percentage of children who decreased deviant peer affiliation	22%		28%		22%	
Stability of deviant peer affiliation (temporal autocorrelation)	$r=0.47^{**}$		$r=0.25^{**}$		$r=0.45^{**}$	

Note. Mean levels of deviant peer affiliation did not significantly increase over time within School 1, School 2, or School 3.

* $p < .05$,

** $p < .01$.

Table 2
Middle School Peer Selection on the Basis of Intervention Status During Grade 6 and Grade 7

Selection and Influence Effects for School 1 (n=398)	Est.	SE	p
Selection of intervention status friends	0.29	0.14	.036*
Selection of similarly deviant peer affiliated friends	-0.05	0.06	.407
Deviant peer affiliation influence	0.09	0.21	.668
Selection of similarly deviant peer affiliated friends × intervention status	0.10	0.05	.046*
Deviant peer affiliation influence × intervention status	-0.28	0.35	.424
Selection and Influence Effects for School 2 (n=336)			
Selection of intervention status friends	0.39	0.51	.444
Selection of similarly deviant peer affiliated friends	0.38	0.43	.377
Deviant peer affiliation influence	0.16	0.16	.802
Selection of similarly deviant peer affiliated friends × intervention status	-0.06	0.45	.894
Deviant peer affiliation influence × intervention status	0.03	0.18	.867
Selection and Influence Effects for School 1 (n=283)			
Selection of intervention status friends	-0.11	0.20	.582
Selection of similarly deviant peer affiliated friends	0.04	0.07	.568
Deviant peer affiliation influence	-0.36	0.33	.276
Selection of similarly deviant peer affiliated friends × intervention status	0.06	1.15	.959
Deviant peer affiliation influence × intervention status	0.14	0.43	.326

Note. Structural, network, and behavioral parameters were estimated in the current model (e.g., outdegree, reciprocity, transitivity, linear tendency, quadratic shape, sex, ethnicity, and socioeconomic status), but omitted from the table to improve readability (see the Results section in the text for results and interpretations of all significant control variables).

*
 $p < .05$.