Published in final edited form as:

J Subst Abuse Treat. 2015 November ; 58: 16–24. doi:10.1016/j.jsat.2015.06.013.

Peer Network Counseling with Urban Adolescents: A Randomized Controlled Trial with Moderate Substance Users

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Abstract

Close peer networks can affect adolescents' health behaviors by altering their social environments, and thus their risk for and protection against substance use involvement. We tested a 20 minute intervention named Peer Network Counseling that integrates Motivational Interviewing and peer network strategies with 119 urban adolescents who reported occasional or problem substance use. Adolescents presenting at primary care clinic were randomized to intervention or control conditions and followed for 6 months. Mixed-effect latent growth models were used to evaluate intervention effects on trajectories of alcohol and marijuana use, offers to use substances, and moderation models to test for interactions between intervention condition and peer network characteristics. A significant intervention effect was found for boys for offers to use alcohol from friends ($p < .05$), along with a trend significant effect for alcohol use ($p < .08$). Intervention was more effective in reducing marijuana use, vs. control, for participants with more peer social support ($p < .001$) and with more peer encouragement for prosocial behavior (school, clubs, sports, religious activities); however, intervention did not affect these network characteristics. Results provide support to continue this line of research to test brief interventions that activate protective peer network characteristics among at-risk adolescents, while also raising some interesting gender-based intervention questions for future research.

Keywords

Peer Network Counseling; Urban Adolescents; Brief Intervention; Primary Care; Motivational Interviewing

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1. Introduction

Adolescent substance use persists as a health issue of national concern, with illicit drug use steadily increasing over the last two years in a national sample of high school students (Johnston, O'Malley, Bachman, & Schulenberg, 2013a). While most adolescents' substance use does not worsen into a disorder, approximately 11% of US adolescents meet the criteria for a substance use disorder (Winters, Leittne, Wagner, O'Leary, & Tevyaw, 2007). Urban youth are particularly vulnerable to early use and future problematic use of alcohol and illicit drugs (Martino, Ellickson, & McCaffrey, 2008; Wright, 2004). For instance, they are disproportionately exposed to trauma (e.g., violence, crime) which increases vulnerability to substance use (e.g., Lee, 2012; Zinzow et al., 2009). Moreover, alcohol and illicit drug use are positively correlated with population density such that adolescents residing in more densely populated areas use substances with greater frequency than their counterparts in less populated areas (Johnston, O'Malley, Bachman, & Schulenberg, 2013b). This disparity is particularly acute for African American youth, who are often overrepresented in such samples (Martino et al., 2008).

1.1 Brief Interventions in Primary Care

Due to the typically non-threatening nature of primary care settings, health care providers have unique access to patients with substance abuse problems. Providing adolescents with brief counseling in primary care settings has been shown to a) reduce the stigma of seeing a substance abuse specialist for teens and their families, b) normalize the process of seeking help before problems become severe, and c) stimulate adolescents to discuss and rethink their substance use within a safe environment (D'Amico, Miles, Stern, & Meredith, 2008; Ernst, Miller, & Rollnick, 2007). Evidence points to the importance of early interventions for at-risk adolescents, a goal particularly addressable in primary care settings, where youth who may be transitioning into heavier substance use might be identified before they begin experiencing major negative consequences (Carney & Myers, 2010). Unfortunately, there are few controlled trials of brief interventions with adolescents set within a primary care setting and thus, the need exists to develop and test these interventions (Harris, Louis-Jacques, & Knight, 2014).

1.2 Peer Network Framework

Social networks can be defined as systems constituted as relational ties and interactions between a finite number of people and entities (Mason, 2014). Among these interactive systems is the peer network, or close friend network. Peer networks, defined for the present study represent close friends that an individual has personal contact (beyond social media) at least monthly. Peer relationships are known to be important mediators of substance use among adolescents (Burk, van der Vorst, Kerr & Stattin, 2012; Light et al., 2013), and thus may be a promising target for interventions. Peer attitudes and behaviors are potent predictors of substance use, with effects varying by gender, race/ethnicity, and type of substance (Mason, Mennis, Linker, Bares, & Zaharakis, 2014). In contrast, evidence supports that positive peer relations are protective against substance use in adolescents through creating and maintaining healthy, prosocial peer networks (Exner-Cortens, 2014; Mrug & McCray, 2013). Recent research has supported the clinical effectiveness of

targeting peer network characteristics with brief intervention with adolescents (Chung, Sealy, Abraham, Ruglovsky, Schall, & Maisto, 2015). Further, a recent review of the mechanisms of change within adolescent substance use intervention found that positive social support was one of three mechanisms identified to mediate intervention effects (Black & Chung, 2014). Finally, Louis-Jacques and colleagues (2014) reported that a brief intervention within primary care succeeded in reducing alcohol onset and consumption among teens with peer risk (friends who drink or approve of drinking). To date, however, no adolescent peer network-focused intervention has been studied in a controlled trial.

1.3 Motivational Interviewing

Motivational Interviewing (MI) is defined as a client-centered, yet directive therapeutic style with the explicit goal of enhancing readiness for change by helping clients explore and resolve ambivalence toward behavioral problems (Miller & Rollnick, 2002). Evidence-based interventions such as MI fit well within pediatric health care settings (Erickson, Gerstle, & Feldstein, 2005). MI is considered an evidenced-based, frontline approach to reducing substance use and negative health outcomes through increased levels of patient-centered care, shared decision making, and improved clinician-patient relationships (Anstiss, 2009; Rollnick, Miller, & Butler, 2008). Findings regarding efficacy of MI with racial and ethnic minority groups generally indicate that MI is an appropriate intervention for diverse populations. In a recent meta-analysis of 119 studies covering twenty-five years, Lundahl and colleagues (2010) concluded that MI may be particularly effective with individuals from racial and ethnic minority groups, supporting similar meta-analytic findings (Austin, Hospital, Wagner, & Morris, 2010; Hettema, Steele, & Miller, 2005). MI may be also be appropriate as an early intervention, addressing moderate substance use or those at-risk for more substantial problems, as MI is particularly helpful with clients who are less motivated or ready to change, more angry or oppositional (Hettema, Steele, & Miller, 2005).

Efforts to provide brief interventions that target adolescent substance use should leverage effective approaches such as MI as well as address the dynamic social processes associated with adolescent substance use involvement. More randomized controlled trials are needed with underserved, populations such as substance using racial minority urban adolescents within primary care settings. In this current study, we sought to address this gap by conducting a randomized clinical trial using a brief, one session intervention: motivational interviewing integrated with social network counseling with at-risk urban youth. Based on this review and our previous work with a similar population where the brief intervention reduced alcohol use related problems and offers for marijuana (Mason et al., 2011), we hypothesized that adolescents in the experimental intervention (Peer Network Counseling) condition would decrease substance use and increase their peer network's protective characteristics relative to the control condition.

2. Method

2.1 Procedure

Participants for the study were recruited between April 2013 and February 2014 from an adolescent medicine outpatient clinic at a large urban academic medical institution in the

southeastern United States as well as from a city public health department, adolescent health program. A total of 119 adolescents were enrolled into the study. Research procedures were identical for both settings, and 104 (87%) of the sample was recruited from the medical center clinic, and the remaining 15 (13%) from the public health clinic. Figure 1 provides details on the number of adolescents approached, enrolled, and followed for six months. Age-eligible (14 to 18 year olds) adolescents presenting to the adolescent clinic for routine care were approached for interest in the study by a research assistant while in the waiting room or pending arrival of the physician into the patient's exam room. Interested adolescents completed screening questions to determine eligibility for the study. Informed consent/assent was obtained from adolescents and parents prior to conducting any research activities. The first authors' university and the city health department's institutional review boards approved the research protocol, and the study received a federal Certificate of Confidentiality from the National Institutes of Health. Participants received \$150 over 6 months as incentive for their time and effort. Following screening and informed consent, teens were randomized into either the intervention or control condition. Randomization was completed using a random number table as well as using blocked randomization to create equal numbers allocated to intervention and control groups. The attention control condition controls for therapist attention by matching the experimental condition in time spent with the adolescent, detailed in section 2.3. Participants completed the baseline assessment while at the clinic using a web-enabled laptop, and follow-up assessments at 1, 3, and 6 months post intervention upon receiving an email or text message with an embedded URL (link) to click on and complete the questionnaires.

2.2 Intervention

The goal of the intervention is to alter the substance use trajectory through reduction or cessation, for at-risk adolescents presenting in primary care. Because our intervention targets at-risk youth who have not been diagnosed with a substance use disorder, the intervention is classified as an indicated prevention intervention. This classification developed by the Institute on Medicine (Mrazek & Haggerty, 1994), specifies types of interventions along a spectrum from universal prevention interventions, to treatment, to maintenance. Indicated prevention interventions are designed for high-risk individuals identified by screening or assessment who do not meet diagnostic criteria, but are at risk for developing a disorder. Thus, the present study falls at the cusp of treatment, and is referred to as a preventive intervention for high risk youth.

Adolescents assigned to the intervention condition received a 20-minute intervention referred to as Peer Network Counseling. The intervention is built upon and extends our previous pilot work (Mason et al., 2011), and is guided by five key MI clinical issues: rapport, acceptance, collaboration, reflections, and non-confrontation. The intervention follows Motivational Enhancement procedures with age-matched substance use normative data presented as feedback. The intervention is structured into four component parts each lasting for 5 minutes: (a) rapport building and laptop presentation of substance use feedback in simple graphic form, (b) discussion of substance use likes/dislikes and discrepancies, (c) introduction of peer network information and graphical feedback, and (d) summary, change talk, and plans.

Prior to the intervention, baseline data from the adolescents' surveys are automatically abstracted (via computer programming) and uploaded to a project website. The therapist then accesses this site via project laptop and the graphic displays of substance use and peer network characteristics are automatically populated and made ready for the therapist to use during the counseling session.

The rapport building and feedback component are used to establish a non-judgmental relationship and to present the adolescent with a graphical display of their substance use compared to national normative data. This component seeks to begin reflection and initial dialogue on the adolescents' current substance.

The session then flows into asking about likes/dislikes of substance use. This simple yet powerful, portion of the intervention often reduces resistance, and relaxes the adolescent as he/she realizes the counselor is open to the positives as well as the negatives regarding their substance use. The adolescents' baseline responses are then reflected back to the teen, highlighting goals and values. These data are used to have the adolescent identify and articulate discrepancies between current use and future goals and values.

The peer network component begins by introducing the concept of peer network and its influence on health using the laptop to illustrate this concept. Next, the teen's peer network is reviewed for risks and protection. Peer networks are reviewed for support, prosocial activities, and encouragement for healthful behavior as well as for substance use, influence/offers to use substances, and risky/dangerous activities. As figure 2 illustrates, adolescents are shown the composition of their peer network in graphic form, such as a bar graph representing levels of risk and protection for each their closest three peers. Teens are encouraged to reflect on their network and to consider making small modifications, such as adjusting the amount of time spent with particular peers as well as time spent at particular locations, in order to support participants' willingness for peer network adjustment.

The last portion of the intervention summarizes the session with appreciation of the client's honesty, and pays particular attention to underscoring discrepancies and reflecting on client-generated change talk. If the adolescent has articulated a change plan, this is reviewed, encouraged, and supported. If the teen has not made a specific change plan, the counselor encourages personal reflection on what was discussed.

2.3 Attention control condition

In an effort to balance the amount of verbal contact with the therapist, adolescents randomized to the attention control group reviewed an informational handout with the therapist, which covered several topics related to health behaviors such as exercise, nutrition/weight management, and life skills. These sessions lasted 20 minutes, matching the experimental condition in length.

2.4 Training and Fidelity

Two therapists held a Master's degree in a mental health field, were trained, supervised and certified by a researcher with extensive experience in MI and Peer Network Counseling. In order to be certified in the intervention, study therapists were required to record 2 training

tapes rated by the study fidelity monitor, and receive a minimum score a 3.5 (indicating beginning competency) on the Motivational Interviewing Intervention Integrity (MITI, v3.1 Moyers et al., 2010) scale. The MITI behavioral coding system was used to code practice sessions and the MI intervention sessions (100%). Study interventionists were successfully certified in the intervention. The average Global MITI ratings of therapists for the recorded intervention sessions ranged from 3.7 to 4.75 with a mean of 4.44 (an average of 3.5 indicates beginning competency, and an average of 4 or greater is considered proficient in the use of MI strategies), (MITI, v3.1 Moyers, et al., 2010). One therapist delivered the majority of the intervention (76%) and both therapists also delivered the control condition.

2.5 Measures

2.5.1. Screening questionnaire—The CRAFFT is a youth substance use screener that uses six yes/no questions to determine risk level (Knight et al., 1999). The CRAFFT is a mnemonic device with questions concerning driving or riding in a Car while someone in the car was using substances, using to Relax, using Alone, Forgetting things while using, having one's Friends request cutting down on use, and getting into Trouble. To qualify for the study, adolescents with screening scores of 2 or 3 are classified as at-risk for substance use disorder. The screening criteria were set to increase the likelihood of including teens with potential problems (moderate users) who would benefit from a brief intervention following other relevant research (D'Amico et al., 2008). If an adolescent's screening score suggested possible substance dependence (endorsing 4 items) he/she was told that they are not eligible and was encouraged to talk to their doctor or social worker. The screening questionnaire also included six mental health questions from the Global Assessment of Individual Needs (Dennis et al., 2000) so that recruitment criteria were less obvious.

2.5.2 Demographic information—Participants completed questions on age, race, ethnicity, and gender. Although not directly pertinent to our goals in this article, age was examined as a potential moderator, but no age effects of any kind were detected. The same was true of race. These results are not shown, and will not be discussed further. We note in passing that the small sample and relatively complex models required to address our main goals suggest caution in interpreting these non-findings with much great confidence. A larger sample would have been required to infer small or zero effects with any reasonable certainty.

2.5.3 Substance use—Substance use was assessed using the Center for Disease Control's Youth Risk Behavior Survey (YRBS; CDC, 2008) substance use items. The YRBS is designed to determine the prevalence of health-risk behaviors among high school students and has shown to be valid and reliable by gender, age, and race/ethnicity (Brener et al., 2002). For the present study, we focused on alcohol and marijuana as these are the primary substances used with this sample, with other substances being used too infrequently for meaningful analysis. Participants were asked the number of days they have used substances (alcohol and marijuana) within the last month, coded as 0= 0 days, 1= 1 or 2 days, 3= 3 to 5 days, 4=6 to 9 days, 5=10 to 19 days, 6=20 to 29 days, and 7=all 30 days. Finally, participants were asked their intentions to use alcohol and marijuana during the next

three months coded as 0= definitely no, 1=probably no, 2= unsure, 3=probably yes, and 4= definitely yes.

2.5.4 Peer Network Characteristics—Peer network data were gathered using the Adolescent Social Network Assessment (ASNA) (Mason et al., 2004). The ASNA is a 13 item assessment that collects information on each participant's closest friends, representing their peer network. The ASNA has favorable internal reliability (with a Cronbach's alpha of .84) and correlates significantly in the expected direction with self-reported measures of substance use (any alcohol, marijuana or other substance) ($r = -.64$), with self-reported alcohol use ($r = -.66$) and with self-reported marijuana use ($r = -.54$) (Mason et al., 2011). Our study focused on the influence of close friend networks, as close friends have more influence on substance use than general peer networks (Cruz, et al., 2012). We aligned the number of nominated close friends to three, as this is within the range (3 to 5) commonly reported for close peer network size (Ennett & Bauman, 1996; Ryan, 2001; Urberg, Degirmencioglu, Tolson, & Halliday-Scher, 1995) and allowed for ease of participant recall and reduced assessment burden.

Adolescents are asked to report on behaviors of up to 3 close friends. For this study we examined three items representing the positive/protective dimension of close peer networks and one item indicative of network risk: 1) Support (instrumental and psychological), 2) Suggesting not using or reducing use of substances, 3) Encouragement of prosocial behaviors, and 4), Offers to use substances. These four items have shown predictive capacity for substance use and represent clear behavioral indicators of peer network characteristics. Specifically, subjects were asked if during the past 30 days, their friend provided them with support such as help with school, money, transportation, or talking through problems, encoded as 0=no, 1=yes, a little, 2=yes, some, 3=yes, a lot; has ever suggested that you not use or reduce your use of any substances, encoded as 0=no, 1=yes; and if their friend encouraged them to participate in sports/exercise, school clubs or teams, volunteering, or religious activities, encoded as 0=no, 1=yes, a little, 2=yes, some, 3=yes, a lot. Participants were also asked the number of days they have been offered alcohol and marijuana, coded as 0= 0 days, 1= 1 or 2 days, 3= 3 to 5 days, 4=6 to 9 days, 5=10 to 19 days, 6=20 to 29 days, and 7=all 30 days.

Higher scores indicate greater peer network protection, and lower scores indicate decreased network protection. Scores were based on previous research where we found having peers that exert influence of non-substance use provided a two-fold protection against substance use and engaging in pro-social/positive activities provided 1.5 times the protection against substance use compared to those who did not engage in positive activities with their peers (Mason, 2009). When used as predictors, these network variables were dichotomized at the median (which approximately equaled the mean, as their distributions were generally symmetrical). These variables were then encoded as 0=low network protection and 1= high network protection. This approach simplified graphing of results and did not affect substantive interpretations of models.

2.6 Analytic Approach

Intervention effects were assessed by comparing outcome trajectories (i.e. slopes) from baseline to 6 months between control and intervention groups from multilevel growth curve models (MLM; Singer & Willett, 2003) estimated in MLwiN v2.23 (Rasbash, Steele, Browne, & Goldstein, 2009). Individuals were defined as level 2 units, with the four waves (baseline, 1 month, 3 month, and 6 month) nested within them as level 1 units. Separate models were estimated for alcohol and marijuana use, offers, and intentions, and three protective dimensions of close peer networks at baseline. For all outcomes, predictors included a time measure calibrated as month post-baseline (thus with values 0, 1, 3, and 6), intervention condition (0 = control, 1 = intervention), either female gender (0 = male, 1 = female) or a dichotomized network support or network encouragement measure, and all interaction effects up to and including the three-way month x intervention x “moderator” (gender, network support network encouragement) term. Up to 4-way models were also examined, even at some risk to over-fitting, but no doubly-moderated effects were found for any outcomes. Because their zeros were arbitrary, peer network variables were mean-centered. Other predictors were coded as described above, as their zeros provided meaningful reference.

Because all predictors were hypothesized to affect outcomes in each model, fully specified (saturated) models were estimated for each outcome by progressively adding main and interaction effects to the model and running the iterative generalized least squares estimation procedure after each addition. This approach helps provide reasonable starting values for parameter estimates and can stabilize model convergence in some instances. For any significant interaction effect, all lower order component interaction terms were retained, ensuring that parameter estimates could be interpreted as applying where any other predictors not part of the term in question had a meaningful zero value.

For purposes of model interpretation, particularly of moderated effects, it is important to bear in mind that only one term, condition by month, applies to treatment effects on slopes for individuals whose value on a given moderator is zero, i.e. boys, and participants in the low network support and low network encouragement groups. On the other hand, for those individuals for whom the moderator is one (girls, and participants in high network support and network encouragement categories), treatment effects on slope are described by two terms: condition by month, and also condition by month by moderator, with the net effect being the sum of these two individual effects. For moderator-zero individuals, this term would of course drop out, because it is multiplied by zero. Similarly, statistical significance of slope difference between treatment and control can be assessed for zero-category moderators by the significance of just the condition by month term, whereas a two-parameter chi-square test (i.e. a Wald test; Snijders & Bosker, 2012) is needed for those in the moderation category with value one.

Empirical distributions of outcome measures were plotted prior to modeling. Peer network variables were reasonably normal, but other outcomes appeared quite non-normal, suggesting alternative distributional assumptions would be appropriate. After some experimentation with more complex alternatives (e.g. hurdle models; Mullahy, 1986), we settled on a negative binomial assumption as the best practical approximation for a relatively

small sample, where model complexity might be a problem, but some adjustment for dispersion was clearly called for (Hu, Pavlicova & Nunes, 2011). Models relate the log of each variable (chosen so as to avoid negative values, in keeping with the variable definitions) to the values of the predictors.

2.6.1 Power calculations—LGM takes advantage of all four measurement occasions to estimate slope differences between control and intervention conditions. Muthen & Curran (1997) conducted simulations to estimate the power of such models under reasonably general conditions, showing at moderate effect sizes on the order of 0.4 to 0.5, power to detect intervention effects ranges from about 0.68 to 0.86.

3. Results

3.1. Baseline Characteristics

Of the 119 adolescents participating in the study, 35 were male (29%), and 84 were female (71%) with a mean age of 16.4 (SD =1.2). The control condition (n=60) was 67% female, while the intervention condition was 75% female. This gender distribution is typical for adolescent health clinics. Most participants were African American (84%), with the rest primarily white, mixed race, and Hispanic ethnicity. Baseline alcohol use mean was 0.9 (SD = 1.1), alcohol offers was 1.1 (SD=1.3), and intentions was 1.45 (SD=1.2). Baseline marijuana use was 1.36 (SD= 1.3), marijuana offers was 2.1 (SD=1.8), and intentions was 1.86 (SD=1.3). Baseline peer network support was 4.6 (SD=2.6) and prosocial encouragement was 3.8 (SD=2.8). There was no statistically significant difference in average the alcohol or marijuana items at baseline or in peer network characteristics.

3.2 Substance Use Results

Table 1 shows results for four models with significant or near-significant intervention effects. These models for alcohol and marijuana days used, and alcohol intentions, and offers, were the only ones that found intervention effects. Other outcomes were not significantly affected by intervention exposure, and are not shown. Furthermore we examined models with age as a moderator, but no age effects were found (results not shown).

All four of the models shown in Table 1 had significant or near-significant 3-way terms, i.e. intervention condition by gender (female) by time (month). Therefore the lower-order terms for each model were required for interpretability (Gelman & Hill, 2007). While this accounts for the final form of each model, substantive interpretation of even modestly complicated growth models is difficult based solely on a vector of parameters.

Figures 3 and 4 are more informative in this regard (these predicted values have been transformed from logarithmic units to original units). To begin with, substantial gender differences are evident, as shown by the significant or trend-significant 3-way interaction effects in all four models. For boys and alcohol use (column 1 of Table 1), hypothesized intervention effects are found. Because the male category of gender has the value zero, the three-way term drops out of a intervention effect on slope calculation for boys, leaving only the condition by month term. In the alcohol use model, the t statistic for this term is about

1.8, with a p-value of about .08, which is not conventionally statistically significant, but worthy of attention in broader context. For girls, the effect is the sum of the condition by month and condition by month by gender terms; the two-parameter Wald test (a chi square test with 2 df) is 2.82 and has a p-value of 0.24, i.e. very weak. Figure 4 shows a clear and significant downward trend in offers for alcohol among boys in the intervention condition ($p < 0.05$) indicating a strong condition by time effect for boys but not for girls.

3.2.1 Gender Effects on Substance Use—Figure 3 through 6 represent all four growth models that illustrate small to medium gender effects for intervention outcomes: Figure 3 alcohol use (Cohen's $d = .50$), Figure 4 offers to use alcohol (Cohen's $d = .60$), Figure 5 intentions to use alcohol (Cohen's $d = .39$), and Figure 6 marijuana use (Cohen's $d = .37$) for boys. Each of these figures show a decline among boys in the intervention condition, whereas these variables increase slightly in the control condition. These findings support a general conclusion of positive intervention effects for boys, compared to control, with the nonsignificant elements of this pattern likely attributable to the relatively small sample, given the generally substantial effect sizes. This pattern is not evident for girls. Slope differences for girls are given by the sum of condition by month and condition by gender by month terms in all four models, and these effects nearly cancel in all cases. In other words, there is no significant intervention effect on these outcomes for girls.

3.3 Peer Network Characteristics Results

We examined the mediating and moderating effect of the peer networks as a post-hoc analysis by testing to determine if the intervention effects on substance use variables might be mediated by intervention effects on peer network characteristics. The lack of any intervention effects on the network variable slopes, however, ruled out such mediation. Nevertheless, we were interested to see whether network characteristics could have moderated intervention effects. Therefore we modeled the substance use variables using the same predictors as the models shown in Table 1, substituting each network variable (social support and prosocial encouragement, encoded as indicator variables per above) for gender. No significant effects were found with the variable, suggesting not using or reducing use of substances as an outcome or moderator variable (not shown). We also looked at models with both gender and network characteristics as moderators, but did not find evidence of joint moderation (not shown).

Results for the network variable moderated models are shown in Table 2. Significant moderation was found for marijuana use, offers to use, and intentions to use, but not for alcohol use, offers, or intentions (these alcohol models are not shown). We limited the table 2 display of marijuana variables to "days used in the past 30 days," as this was most closely related to our hypothesized treatment effects on substance use. Figures 7 and 8 display significant 3-way interactions among intervention, time, and network characteristics, peer support and prosocial encouragement. This indicates that the intervention worked as expected for youth with these protective peer network characteristics. For those lacking network support or encouragement, the intervention was not effective in the intervention condition relative to controls. This is shown by the significant condition by month effects in

each model, because this term is the only slope effect of intervention when these network variables are zero.

4. Discussion

The results from this study generally support the efficacy of Peer Network Counseling, but these effects are somewhat complicated and contingent. Here we will summarize the picture that emerges from our analyses, and then go on to discuss where this picture leaves us, and where it might lead.

Intervention effects on growth slopes were noted for measures of alcohol offers ($p=.02$) and previous 30-day use ($p=.08$) among boys. The reduction of alcohol offers for the intervention condition suggests that alcohol use behavior may be closely associated with adolescents' peer network characteristics of risk or protection, at least for boys as we did not find this effect for girls. Decreasing offers may imply fewer drinking peers within boys' networks, or a change in peer behavior, in a less risky direction. A 20-minute intervention that may sway peer-related behavior such as offers for alcohol for up to 6 months is very promising, and could be considered a fairly good return on investment.

However, for girls in the intervention condition marijuana and alcohol use slightly increased relative to control. Intervention-based attenuation of all these measures over the six month study period (relative to control) was found for boys, but not girls. The significant or near-significant intervention effects (condition by month) in the hypothesized direction shown in Table 1 describe the intervention-contingent average trajectories for boys. For girls, these trajectories are the sum of the condition by month and condition by month by gender terms, which in each model almost exactly cancel out. We do not have data to determine why girls did not respond as hypothesized to this intervention. We found no significant baseline gender differences on all marijuana and alcohol variables. One explanation may be related to the interaction of gender and peer effects. For example, research has shown that the selection of peers with similar alcohol use was stronger for boys during early adolescence and for girls during late adolescence (Burke, van der Vorst, Kerr, & Stattin, 2012). It may be that with our sample's mean age of 16.4, girls were more involved with alcohol using peers, and thus peer associated alcohol behavior is more stable, relative to boys. While this interpretation is consistent with our study, it is not a particularly satisfying explanation; one would like to know much more about the specific interaction mechanisms behind these still rather descriptive regularities. Future studies examining such mechanisms and gender-based outcomes in more detail are warranted.

Although we did not find intervention effects for marijuana offers or intentions, we did find such effects in the expected direction among individuals with a higher level of social support and prosocial encouragement for not using. Neither support nor encouragement mediated this effect, because intervention did not have any effect on these measures. Nevertheless, for youth who had higher social support or prosocial encouragement, the intervention was effective in attenuating marijuana use. Similar moderation effects were not found for alcohol. One explanation for this difference between substances is that peer effects operate differently on different substances. Research has demonstrated that peer influence to use

substances appears to be stronger with marijuana than alcohol (Pearson, Steglich & Snijders, 2006; Mason et al., 2014)

This finding raises several issues, i.e. both the apparent importance of protective network characteristics to intervention effectiveness, and the lack of any intervention effect on these network characteristics. It is perhaps ambitious to expect that a 20 minute intervention would be sufficient to impart both the motivation and methods needed to make such a change among peers. Longer-term support may be necessary, e.g. from parents or other adults with whom youth come in regular contact. It is also possible that six months is too short a time to affect qualitative change in affiliations, though again, multiple (if brief) interventions may be required.

Even so, finding that peer network social support and prosocial behavior encouragement seem to potentiate the effects of a brief intervention is an encouraging indication that this research could lead in a promising direction. One might imagine that the intervention provides youths with food for thought, where new behaviors are subsequently “tried out” among an adolescent’s peers. If the peers are generally receptive to these alterations, this might lead to mutual reinforcement of these behaviors, resulting in a shift to a different, more pro-social norm in the peer group. Although field studies of social influence have tended to emphasize pro-substance influence (Burk, van der Vorst, Kerr & Stattin, 2012; Light et al., 2013), there is also specific evidence that peers can be a source of protection from risk (Exner-Cortens, 2014; Mrug & McCray, 2013; Siennick & Osgood, 2012). Our results suggest, in addition, that brief interventions like the one described in this article can reduce risk enhancing peer-based behaviors such as offers for alcohol use. Such a conclusion provides additional motivation to both understand the dynamic mechanisms underlying such risk reduction, as well as to find effective but compact intervention protocols that might directly promote protective characteristics such as peer support and prosocial encouragement. The present study advanced our knowledge by finding intervention effects on alcohol use and alcohol offers for boys and on marijuana for both genders with protective peer networks.

These findings should be considered in light of the limitations of this study. First, our sample of 119 is modest and may limit the power to detect significant changes, especially where complex contingent effects may be present. Second, our measurement outcomes were self-reports and did not include a biological measure. Introducing biological assessments would provide an important validation for the methods used here. Third, our follow-up design extended only 6 months. Longer-term post-intervention assessments would offer more clear-cut evidence regarding both time required for changes, and extinction effects if any. Fourth, we did not have teens identify their close peers in this study due to IRB concerns of identifying peers engaged in illegal behavior. Thus we are able to report on changes of characteristics and peer behaviors, but not on actual peers within a close friend network. Using recall methods that don’t use names, (gender, age, nickname, e.g.) perhaps is one way to collect these data in the future. Finally, our study was conducted with a sample of non-intervention seeking, mild substance using majority African American urban adolescents within a primary care setting. Thus these findings may not be generalizable to other populations or to suburban or rural settings.

In all, these findings provide promise for using Peer Network Counseling to address moderate substance use, especially among urban adolescents with protective peer networks. This study may point to protective peer networks as a strong basis for the utilization of a MI-based, peer focused intervention, particularly for marijuana use. Perhaps using network characteristics as a screen to target particular types of interventions could be tested in future research efforts. The intervention effect of reduced alcohol offers among boys is encouraging for future research. Urban adolescents who are at-risk for substance use disorders are a traditionally hard to reach, underserved, and vulnerable population. More translational research is needed within non-traditional settings such as primary care to address this population's need for early intervention approaches. Finally, more in-depth research, perhaps including qualitative methods, is needed to better understand the meaning of alcohol and marijuana use and the gender-based nuances associated with urban youth.

Acknowledgements

This research was supported by a grant, number 1R34DA032808, from the National Institute on Drug Abuse to the first author. The findings and conclusions are those of the authors and do not necessarily represent the views of the National Institute on Drug Abuse, or National Institute of Health.

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Highlights

- Adolescents were enrolled in Peer Network Counseling and followed for 6 months
- 20 minute intervention reduced offers to use alcohol from friends among boys
- Intervention reduced marijuana use for youth with positive and prosocial peer networks
- Results support further research in targeting protective peer networks for adolescents

Figure 1.

Consort flow diagram detailing allocation, follow-up, and analysis numbers.

Figure 2.
Peer network counseling feedback illustration of risk and protective characteristics of peers.

Figure 3.

Line graph illustrating alcohol days used during previous 30 (categories 0–7) by condition and gender across four time points.

Figure 4.
Line graph illustrating number of alcohol offers (categories 0–7) during previous 30 days by condition and gender across four time points.

Figure 5.

Line graph illustrating intentions to use alcohol during the next 90 days (rating categories 0–4) by condition and gender across four time points.

Figure 6.

Line graph illustrating marijuana days used during previous 30 (categories 0–7) by condition and gender across four time points.

Figure 7.
Line graph illustrating moderating effect of peer network encouragement by condition on marijuana use across four time points.

Figure 8.

Line graph illustrating moderating effect of peer network support by condition on marijuana use across four time points.

Table 1

Substance use models, moderated by gender

	Outcomes: estimate (SE)			
<i>Fixed Effects</i>	Alcohol Days Used	Alcohol Offers	Alcohol Intentions	MJ Days Used
Intercept	−0.70 (0.28) [*]	−0.46 (0.27)	−0.31 (0.21)	0.11 (0.22)
Condition	0.07 (0.44)	0.49 (0.39)	0.40 (0.30)	0.36 (0.32)
Gender/F	0.87 (0.32) ^{***}	0.87 (0.31) ^{**}	0.93 (0.24) ^{***}	0.41 (0.26)
Month	0.08 (0.06)	0.05 (0.06)	0.05 (0.05)	0.04 (0.04)
Cond x Month	−0.20 (0.11) ⁺	−0.23 (0.10) [*]	−0.12 (0.07)	−0.08 (0.05)
Cond x Gender/F	−.61 (.50)	−0.96 (0.44) [*]	−0.66 (−.34) ⁺	−0.80 (0.38) [*]
Gender/F x Month	−0.15 (0.07) [*]	−0.07 (0.07)	−0.08 (0.05)	−0.10 (0.04)
Cond x Gender/F x Month	0.28 (0.13) [*]	0.26 (0.11) [*]	0.13 (0.08) ⁺	0.15 (0.06) [*]
<i>Random Effects</i>				
Level 1 (month) Overdispersion	−0.06 (0.09)	−0.04 (0.07)	−0.26 (0.03) ^{***}	−0.27 (0.10) ^{**}
Level 2 (person)	0.57 (0.12) ^{***}	0.56 (0.11) ^{***}	0.29 (0.06) ^{***}	0.61 (0.10) ^{***}
Analysis N (individuals x months)	465	456	462	465

p<.001**
p<.01*
p<.05+
p<.10

Table 2

Substance use models, moderated by peer network variables.

	Outcomes: estimate (SE)	
<i>Fixed Effects</i>	MJ Days Used By NetEnc	MJ Days Used By NetSup
Intercept	0.53 (0.14) ***	0.52 (0.21) **
Condition	−0.33 (0.21)	−0.54 (0.39)
Network Support		−0.32 (0.16) *
Network Encouragement	−.31 (0.16) +	
Month	−0.09 (0.03) **	−0.11 (0.03) ***
Cond x Month	0.10 (0.04) *	0.14 (0.05) ***
Cond x Network Support		0.72 (0.24) **
Cond x Network Encouragement	0.31 (0.24)	
Network Support x Month		0.16 (0.05) ***
Network Encouragement x Month	0.13 (0.05) **	
Cond x Network Support x Month		−0.24 (0.07) ***
Cond x Network Encouragement x Month	−0.17 (0.07) *	
<i>Random Effects</i>		
Level 1 (month) Overdispersion	−0.27 (0.04) ***	−0.29 (0.04) ***
Level 2 (person)	0.59 (0.10) ***	0.59 (0.09) ***
Analysis N (individuals x months)	450	450

p<.001**
p<.01*
p<.05+
p<.10