

Reducing Social Stress in Urban Adolescents with Peer Network Counseling

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Abstract Increased social stress in the context of peer interactions is associated with multiple negative health outcomes, including substance use. Addressing social stress could provide protective effects for adolescents who are particularly vulnerable to peer-based issues such as loneliness and perceived isolation. Toward this end, we examined the efficacy of a 20-min substance use intervention named peer network counseling to reduce social stress with 119 urban adolescents. Adolescents presenting at primary care clinics were randomized into treatment or control conditions and followed for 6 months. Utilizing a repeated measures general linear model, we examined the effects of peer network counseling while controlling for race, gender, age, depression symptoms, and substance use (alcohol, marijuana). At 6 months the peer network counseling condition decreased social stress compared to controls ($p < 0.05$). A linear mixed-effects moderation model revealed that peer network counseling temporarily moderated the effect of alcohol use, but not for marijuana or heavy alcohol use. Peer network counseling seems to reduce social stress, which suppresses alcohol use among peer network counseling participants in the short term. These promising findings appear to support the efficacy of peer network counseling in reducing social stress, which can moderate alcohol use among urban adolescents.

Keywords Peer network counseling · Social stress · Adolescents · Loneliness · Heavy alcohol use · Brief treatment

Introduction

Adolescence is a sensitive period for the effects of stress on mental and behavioral health. Social stress, such as loneliness and perceived isolation, in particular, has been associated with multiple negative health outcomes. Adolescents can perceive being socially isolated, which is connected to the feeling of loneliness, and both of these terms can be understood as components of social stress (Laursen and Hartl 2013). Adolescent social stress can be conceptualized as the experience of interpersonally produced stress (Reynolds and Kamphaus 2004). Interpersonal stressors are often exacerbated during transitional periods such as entering high school or college. These changes can disrupt established peer networks, reduce social support, and thus increase social stress. Research suggests that the risk of mental health problems may increase with the frequency at which adolescents encounter social stress such as loneliness (Cacioppo et al. 2015; Qualter et al. 2013; van Dulmen and Goossens 2013; Van Rode et al. 2015). To be clear, in the present study loneliness and social isolation are the main constructs under consideration and both are forms of social stress.

Loneliness can be experienced as physically painful for adolescents and is thought to initiate risk behaviors such as substance use or sexual behavior that are used as coping mechanisms to reduce social pain (Stickley et al. 2014). Loneliness can be understood as a form of pain, which is

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derived from social isolation and can mirror the brain's response to physical pain (van Dulmen and Goossens 2013). Thus, the subjective experience of perceived isolation and loneliness can actually “hurt” the adolescent, who then seeks ways to mitigate this discomfort. Some adolescents self-medicate with various substances as a means of coping with this type of social pain. In a large study that examined the association of loneliness and behavioral health among adolescents, loneliness was associated with lifetime use of illicit drugs and marijuana, past 30-day use of alcohol, and binge drinking (Stickley et al. 2014). Relatedly, in a recent systematic review of loneliness, the statistically significant association between loneliness and smoking was established among adolescents, with researchers noting that new smokers may smoke to increase social acceptance and thereby reduce loneliness (Dyal and Valente 2015). Consequently, there is sufficient evidence that loneliness and perceived social isolation are associated with substance use among adolescents, and therefore is an important and needed area for intervention research.

Social isolation creates unique risk factors among adolescents. In both adolescent animal and human models, social exclusion and a lack of social stimulation has shown to be associated with increased anxiety relative to adults, or young children (Fuhrmann et al. 2015). Successfully moving through the critical developmental period of adolescence is conditioned upon developing and maintaining healthful peer interactions (Dishion et al. 1991; Hartup 2009; Molloy et al. 2011). When adolescents struggle during these transitional periods, they become particularly vulnerable to both behavioral and mental health consequences of loneliness and social isolation.

Social stress such as loneliness and social isolation has been shown to reduce the perceived risk in an individual's environment, increasing chances for engaging in behavioral health risks. When encountered with stress, adolescents uniquely demonstrate increased risk taking behavior and lower cost sensitivity compared to adults (Jamieson and Mendes 2016). Thus, adolescents are primed for both increased risk taking as well as mental health problems in the context of social stress. Adolescents perceive and experience loneliness and perceived isolation qualitatively differently than younger children and adults. This body of research provides justification for testing interventions to address these interpersonal issues during adolescence.

Limited research exists on the efficacy of treating loneliness (Stickley et al. 2014). The available research indicates that the primary clinical approaches consist of cognitive behavioral therapy to modify maladaptive social cognitions, group therapy to connect lonely individuals, social skills training to provide interpersonal skills, and community outreach interventions to provide ongoing social support. Among these approaches, cognitive behavioral therapy is

most beneficial in reducing loneliness (Cacioppo et al. 2015). However, this research was conducted with adult samples. Hence, the need exists to rigorously test interventions that address social stressors such as loneliness and isolation with adolescent populations.

A useful theoretical framework in which to understand loneliness and social isolation is social network theory (Berkman and Glass 2000). Social network theory assumes that an individual's interpersonal relationships are responsible for determining individual behavior, access to resources, and ultimately health outcomes (Berkman and Glass 2000). Individual's experiencing elevated levels of loneliness and social isolation may be less socially integrated through reduced (a) social engagement with pro-social activities, (b) level of influence regarding shared values and norms, (c) emotional, instrumental, and informational support, and (d) person to person contact that serve as behavioral models. Berkman and Glass claim that these mechanisms are likely to be most predictive of health promoting and compromising behaviors, and are thus important targets for behavioral change.

The current study aims to test a brief intervention's efficacy in reducing two forms of social stress: loneliness and social isolation. The data are drawn from the original study that was designed to reduce adolescent substance use. The intervention has shown efficacy in reducing substance use and there is evidence that peer relations are an important mechanism of change (Mason et al. 2015). Based on these findings, we sought to test social stress as an outcome and as a moderator, interacting with brief treatment to alter substance use among adolescents. Given the susceptibility of adolescents to social stress, and the association between social stress and substance use, we examined the efficacy of a 20-min substance use intervention named peer network counseling (PNC) to reduce social stress among 119 urban adolescents. We tested the effects of PNC on social stress as an outcome variable, as well as a moderator of the effects of treatment condition on alcohol and marijuana use. Specifically, we hypothesized that adolescents randomized to the PNC condition would have reduced social stress scores at 6 months compared to the control condition. We further hypothesized that social stress would moderate the effects of PNC on alcohol and marijuana use, such that lower levels of social stress would be associated with less alcohol and marijuana use.

Method

Participants

Participants for the study were recruited between April 2013 and February 2014 from an adolescent medicine outpatient

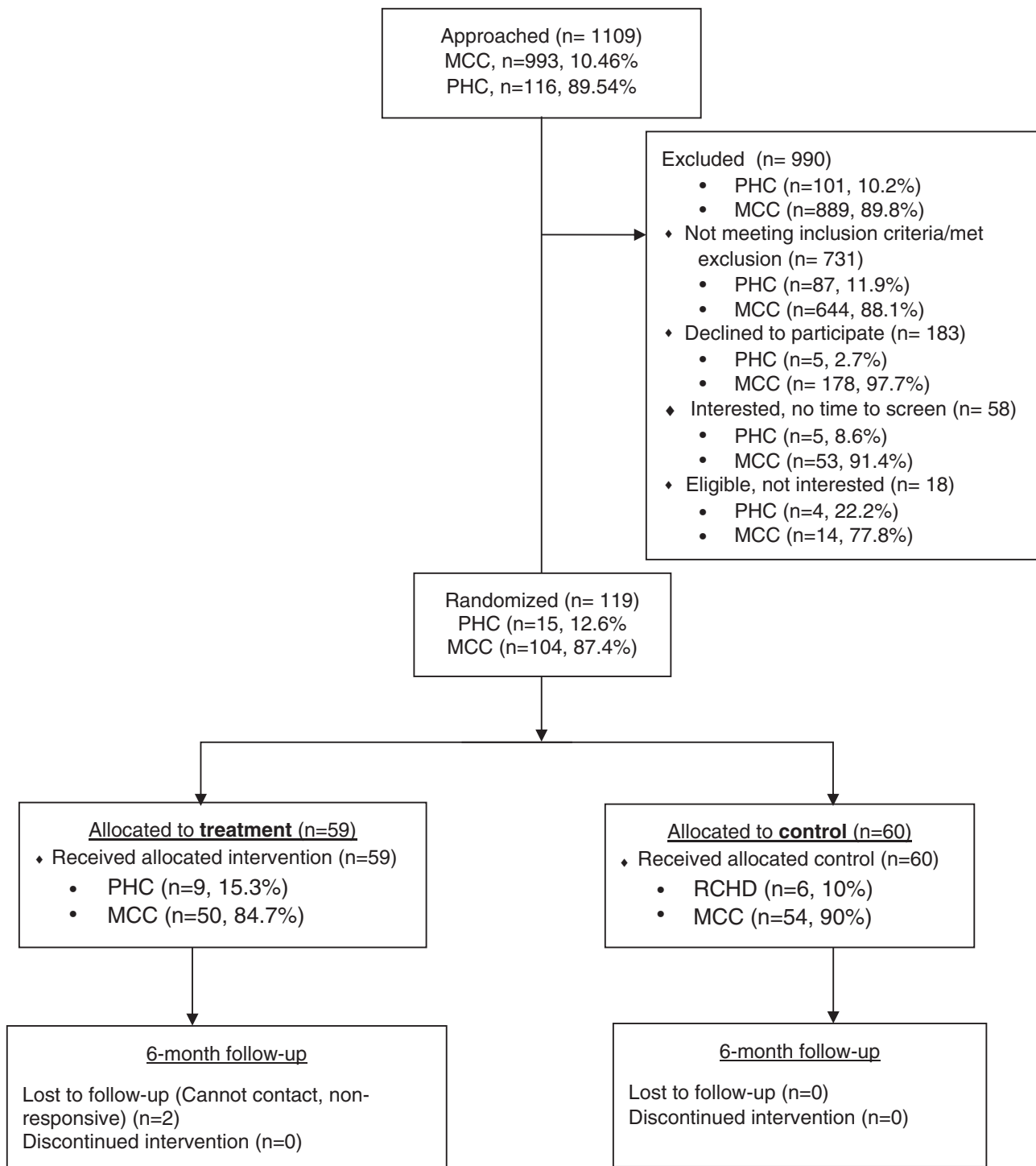


Fig. 1 A consort chart of the participant flow, condition allocation, and follow-up rates across the study. Final number of participants was 119

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; 104 participants (87 %) of the sample were 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 6 months. Participants aged 14–18 years old were selected in order to capture the most at-risk age group for problematic alcohol and marijuana use.

Age-eligible 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. 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 using blocked randomization to create equal numbers allocated to intervention and control groups.

Random sampling blocks representing two, four, six, or eight participants were randomly used during the allocation process to ensure balance in the distribution of participants in across the treatment and control conditions. For example, if half a sampling block was filled with a particular condition, the remaining participants were then allocated to the alternative condition, ensuring equal numbers for each condition. The attention control condition controls for therapist attention by matching the experimental condition in time spent with the adolescent is detailed in the attention control section below. 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.

Procedure

Adolescents assigned to the intervention condition received the PNC intervention (see Mason et al. 2015 for details). PNC is built upon motivational enhancement therapy (MET), a structured intervention based upon motivational interviewing principles (Miller and Rollnick 2013). MET is a client-centered counseling style designed to activate client's motivation to change through the resolution of ambivalence and elicitation of client change talk (client's stated reasons for change). MET has been widely used within health care settings and primary care in particular (Rollnick et al. 2008), and thus fits well within PNC.

PNC is guided by five key clinical issues: rapport, acceptance, collaboration, reflections, and nonconfrontation. PNC incorporates MET procedures such as providing participants normative feedback of their personal substance use compared to age-matched national data. The intervention is structured into four components each lasting for 5 min: (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.

Uniquely, PNC targets peer relations as an active ingredient in making healthful behavioral change. PNC provides support and acceptance of adolescents' peer network health (the sum of protective and risky peer behaviors), while addressing the wide influence peers can have on mental health, academics, careers, and substance use. Adolescents are provided the opportunity to critically examine their personal networks and to determine the composition of their network as well as temporal and place-based considerations (e.g., amount of time spent in locations).

Prior to the intervention, baseline data from the adolescents' surveys are automatically abstracted (via computer programming) and uploaded to a project website. Adolescents answer questions about their substance use, their values and beliefs related to substance use, and about their peer networks. 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 peer network portion of PNC is detailed here as it is most related to the construct social stress, which is the focus of the present study. The peer network component begins by introducing the importance of peer networks and the influence on health, school, and future goals. The therapist uses a colorful, animated powerpoint slide with graphics to illustrate this concept. Next, the teen's personal peer network is reviewed for risks and protection. Peer networks are reviewed for psychological and instrumental support, pro-social activities, and encouragement for healthful behavior, as well as for substance use, influence/offers to use substances, and risky/dangerous activities. 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 of their three closest peers. Each bar has both strengths and risks plotted along a healthy to unhealthy continuum. Participants' network health is visualized for them to review with the therapist's assistance.

Teens are encouraged to reflect on their network in terms of support and encouragement, 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. In this way, participants are not asked to change their entire network, but rather make modifications that can change the context of these relationships, thereby producing different behavioral outcomes.

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 min, matching the experimental condition in length.

Measures

All measures were collected at baseline, 1, 3, and 6 months, with demographic data collected only at baseline. The setting of the study (busy urban primary care clinics) required a brief assessment battery in order to fit in before or after an adolescent's health care appointment. Because the original study's primary aim was to assess the treatment effects of PNC on substance use and related variables such as readiness to change, high-risk sexual behavior, and peer network health (Mason et al. 2015), only 12 items were selected from 6 scales from the Behavior Assessment System for Children, second edition. Items were selected that have shown to be associated with substance use outcomes from the following scales: social stress, depression, anxiety, parent relations, self-esteem, and school problems.

Demographic Information

Participants completed questions on age, race, and gender.

Alcohol and Marijuana Use

Alcohol and marijuana use was assessed using the Center for Disease Control's Youth Risk Behavior Survey (CDC 2012) substance use items. Participants were asked the number of times they used marijuana within the last 30 days, encoded as 0 = 0 times, 1 = 1 or 2 times, 2 = 3–9 times, 3 = 10–19 times, 4 = 20–39 times, and 5 = 40 or more times. Participants were asked the number of days that they used alcohol (at least one drink, more than a sip of alcohol, beer, or wine) during the past 30 days, encoded as 0 = 0 days, 1 = 1 or 2 days, 2 = 3–5 days, 3 = 6–9 days, 4 = 10–19 days, 5 = 20–29 days, and 6 = all 30 days. Participants also were asked "during the last 30 days have you had three or more drinks of alcohol in a row, that is, within a couple of hours?". Responses were encoded as 0 = 0 days, 1 = 1 or 2 days, 2 = 3–5 days, 3 = 6–9 days, 4 = 10–19 days, 5 = 20–29 days, and 6 = all 30 days.

Social Stress

Social stress was measured using two items from the Social Stress scale of the Behavior Assessment System for Children-Second Edition, Self-Report of Personality form (Reynolds and Kamphaus 2004). Two items were chosen due to time-limits of the measurement battery and have been used with similar research (Mason et al. 2015). These items

capture loneliness and perceived isolation. The items used were "I am lonely" and "People act as if they don't hear me", both encoded as 0 = false, 1 = true and were combined to form a two-item measure. These two items correlate with substance use and depression ($p < 0.05$), and reliability analysis using Spearman–Brown, the appropriate statistic for two-item measures (Eisinga et al. 2013), produced an acceptable coefficient of 0.61. No time parameter is provided to participants for the self-report personality measure.

Depression

Depressive symptoms were measured using two items from the Depression scale of the Behavior Assessment System for Children-Second Edition, Self-Report of Personality form (Reynolds and Kamphaus 2004). Two items were chosen due to time-limits of the measurement battery and have been used with similar research (Mason et al. 2015). These items capture hopelessness and inability to enjoy life. The items used were "I don't seem to do anything right" and "I feel like my life is getting worse and worse", both encoded as 0 = false, 1 = true. As with the social stress items, no time parameter is provided to participants for the self-report personality measure.

Data Analyses

We calculated descriptive statistics on all key variables used in our models. To determine the effect of the intervention, a general linear repeated measures model was used to examine follow-up assessments (Time 2, 3, 4), and baseline (Time 1) scores on the key outcome variable: social stress. We conducted a repeated measures analysis, analysis of variance, controlling for race, gender, age, depression symptoms, and alcohol and marijuana use, and examined condition \times time interactions. We obtained effect sizes using the Partial Eta Squared statistic, allowing us to test intervention effectiveness compared to control and across time (baseline to 6-month follow-up).

To test the hypothesis that social stress moderates the relationship between treatment condition and alcohol and marijuana use, we created a moderation model with demographic variables (age, gender, and race) as controls, and included the predictor variable (treatment condition), the moderator variable (social stress), and then the interaction term treatment condition \times social stress. We conducted three moderation tests for past 30-day marijuana use, past 30-day alcohol use, and past 30-day heavy alcohol use. To facilitate interpretation of results, we mean-centered social stress. A linear mixed-effects model was fit for each moderation test, with fixed effects for condition and time (with their interaction), and for social stress (interacted with condition, time, and their interaction). The model was adjusted for age,

Table 1 Descriptive statistics of study variables by condition ($n = 119$)

	Control ($n = 60$)	Treatment ($n = 59$)	<i>P</i> -value
Age	16.5 (1.35)	16.4 (1.23)	0.62
Female	66.7 %	74.6 %	0.34
African American	83 %	85 %	0.83
Baseline social stress	0.44 (0.62)	0.53 (0.77)	0.46
Baseline depression	0.49 (0.78)	0.63 (0.76)	0.33
Baseline marijuana use	2.10 (1.08)	2.03 (1.00)	0.76
Baseline alcohol use	3.18 (2.32)	2.26 (2.36)	0.12
Baseline heavy alcohol use	1.39 (1.36)	0.80 (1.34)	0.08

Note: Marijuana use: 1 = 1 or 2 times, 2 = 3–9 times, 3 = 10–19 times, 4 = 20–39 times

Alcohol use: 0 = 0 days, 1 = 1 or 2 days, 2 = 3–5 days, 3 = 6–9 days, 4 = 10–19 days, 5 = 20–29 days, and 6 = all 30 days

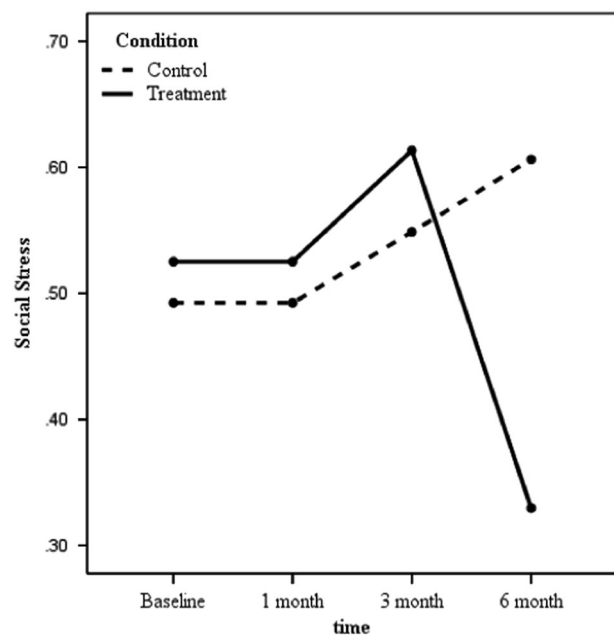
sex, race, and depression. Within-subject dependence due to repeated measurements over time was modeled with unstructured correlation pattern. Moderation for each substance abuse measure was assessed by inspecting for significant interactions with social stress, and predicted values for abuse measures at various levels of social stress were used to visualize any potential moderation.

Missing data were handled using multiple imputation procedures (i.e., expectation maximization algorithm) in SPSS V. 21. Missingness for self-reported data ranged from 0 to 15 %. Little's missing completely at random test was subsequently conducted ($\chi^2 = 3.140$, $DF = 6$, $p > 0.79$), indicating no systematic missingness. Imputed data were then combined using methods described by Rubin (1987). All analyses were conducted using IBM Statistics SPSS version 21 (2012) and the Hayes (2013) Conditional Process Analysis program.

Results

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 treatment condition was 75 % female. Most participants were African American (84 %), with the rest primarily white, Hispanic, or mixed race. Table 1 provides means and standard deviations of baseline social stress, depression, marijuana, and alcohol use. There were no statistically significant differences in variables at baseline between treatment conditions. We maintained a 95 % follow-up rate over 6 months.

The results supported the first hypothesis, that the PNC condition would reduce social stress at 6 months compared to the controls. The repeated measures model found a significant effect ($F [3, 116] = 3.13$, $p < 0.05$), with the PNC

**Fig. 2** The effects of PNC on social stress by condition over 6 months, indicating a possible delayed treatment effect at month 3

producing a small effect size relative to the control group ($\eta^2 = 0.05$). The 6-month PNC group social stress mean was 0.41 ($SD = 0.68$) and the control group use was 0.53 ($SD = 0.72$). At 3 months, a distinct change in slope occurs. The PNC group sharply reduced social stress, while social stress increased in the control group. Figure 2 illustrates the change in social stress by condition over 6 months.

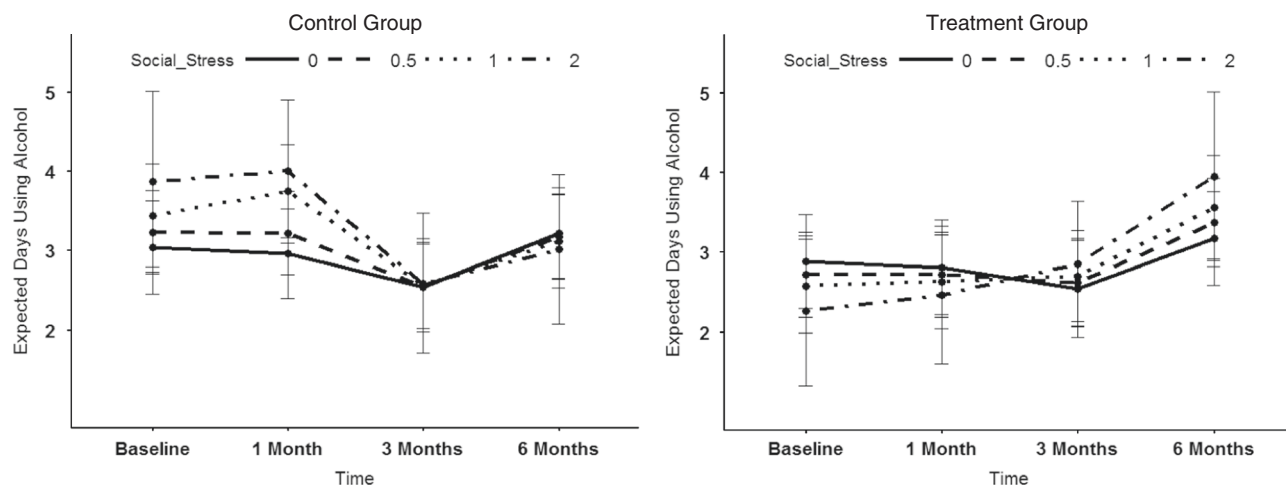
The moderation analyses partially supported the second hypothesis, that social stress would moderate the effects of PNC on alcohol and marijuana use. A weak moderating effect was found for alcohol use, but not for marijuana use or heavy alcohol use. Table 2 provides a summary of the number of estimated parameters in each moderation model used to predict only marijuana use, alcohol use, and heavy alcohol use. As can be seen, the interaction between condition \times time \times social stress for alcohol use was marginally significant at the 5 % level ($p = 0.052$), implying a weak moderating effect. In Fig. 3, we can see that the estimated number of days using alcohol is nearly equal when social stress is 0. However, as social stress increases from 0.5 to 2, the expected number of days using alcohol after 1 month increases in the control group, while the estimates decrease in the PNC group. In both groups, there appears to be some recidivism between 3 and 6 months.

Discussion

Results from this study appear to support the initial efficacy of PNC in reducing social stress among urban adolescents.

Table 2 Moderation analysis predicting marijuana use, alcohol use, and heavy alcohol use by condition and time

Effect	Number of parameters	Marijuana use		Alcohol use		Heavy alcohol use	
		<i>F</i>	<i>P</i> -value	<i>F</i>	<i>P</i> -value	<i>F</i>	<i>P</i> -value
Age	1	1.44	0.23	0.57	0.45	3.14	0.08
Sex	1	0.50	0.48	0.70	0.40	2.47	0.12
Race	1	2.70	0.10	1.63	0.20	4.48	0.04
Depression	1	2.24	0.14	0.33	0.57	1.71	0.19
Condition	1	0.15	0.70	0.09	0.77	0.98	0.32
Time	3	2.83	0.04	4.45	0.004	5.75	0.001
Condition × time	3	0.06	0.98	0.06	0.98	0.76	0.52
Social stress	1	1.38	0.24	1.09	0.30	2.25	0.14
Social stress × condition	1	0.81	0.37	0.87	0.35	0.96	0.33
Social stress × time	3	0.68	0.57	0.13	0.94	0.90	0.44
Social stress × condition × time	3	0.24	0.87	2.59	0.052	0.93	0.43

**Fig. 3** Estimated number of days using alcohol moderated by social stress by time and condition, demonstrating the suppressing effect of PNC on stress

These results seem to demonstrate that PNC can reduce social stress in the form of loneliness and perceived isolation through active reflection on adolescents' peer networks. The findings also support earlier pilot research with PNC that found decreases in social stress among urban adolescents (Mason et al. 2011).

Social stress levels were similar from baseline to the 3-month follow-up assessments. After 3 months the trajectories diverge, with the PNC group steeply reducing the level of social stress while controls' social stress increased. It is unknown why the trajectory would change 3 months after the PNC session. Similarly, it is unknown why the control condition trajectory increased at this same time point. However, in the primary outcome study of PNC, similar trajectories were found with alcohol and marijuana use, with treatment effects appearing to be delayed and then altering the slope at month 3 (Mason et al. 2015). It could

be that the follow-up surveys activate the adolescents' reflection on peers and their own social stress, prompting them to make adjustments in their peer network, which in turn could reduce social stress. More research is needed to further examine the PNC-related mechanisms associated with changes in social stress.

The second major finding was that PNC moderated social stress' effect on alcohol use; however, this effect appears to have its strongest influence from baseline to approximately 2 months. This result supports previous related research that has shown stress to be a major contributor to problematic alcohol use (Grzywacz and Almeida 2008; Stickley et al. 2014). One interpretation of this finding is that adolescents who are experiencing higher levels of social stress participate in drinking in order to be accepted by particular risk-engaging peers, and thus reduce their loneliness and perceived isolation. These adolescents may

have less access to social support resources and therefore engage in drinking in order to belong. It is unknown why marijuana use was not associated with social stress and moderated by the treatment. More research is needed to understand the short-term effects of PNC on alcohol use through reductions in social stress. Future research could employ larger samples in order to tease out associations among various substances and social stress.

Results from this study should be tempered by the following limitations. First, the construct social stress was self-reported and may be subject to bias. Including parents, peers, and perhaps teachers may have provided greater external validity. Second, the construct was measured with only two items. While the reliability analysis result was acceptable with the two items, using the full scale of social stress or another comparable measure would improve confidence in the findings. As the present study was a secondary analysis of a substance use outcome trial, the social stress construct was not the primary outcome variable targeted by PNC. Due to this fact, the measure is less than ideal, but scientifically acceptable. Third, the study followed participants for 6 months, providing a limited trajectory for outcomes. Finally, the sample is primarily urban African American and may not generalize to other groups and settings. Because this population is underserved, the sample composition is also a strength of the study's purposeful design.

In all, these results provide promising evidence for the brief, socially based intervention PNC to reduce social stress among underserved, urban adolescents. Attending to adolescents' peer network health may provide an indirect pathway to sensitive issues such as loneliness and isolation. Unfortunately, these issues are often associated with high-risk behaviors such substance use and are thus important targets when addressing adolescent well-being. These findings suggest that this line of research is worthy of further investigation into the clinical utility of addressing social stress and substance use. Mental health providers may find that addressing social stress is less threatening to some adolescents than directly inquiring about substance use. In this way, adolescents may disclose coping methods and provide clinically useful material in which the clinician may address.

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Compliance with Ethical Standards

Conflict of interest The authors have no conflict of interest related to this manuscript or the related research.

Protection of participants The 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.

Informed consent All participants provided informed consent and if a minor assent with parental consent.

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