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Psychosocial relationship status and quality as predictors of exercise intervention adherence and substance use outcomes: Results from the STRIDE (CTN-0037) study

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Abstract

Social/intimate relationship status and quality are associated with health-promoting behaviors, while living alone or being isolated are adversely associated with physical and mental health outcomes. Limited work has investigated how particular components of one's social environment – usual living arrangements, satisfaction with those arrangements, and global social and family discord – are related to substance use reduction and intervention adherence. We investigated these questions in 270 individuals receiving study intervention for stimulant abuse/dependence through the multi-site Stimulant Reduction Intervention using Dosed Exercise (CTN-0037) trial. Using mixed effects modeling, results indicated that individuals with baseline social discord used stimulants on more days throughout the intervention period than those without social discord ($d=0.39$). An interaction between gender, usual living arrangements, and satisfaction with those arrangements indicated that women who lived alone and were dissatisfied with that arrangement reported greater days of stimulant use compared to several other groups ($d=1.46$). Finally, individuals who reported usually living with a non-partner over the past three years attended a greater percentage of intervention sessions compared to those usually living with a partner ($d=0.34$). These results identify sample subgroups with adverse stimulant use and intervention adherence outcomes and suggest areas for future inquiry/intervention.

Keywords

Stimulant abuse/dependence; Exercise; Psychosocial functioning; Relationship discord

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1. Introduction

Social relationships have a profound – and generally positive – effect on physical and mental health. In addition to the *presence* of social relationships, such as close friendships, family, and intimate/romantic relationships, the *quality* of social relationships is also assessed. Relationship quality is typically assessed through self-report measures or observational coding from dyadic interactions. These quality assessments also usually include perceptions of support received, the extent of positive communication present, and the extent of shared interests. Substantial literature has demonstrated the benefits of perceived social support on general physical health and the functioning of specific physiological systems, including cardiovascular and immunological systems (Uchino, 2006; Umberson et al., 2010). Relationship status, including marriage and cohabitation, has also been associated with better physical and mental health outcomes among both men and women (Dush and Amato, 2005) and reductions in the likelihood of mortality, especially among men (Robards et al., 2012). One explanation for this enhanced physical and mental health may be the health-promoting behaviors, including adherence to exercise and management of chronic medical conditions (DiMatteo, 2004), that committed and supportive relationships provide. Conversely, living alone, being socially isolated, or being lonely have been adversely associated with physical and mental health outcomes (Hawkey and Cacioppo, 2010; Udel et al., 2012). Taken together, these positive outcomes of social relationships also presume a high-quality, supportive relationship to occur. However, the assumption of a supportive relationship is not necessarily borne out in substance use literature.

Within the substance use literature, on the one hand, some literature mirrors that cited above. For example, intimate relationship formation (Rhule-Louie and McMahon, 2007) has been associated with declines in substance use (Fleming et al., 2010; Heinz et al., 2009) and in diagnosable alcohol and drug abuse disorders (Scott et al., 2010). Relationship intimacy and commitment – including marriage – are associated with a reduction in one's drinking (Fischer and Wiersma, 2012), as is the reduction in drinking by one's spouse (Falba and Sindelar, 2008). Furthermore, longer relationship duration has been associated with declines in substance abuse/dependence diagnoses (Gibb et al., 2011). General perceived social support from one's spouse is associated with a reduction in smoking behaviors throughout marriage (Derrick et al., 2013), suggesting that supportive spouses contribute to substance use reduction, while living alone and being divorced or widowed has been associated with increased risky alcohol usage (Schnuerer et al., 2013).

These findings all presume high-quality, supportive, dyadic relationships that are generally protective against adverse substance use outcomes. However, these supportive relationships do not necessarily characterize the relationships of individuals with substance use disorders. In fact, poor social adjustment in a variety of domains characterizes family members and significant others of illicit drug users (Hudson et al., 2002), and conflictual relationships among substance-using individuals and close others, such as family members, have been associated with increased substance use (Denton et al., 2014a). Furthermore, unlike in non-substance using populations, relationship quality must also take into account the substance use patterns of their partner, and a partner's substance use can weaken or even reverse the typically-protective effects of social relationships on health outcomes. For example,

individuals are more likely to engage in future substance use if their partner previously used such substances (Homish et al., 2007), while assortative mating for psychopathology such as substance use disorders is common (Rhule-Louie and McMahon, 2007). In addition, relationship quality can sometimes have counterintuitive effects on substance use treatment outcomes, such as an unexpectedly direct association between relationship quality and drug use (McCollum et al., 2005). Finally, gender differences occur when examining relapse for alcohol and substance abuse. For women, being married and experiencing marital stress were associated with alcohol relapse, while marriage was a protective factor for alcohol relapse rate among men (Walitzer and Dearing, 2006). Gender might therefore be an important moderator of substance use throughout and after intervention. Taken together, this research suggests that a partner's use of substances might negatively affect the ability for a problematic substance user to remain abstinent and therefore suggest that the positive outcomes presumed between relationship status/quality and mental health outcomes do not necessarily hold when examining the interpersonal relationships of substance-using individuals.

Recent research has determined that marriage is becoming less common, while other forms of first unions, such as cohabitation, are becoming more frequent (Copen et al., 2013). Additional findings indicate high rates of divorce among substance abusing individuals (Cranford, 2014) and substantial rates of conflict, including physical violence, before entering substance abuse treatment (Chermack and Blow, 2002). Taken together, this research suggests that substance-using individuals are even less likely to be married or in a high-quality, committed intimate relationship compared to the general population. In light of these findings, rather than a crude measure of marital or intimate relationship status, our work examines whether one's usual living arrangements over the prior three years, as well as satisfaction with these living arrangements, predict intervention adherence and substance use outcomes throughout treatment. Then, in order to provide an additional test of general relationship quality both inside and outside of these usual living arrangements, we include additional measures of global family and social discord. Taken together, these measures provide creative proxies for relationship quality and consider measures of relationship status – other than marriage – that are especially germane for a substance abusing population.

In a sample of stimulant users, we extend prior research by investigating whether: (1) the type of and satisfaction with one's usual living arrangements over the prior three years are associated with reduction in substance use during study interventions including exercise and health education, as well as adherence to these interventions; (2) social and family discord are related to these outcomes; and (3) gender moderates these analyses. Based upon prior research, we hypothesize that living with another person (i.e., intimate relationship partner or non-partner), being satisfied with the usual living arrangement, and having a lower level of conflict in close relationships will be associated with greater levels of intervention adherence and reductions in substance use throughout the intervention period.

2. Method

2.1. Participants and procedure

Participants were recruited from nine community-based, geographically-diverse residential substance abuse treatment programs in the United States through the multi-site Stimulant Reduction Intervention using Dosed Exercise (CTN-0037) trial conducted within the National Drug Abuse Treatment Clinical Trials Network. All participating sites, including the primary site, received Institutional Review Board approval. All participants provided written informed consent before enrollment, and data from 302 participants were collected.

Full study procedures have previously been described previously (Trivedi et al., 2011a, b), and important procedures pertinent to the current study are described here. Eligible participants included individuals with stimulant abuse or dependence (cocaine, methamphetamine, amphetamine, or another stimulant excluding nicotine and caffeine) over the past 12 months as defined by the Fourth Edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994). Eligible participants must have reported stimulant use within 30 days prior to their admission to the residential treatment program and had received medical clearance to engage in cardiovascular exercise. Individuals were excluded if they had a general medical condition that ruled out exercise, had engaged in significant levels of aerobic exercise over the previous three months before study enrollment, met criteria for a current psychotic disorder or opiate dependence, were pregnant, or were considered a high suicide risk. Participants were randomized to receive either health education (HEI; three weekly sessions of one-on-one psychoeducation) or high-dose aerobic exercise (DEI; defined as a dosage of 12 kcal/kg/week, i.e., 30–50 min, 3–5 times per week) for each of 12 weeks. These two potential interventions constituted the full study intervention, with no other adjunct interventions for stimulant-use.

2.2. Measures

2.2.1. Demographics—Participants' gender, race, ethnicity, education, and age were collected.

2.2.2. Intervention adherence—Intervention adherence was defined as the percentage of intervention sessions attended and was computed as a ratio of the number of intervention sessions attended divided by the total number of possible intervention sessions.

2.2.3. Days of stimulant use—The number of days during the 12 intervention weeks where stimulants were used was measured by a combination of the Timeline Followback procedure (Sobell and Sobell, 1992) and urine drug screens, each completed at study screening and three times per week over the intervention phase. This Timeline Followback procedure possesses excellent psychometric properties (Fals-Stewart et al., 2000) and uses a semi-structured interview alongside a calendar and additional memory aids to prompt participants to accurately recall days on which stimulants were used. The selection of this endpoint measure, rather than simply relying on urine drug screens, has been previously described (Trivedi et al., 2011b). The ELCON algorithm was used to reconcile discrepancies between participant self-report (Timeline Followback) and urine drug screen data, following

established procedures (Oden et al., 2011). The primary outcome period used for the original study (Trivedi et al., 2011a) was used in this analysis. Days of stimulant use were computed during a 63-day period (Days 22-84) by calculating the percentage of days in which stimulants were used during the intervention.

2.2.4. Usual living arrangements—The family/social subscale of the Addiction Severity Index-Lite (ASI-Lite; McLellan et al., 1980) was administered to inquire about participants' usual living arrangements. Participants' usual living arrangements over the past three years, or most recent arrangement if time was evenly split between arrangements, were queried at baseline. Current living arrangements may not necessarily have perfectly reflected participants' endorsed usual living arrangements over the prior three years, for cases in which current arrangements were different than usual arrangements over the past three years. Answer responses included: *with sexual partner and children*; *with sexual partner alone*; *with children alone*; *with parents*; *with family*; *with friends*; *alone*; *controlled environment*; and *no stable arrangement*. In order to create meaningful groupings of usual living arrangements with sufficient sample sizes adequately powered to test effects, we collapsed usual living arrangements into three categories: *living with partner* (choices 1–2), *living with non-partner* (choices 3–6), and *living alone*. Individuals in a controlled environment and with no stable arrangement were removed from analysis. In this way, the specific social context of living arrangements (i.e., whether individuals lived with a partner, another person, or alone) was isolated. Participants were also asked whether they were satisfied with their usual living arrangements, with options of *yes*, *no*, and *indifferent*.

2.2.5. Family discord and social discord—Following prior established procedures (Koeter and Hartgers, 1997), the composite family and social score from the ASI-Lite was deconstructed into separate family and social discord components, because the reliability of the separate scales is greater than the composite scale (Denton et al., 2014b). Family discord was defined as a non-zero response to any of the four items: “how many days in the past 30 have you had serious conflicts with your family?”; “How troubled or bothered have you been in the past 30 days by family problems?”; “How important to you now is treatment or counseling for family problems?” and “Have you had significant periods in which you experienced serious problems in the past 30 days with: mother, other significant family, father, brothers/sisters, sexual partner/spouse, children?” Social discord was defined as a non-zero response to any of the four items: “how many days in the past 30 have you had serious conflicts with other people (excluding family)?”; “How troubled or bothered have you been in the past 30 days by social problems?”; “How important to you now is treatment or counseling for social problems?” and “Have you had significant periods in which you experienced serious problems in the past 30 days with: close friends, neighbors, co-workers?”

2.3. Statistical analyses

In order to most efficiently test the hypotheses which involve interactions between multiple effects with longitudinal data, we chose to use two linear mixed-effects models to assess the effects of usual living arrangements, satisfaction with usual living arrangements, family discord, and social discord for each outcome: adherence and days of stimulant use. This

approach resulted in our estimating four models. Two models were run to examine usual living arrangements/satisfaction with living arrangements for each outcome, and another two models were run to examine social/family discord for each outcome. Eight interaction terms were tested for each of the four models. In the first two models, all two-way and three-way interaction terms with usual living arrangements, satisfaction with usual living arrangements, and gender were included for each outcome. In the second two models, all two-and three-way interactions with family discord, social discord, and gender were included for each outcome. Non-significant interaction terms were removed from subsequent models. A significant three-way interaction requires a large number of pairwise comparisons ($n=120$) of subgroups to understand the nature of the interaction. Such a large number of tests requires an adjustment for multiple comparisons; however, the hypothesis – generating nature of the analysis suggests an approach that errs on accepting false-positive findings rather than rejecting true-positive findings. Therefore, a Bonferroni or other multiple-comparison adjustment would be too conservative for this analysis, and we chose to use $p < 0.01$ to assess pairwise comparisons significance. As in prior research with this sample (Trivedi et al., in press) site assignment was a random effect and all other effects were fixed. Outliers were assessed by extreme studentized residuals and removed.

Following prior research (Trivedi et al., in press), each model included covariates of age, education, intervention group, days of stimulant use in the 30 days before treatment admission, race/ethnicity (including variables of African-American/non-African-American and Hispanic/non-Hispanic), usual living arrangements/satisfaction with usual living arrangements, and social/family discord. Cohen's d effect sizes were computed for significant pairwise comparisons (Cortina and Nouri, 2000) using standard conventions (Cohen, 1988) of 0.2 (small), 0.5 (medium) and 0.8 (large). $P < 0.05$ was used to assess significance in all analyses except for post-hoc pairwise comparisons, where $p < 0.01$ was used. As prior research (Trivedi et al., in press) determined no significant differences between HEI and DEI groups on days of stimulant use throughout the intervention, analyses did not examine differences between intervention groups or consider intervention group as a moderator of analyses. Linear mixed models were fit using Proc Mixed in SAS version 9.4.

3. Results

3.1. Demographics and descriptive information

Demographic and descriptive information can be found in Table 1. Data from 302 participants was collected; however, 30 participants reported being in an unstable ($N=22$, 10 DEI and 12 HEI) or controlled environment ($N=8$, 6 DEI and 2 HEI) and were eliminated from analyses and 2 participants were missing data on usual living arrangements and family discord, leaving 270 participants for analysis. The only difference among the 270 participants included in the analyses and the 30 excluded was in the social discord rate: 53% of those included in the analyses reported social discord, compared to 59% of those in an unstable living arrangement and 38% in a controlled environment. Of the 103 participants who reported living with a partner as their usual living arrangement during the past three years, analyses indicated that at study entry 42 (40.8%) were never married, while 36 (35.0%) were separated/divorced/widowed, and 25 (24.3%) were married.

3.2. Days of stimulant use as outcome

One outlier was detected and removed, and covariates were entered as mentioned above.

3.2.1. Model testing interactions with usual living arrangements/satisfaction with usual living arrangements—Table 2 reports the full analyses for this final model, where it can be seen that there is a significant three-way interaction between gender, usual living arrangements, and satisfaction with usual living arrangements ($F=3.8$, $df=2,235$, $p=0.025$, see Table 2). To clarify this interaction, 120 separate pairwise comparisons were tested to incorporate all possible groupings. Results indicated that 9 pairwise comparisons were statistically significant at the $p=0.01$ level, using the full sample of $n=270$ in all analyses (Table 3). In all significant comparisons, one of the groups was always comprised of women who usually lived alone and were dissatisfied with those arrangements. This group demonstrated a significantly greater number of days of substance use (20.4 days) compared to the other nine groups, where days of use ranged from 2.9 to 6.5 days (effect sizes ranged from 1.46 to 1.89). Five pairwise comparisons involving women who lived alone and were dissatisfied with that arrangement, compared to other groupings, were non-significant. Additional details about these analyses are reported in Table 3 and Fig. 1.

3.2.2. Model testing interactions with social/family discord—A significant main effect of social discord was found after removing non-significant interaction terms, such that individuals who reported the presence of social discord used stimulants on more days (9.1 days) compared to those individuals who reported no social discord (5.4 days) ($F=8.4$, $df=1,244$, $p=0.004$, $d=0.39$, see Table 4). No other significant main effects or interactions of family discord with social discord, gender with family discord, gender with social discord, or gender with family discord with social discord were found.

3.3. Percentage of intervention sessions attended as outcome

Two subjects were initially removed as outliers, and no significant interaction terms were found, so interaction terms were deleted from the models.

3.3.1. Model testing interactions with usual living arrangements/satisfaction with usual living arrangements—The model controlling for covariates as mentioned above, and after removing nonsignificant interaction terms, indicated a significant main effect of usual living arrangements on the percentage of sessions attended ($F=3.2$, $df=2,224$, $p=0.041$, see Table 5). A significant pairwise comparison ($t=-2.5$, $p=0.013$) was found between the percentage of sessions attended among individuals living with a partner (62.5% of sessions attended) compared to those individuals living with a non-partner (74.6% of sessions attended; $d=0.34$). Individuals who reported usually living alone were in the middle of the two other groups (65.7% of sessions attended). Interactions of ULA with satisfaction with ULA, gender with ULA, gender with satisfaction with ULA, and gender with ULA with satisfaction with ULA were non significant.

3.3.2. Model testing interactions with social/family discord—Neither social discord nor family discord were significant main effects on the percentage of intervention sessions attended. Also, interactions of family discord with social discord, gender with

family discord, gender with social discord, and gender with family discord with social discord were not significant.

4. Discussion

The current study examined the role of usual living arrangements, satisfaction with usual living arrangements, social discord, and family discord as predictors of days of stimulant use throughout intervention and intervention adherence. The results demonstrated that, as expected, social discord was positively associated with days of substance use, with an effect size in the small-to-medium range. Women who reported usually living alone and being dissatisfied with those arrangements also reported greater days of stimulant use throughout the intervention compared to several other groups, with a large effect size in all results, although the sample size for the comparison group was small, and there were five additional cells that this grouping did not significantly differ from. However, contrary to expectations, individuals usually living with a partner reported attending significantly fewer intervention sessions compared to those usually living with a non-partner, with an effect size in the small-to-medium range.

Our study demonstrated several findings in accordance with prior research, although they should be replicated before generalizability can be ascertained. As expected, social discord was associated with significantly greater days of substance use throughout intervention. This finding aligns with other research that has demonstrated how perceptions of emotional and social support from one's larger social network are associated with cessation of nicotine and cocaine use (Hanson et al., 1990; Havassy et al., 1995) and extends the research on the impact of familial or marital relationships on substance use outcomes (Denton et al., 2014a; Derrick et al., 2013). We also demonstrated that women who usually lived alone and were dissatisfied with those arrangements reported greater days of substance use than several – but not all – other groups. This three-way interaction, although with a very small sample size that could be driven by an outlier effect, adds to literature that has demonstrated the impact of being single or socially isolated on adverse health (Hawkley and Cacioppo, 2010; Udell et al., 2012) and substance use outcomes (Schnuerer et al., 2013) by demonstrating that women who are especially unhappy with this arrangement are most at risk for greater substance use. Prior research demonstrates women display higher levels of sociotropy (investment in interpersonal relationships) compared to men (McBride et al., 2005); although unable to be tested with our data, this discrepancy in relationship investment might partially explain our finding that women, but not men, were especially likely to use substances to the extent they also usually lived alone and were dissatisfied with this arrangement. Women who were dissatisfied at being alone – suggesting that they may have desired a different social arrangement characterized by at least another person to potentially provide social support – could also have used substances in greater amounts as a form of coping with this discrepancy in their social functioning desires versus reality. Indeed, both theoretical research (Wurmser, 1974) and empirical reviews (Akerlind and Hornquist, 1992) have determined a relationship between loneliness and substance misuse. Furthermore, although with a very small sample size, our findings are consistent with clinical experience and prior research discussing the special impact of intimate relationship functioning for women.

One discrepancy from prior research was determined, that individuals who reported living with a partner attended significantly fewer intervention sessions compared to those living with a non-partner. This finding conflicts with prior research demonstrating that married people report greater adherence to health-promoting behaviors compared to unmarried individuals (DiMatteo, 2004). One explanation for this discrepancy is that our study did not directly examine marital status as a predictor, but instead used usual living arrangements, which is not identical to relationship status. Parenting responsibilities might also explain this discrepancy, given that, especially for women, caretaking responsibilities could have affected session attendance. However, participants who reported living with children could have been in either the living with partner or the living with non-partner categories, and there was no explicit data available as to how many participants had children, or what their respective parenting responsibilities were. Substance use of a partner might also mediate the relationship between living with a partner and intervention adherence, but substance misuse status of partners was not assessed in our sample, a limitation of this work.

Additional study limitations included the lack of a clear measure of relationship status that coincided with the same timeframe as usual living arrangements were assessed, the lack of a sophisticated measure of relationship quality beyond general measures of social and family discord, and the use of post-hoc analyses on a convenience sample. Furthermore, the retrospective nature during which data was collected about usual living arrangements prevented a clear understanding of the causality between psychosocial relationship status and functioning and substance abuse outcomes. The timeframe for which usual living arrangements were collected (retrospective report of the prior three years) was different from that of the stimulant use outcome data, meaning that some participants may have been in a different living arrangement over the study intervention period than endorsed by the baseline retrospective living arrangement measure. Nonetheless, the baseline report of usual living arrangements over the prior three years was used in association with substance use outcomes over the intervention's duration. Finally, the sample size for our three-way-interaction comparison group (women living alone and dissatisfied with that arrangement) was small, with very low cell means.

In spite of these limitations, this study was characterized by several strengths. Our study collected data from nine geographically and ethnically diverse sites around the United States, enhancing external validity, and incorporated sophisticated analytic techniques. The current analysis was theoretically informed by substantial literature on the bidirectional association between one's social environment (usual living arrangements) and the quality of those relationships with substance abuse outcomes.

Our study also suggests several areas of potential clinical significance. First, although with a small sample size that is hypothesis-generating and should be confirmed in a larger sample, our findings suggest that women who live alone and are dissatisfied with those arrangements report higher levels of substance use throughout intervention as compared to several other sample subgroups. Therefore, preventative interventions, perhaps in part through psychoeducation about the need for social support and in providing communication training or other skills to improve the quality of one's social support and social relationships, geared specifically at this population, might improve substance use outcomes. Treatment should

also assess reasons for dissatisfaction with usual living arrangements and make use of problem-solving interventions to ameliorate such concerns. It may also be important for substance-using women living alone to seek and receive greater levels of social support from friends, family, or even 12-step and other mutual support groups so as to buffer against their greater risk for substance use. Our finding that individuals usually living with their partner attended significantly fewer intervention sessions as compared to those living with their non-partner indicates the need to consider alternative forms of education and substance abuse treatment, such as partner-assisted therapy (Baucom et al., 2014) or community reinforcement and family training (Meyers et al., 1998). These treatments involve a collateral partner to provide education and support to their treatment-seeking partner and thereby may encourage intervention fidelity and attendance. In summary, our work adds to the literature on the impact of understanding one's social environment and its quality by yielding clinical implications through identifying specific groups of stimulant abusers receiving intervention who are more and less likely to attend and respond to interventions aimed at reducing illicit stimulant usage.

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Fig. 1. Days of stimulant use, by usual living arrangements and satisfaction with usual living arrangements, for men (a) and women (b). Blank columns indicate cells without any participants.

Table 1

Demographic and descriptive information for individuals living with a partner, a non-partner person, or alone.

Baseline variable	All participants (N =270)	Living with partner (N =103)	Living with non-partner (N =111)	Living alone (N =56)	Statistic	p-value
Age, in years, M (SD)	38.71 (10.7)	37.98 (10.3)	37.79 (11.3)	41.89 (9.8)	3.2	0.043
Years of education, M (SD)	12.42 (1.9)	12.30 (2.1)	12.43 (1.8)	12.64 (1.5)	0.6	0.548
Female	113 (41.9%)	42 (40.8%)	57 (51.4%)	14 (25.0%)	10.7	0.005
Marital Status					23.3	0.001
Married	37 (13.7%)	25 (24.3%)	10 (9.0%)	2 (3.6%)		
Widowed/Divorced/Separated	91 (33.7%)	36 (35.0%)	30 (27.0%)	25 (44.6%)		
Never Married	142 (53.6%)	42 (40.8%)	71 (64.0%)	29 (51.8%)		
Satisfaction with ULA					21.4	0.001
Not Satisfied	79 (29.3%)	20 (19.4%)	45 (40.5%)	14 (25.0%)		
Indifferent	22 (8.12%)	14 (14.6%)	1 (0.9%)	7 (12.5%)		
Satisfied	169 (62.6%)	69 (67.0%)	65 (58.6%)	35 (62.5%)		
Family Discord	122 (45.2%)	50 (48.5%)	52 (46.9%)	20 (35.7%)	2.6	0.270
Social Discord	83 (30.7%)	28 (27.2%)	35 (31.5%)	20 (35.7%)	1.3	0.523
Race/Ethnicity					4.1	0.659
White/Not Hispanic	124 (46.1%)	54 (52.4%)	50 (45.1%)	20 (36.4%)		
Black/Not Hispanic	114 (42.4%)	38 (36.9%)	49 (44.1%)	27 (49.1%)		
Other/Not Hispanic	5 (1.9%)	2 (1.9%)	2 (1.8%)	1 (1.8%)		
Hispanic/Latino	26 (9.6%)	9 (8.7%)	10 (9.0%)	7 (12.5%)		
Currently Employed	87 (32.2%)	32 (31.1%)	29 (26.1%)	26 (46.4%)	7.1	0.028

Note. ULA = Usual living arrangements, Statistic = F-value for age and years of education and chi-square for all other variables.

Table 2

Linear mixed-effects model for days of stimulant use testing for significant interactions involving gender, usual living arrangements, and satisfaction with usual living arrangements.

Effect	(num, deno) <i>df</i>	F-statistic	p-value
Age (yrs)	1, 154	1.6	0.210
Race	1, 203	1.2	0.265
Hispanic	1, 142	0.1	0.741
Baseline stimulant use	1, 230	18.6	0.000
Education (yrs)	1, 229	0.2	0.670
Intervention group	1, 234	0.8	0.373
Family discord	1, 233	0.1	0.796
Social discord	1, 236	8.2	0.005
Gender	1, 134	0.8	0.370
Usual living arrangements (ULA)	2, 234	1.8	0.170
Satisfaction with ULA	2, 236	5.2	0.006
ULA $\times$ satisfaction with ULA	4, 236	1.7	0.147
Gender $\times$ ULA	2, 232	0.7	0.516
Gender $\times$ satisfaction with ULA	2, 235	3.4	0.035
Gender $\times$ ULA $\times$ satisfaction with ULA	2, 235	3.8	0.025

Table 3

Significant ($p < 0.01$) pairwise comparisons describing the three-way interaction between gender, usual living arrangements, and satisfaction with usual living arrangements on post-intervention days of stimulant use.

Gender	ULA	ULA satisfaction	N	M (SEM) [range] days of stimulant use	df	t-value	p-value	d
^a Female	Alone	Not satisfied	4 ^b	20.36 (4.78) [0–34]				
Male	Partner	Indifferent	6	2.90 (3.77) [0–12]	237	-2.9	0.004	1.87
Male	Partner	Satisfied	43	5.67 (1.50) [0–30]	25	-2.9	0.004	1.54
Male	Non-partner	Not satisfied	24	6.50 (1.94) [0–42]	237	-2.7	0.007	1.46
Male	Non-partner	Satisfied	29	5.39 (1.81) [0–57]	235	-2.9	0.004	1.89
Female	Partner	Indifferent	8	4.84 (3.42) [0–19]	232	-2.6	0.009	1.62
Female	Partner	Satisfied	24	4.22 (1.97) [0–22]	237	-3.1	0.002	1.70
Female	Non-partner	Not satisfied	21	5.08 (2.27) [0–27]	225	-2.9	0.004	1.57
Female	Non-partner	Satisfied	35	6.09 (1.72) [0–43]	233	-2.8	0.006	1.48
Female	Alone	Satisfied	9	2.57 (3.15) [0–31]	236	-3.1	0.002	1.87

Note.

^a denotes the comparison group against which all other groups below were tested

^b days of use for the 4 participants were 0, 24, 30, 34.

ULA = Usual living arrangements

Table 4

Linear mixed-effects model for days of stimulant use testing for significant interactions involving gender, family discord, and social discord^a.

Effect	(num, deno) <i>df</i>	F-statistic	p-value
Age (yrs)	1, 164	0.8	0.376
Race	1, 210	0.7	0.416
Hispanic	1, 153	0.3	0.572
Baseline stimulant use	1, 240	16.8	0.000
Education (yrs)	1, 233	0.4	0.541
Intervention group	1, 242	1.2	0.275
Family discord	1, 245	0.0	0.886
Social discord	1, 244	8.4	0.004
Gender	1, 87	0.1	0.754
Usual living arrangements (ULA)	2, 241	1.5	0.236
Satisfaction with ULA	2, 244	2.2	0.110

Note:

^aNo interactions included because they were not significant

Table 5

Linear mixed-effects model for percent of sessions attended testing for significant interactions involving gender, usual living arrangements, and satisfaction with usual living arrangements^a.

Effect	(num, deno) <i>df</i>	F-statistic	p-value
Age (yrs)	1, 214	4.4	0.038
Race	1, 235	0.0	0.950
Hispanic	1, 204	0.5	0.490
Baseline stimulant use	1, 245	0.0	0.848
Education (yrs)	1, 245	0.0	0.959
Intervention group	1, 238	8.4	0.004
Family discord	1, 245	0.6	0.431
Social discord	1, 240	0.5	0.490
Gender	1, 167	4.4	0.038
Usual living arrangements (ULA)	2, 244	3.2	0.041
Satisfaction with ULA	2, 242	1.1	0.335

Note:

^aNo interactions included because they were not significant