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Associations between Religiosity, Perceived Social Support, and Stimulant Use in an Untreated Rural Sample in the U.S.A

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Abstract

Background—Religiosity and perceived social support (SS) may serve as protective factors for more severe substance use in adults.

Objectives—This study sought to examine whether aspects of religiosity and SS are associated with longitudinal reductions in stimulant use over three years in an untreated sample of rural drug users.

Methods—Respondent-driven sampling was used to recruit stimulant users (N = 710) from Arkansas, Kentucky, and Ohio. Follow-up interviews were conducted at 6-month intervals for 36 months.

Results—Our bivariate findings indicate that higher religiosity was associated with lower odds and fewer days of methamphetamine and cocaine use. After controlling for covariates, higher religiosity was associated with fewer days of crack cocaine use, but more days of methamphetamine use among a small sample of users in the two final interviews. Higher SS from drug-users was also associated with higher odds and days of methamphetamine and powder cocaine use, while higher SS from non-drug users was associated with fewer days of methamphetamine use.

Conclusions/Importance—Our bivariate findings suggest that higher levels of religiosity may be helpful for some rural individuals in reducing their drug use over time. However, our multivariate findings suggest a need for further exploration of the potential effects of religiosity on longer-term drug use, especially among those who continue to use methamphetamine and/or

remain untreated. Our findings also highlight the potential deleterious effect of SS from drug users on the likelihood and frequency of methamphetamine and powder cocaine use over time among untreated rural drug users.

Keywords

stimulant use; rural drug users; social support; religion

1. Introduction

Cocaine and methamphetamine use have become significant public health issues for many rural US communities over the last decade (Booth et al., 2010; Gfoerer, Larson, & Colliver, 2007; Lambert, Gale, & Hartley, 2008). Rural communities are particularly vulnerable to stimulant use as they often lack needed resources to address legal and health consequences associated with using these illicit drugs (Booth et al., 2010; Booth, Leukefeld, Falck, Wang, & Carlson, 2006; Kramer et al., 2012), as well as the potential treatment needs. Few formal substance use disorder (SUD) treatment options are available within rural communities (Carlson, et al., 2010) and access to treatment programs that do exist may be limited by low availability, limited public transportation, and concerns about being stigmatized within the community (SAMHSA, 2007). Even when formal SUD treatment programs are available, they tend to be underutilized among drug users (Oser et al., 2011; Price, Risk, & Spitznagel, 2001), pointing to the importance of understanding whether informal sources of support for reducing substance abuse are associated with reductions in drug use in rural populations.

Religiosity is one type of informal support that may help protect against more severe substance use in adults (Borders & Booth, 2013; Koenig et al., 1994; Staton-Tindall et al., 2013). More frequent church attendance, prayer, and considering oneself to be “born again” are associated with lower odds of a recent (6-month) alcohol use disorder in adults (Koenig et al., 1994). Among a sample of rural substance users, more frequent church attendance is associated with lower odds of developing an alcohol use disorder over a three-year period (Border & Booth, 2013). Higher scores on a measure of existential well-being are associated with fewer days (in the past 30 days) using alcohol and cocaine among a sample of African American women (Staton-Tindall et al., 2013). Higher ratings on a scale measuring the importance of religion in one's day-to-day life are associated with lower marijuana and alcohol use severity in college students (Luk et al. 2013). These studies suggest that religiosity may help protect against more severe substance use in adults, and some scholars have suggested that religious activities provide access to social support from non-drug using peers and prosocial activities which may help explain this effect (Marsiglia, Kulis, Nieri, & Parsai, 2005).

Indeed, social support can take many forms including support that is emotional (i.e., someone acting as a confidant), instrumental (i.e., providing tangible help or assistance), and companionate (i.e., a group with whom to socialize) (Dour et al., 2014). Perceived social support (SS) is the most commonly measured index of social support (Ibarra-Rovillard & Kuiper, 2011) and is generally defined as the perceived availability and exchange of psychosocial and/or physical resources (Gottlieb, 2000). Lower SS is longitudinally

associated with higher severity of drug use among patients receiving outpatient substance abuse treatment (Dobkin, Civita, Paraherakis, & Gill, 2002). Further, lower SS reported while in treatment is also associated with greater chance of relapse in cocaine use among cocaine dependent men after treatment discharge; however higher SS reported prior to treatment entry is associated with greater relapse in cocaine use (McMahon, 2001). Together, these findings suggest that some types of SS may not be “positive” or aimed at promoting abstinence from drug use. For example, Jonas, Young, Oser, Leukefeld, & Havens (2012) found that rural users of opioids often hold positions of “high social capital” among their drug using peers, suggesting that some opioid users may use drugs to gain social status among their drug using peers. Therefore, it is important to understand the potential long-term effects of positive (e.g., promotes abstinence) and negative (e.g., promotes continued drug use) forms of SS on drug use.

The current study therefore sought to examine whether (a) higher levels of religious beliefs, greater frequency of attendance to religious services, and higher levels of SS from non-drug users was associated with lower odds (and fewer days) of methamphetamine, crack cocaine, and powder cocaine use among an untreated sample of rural stimulant users over a three-year period, and (b) whether higher levels of SS from drug-users is associated with a higher likelihood (and more days' use) of using these stimulants over three-years in this population.

It is important to note that this study builds on a prior investigation examining the effects of race and methamphetamine legislation on use of stimulants in the same sample of rural drug users over a two-year period (Borders et al., 2008). The current report includes the two-years of longitudinal data examined in Borders et al. (2008) and extends this prior research by including (a) a third year of follow-up data on stimulant use in this rural sample and (b) extending this investigation to examine the potential association of religiosity and types of SS on stimulant use among rural stimulant users who did not receive formal or informal (e.g., mutual help groups) drug treatment over the three-year follow-up period after baseline.

2. Method

2.1. Sample, Eligibility, and Recruitment

Data were collected from June 2005 - September 2007 from a natural history study of 710 stimulant users living in rural counties of Arkansas, Kentucky, and Ohio (Booth et al., 2006). Eligible participants were: (1) not in formal or informal (e.g., self-help groups) drug abuse treatment within the past 30 days; (2) 18 years of age or older; (3) had used methamphetamine, crack cocaine or powder cocaine by any route of administration in the past 30 days, and (4) had a verifiable address within one of the study counties.

Each of the study sites recruited participants using Respondent-Driven Sampling (RDS), a type of snowball sampling (Heckathorn, 1997; Wang et al., 2004). Study staff identified potential “seeds” by meeting with drug treatment providers in the local area, distributing research study business cards to individuals who might know drug users, and visiting places frequented by drug users such as bars (Draus, Siegal, Carlson, Falck, & Wang, 2005). Study seeds were asked to complete a baseline interview and then asked to hand out referral coupons describing the study to up to three people they knew used drugs. Each seed received

\$10 each for up to three referrals who contacted the study coordinator, were eligible and enrolled in the study.

2.2. Study Procedure

The study was approved by the institutional review boards at each of the investigators' universities and study researchers received a Certificate of Confidentiality from the National Institute on Drug Abuse (NIDA). Study participants completed the informed consent process prior to the baseline interview. Trained research assistants conducted the face-to-face baseline and follow-up interviews using computer-assisted personal interview software on a laptop computer. Follow-up interviews were conducted at 6-month intervals for a total of 36 months. Follow-up interviews consisted of generally the same questions as asked in the baseline interview. Demographic information was collected and updated at each follow-up interview to optimize the ability of study staff to re-locate participants for the subsequent follow-up. This resulted in a 73% follow-up participation rate at the final 36-month interview.

2.3. Dataset

The goal of analysis was to understand factors associated with drug use in the absence of treatment. Therefore, we excluded data for participants who reported receiving formal or informal drug treatment only at the interview in which they reported obtaining treatment and subsequent interviews under the premise that obtaining treatment would be associated with a change in drug use trajectory. Specifically, participants (N = 710) were asked at each of the follow-up periods to indicate whether they received treatment for substance abuse (alcohol or drug) since their last follow-up interview. Once a participant indicated “yes” at any subsequent follow-up, their data were excluded from the analysis from that specific assessment period throughout the rest of the follow-up interviews. For example, for a participant receiving drug treatment at interview 4, data from interviews 1-3 would be included in the analyses, while data for interviews 4-7 would not be included.

2.4. Measures

Dependent variables—Dependent variables included prior 6-month (yes/no) and 30-day (number of days) use of methamphetamine, powder cocaine, and crack cocaine. For each substance, the interviewer asked the participants whether they used a specific substance in their lifetime. If lifetime use was endorsed by the participant, the interviewer asked whether the substance was used in the prior 6-months and the number of days the substance was used in the prior 30-days.

Independent variables—Religiosity and social support were the independent variables of interest in this study. We assessed two components of religiosity including overall religious feelings and beliefs and frequency of attendance to religious services using three questions from the General Social Survey (Smith, Marsden, Hout, & Kim, 2010). The first question measured overall religious feelings, “How religious do you feel you are?” while the second question measured overall importance of religion in one's life, “To what extent do you consider yourself a religious person?” Responses to both questions were provided on a 5-point Likert scale ranging from 1 (not at all) to 5 (very). A third question assessing

frequency of church attendance was also included, “How often do you go to church?” Response options for this question included more than once a week, weekly, monthly, yearly, holidays, and don't attend. The Cronbach's coefficient for all three items in the first interview was .70.

We included two summary measures of SS to differentially examine the role of SS received from non-drug users and drug users on the likelihood (and days) of stimulant use. Two of the five statements used to assess SS were adapted from the Medical Outcomes Study Social Support Questionnaire (Sherbourne & Stewart, 1991): (a) “There are people I can have a good time with” and (b) “There are people who show they love or care for me.” Three additional statements were added: (c) “There is someone I can talk to about important decisions in my life”, (d) “There are people who recognize my abilities”, and (e) “There are people I can count on in emergencies.” Response options for all five statements ranged from 1 (strongly disagree) to 4 (strongly agree). Both types of SS were assessed using these same five statements with separate instructions requesting a response according to people in the participants' life who use drugs and do not use drugs. A summary measure for each type of SS was created using the means of all five questions for a specific support type (i.e., non-drug user or drug user), with a higher score indicating more support. The Cronbach's coefficient for the non-drug user ($\alpha = .84$) and drug user ($\alpha = .78$) SS scales measured at baseline indicate reasonable internal consistency.

Covariates were included in our statistical models based on review of prior literature documenting characteristics of individuals associated with remission from stimulant use. For example, demographic characteristics such as gender, relationship status (married or single), ethnicity (Black or not), age, education (high school or not), and state where the study was conducted (Arkansas, Kentucky, or Ohio) were included given that these factors may be associated with stimulant use in both U.S. population (Lopez-Quintero et al., 2010) and rural samples (Borders et al., 2008) of drug users. The variable *Time* representing baseline to the 36 month interviews (1 through 7) was also included. We also included as covariates the Addiction Severity Index (ASI; McLellan et al., 1992) legal, employment, and family problem scales as higher scores on these scales (indicating greater severity of a problem) are associated with greater likelihood of methamphetamine and cocaine use in a prior report using this sample of rural drug users (Borders et al., 2008). We also included as covariates the ASI alcohol severity scale and Brief Symptoms Inventory (BSI; Derogatis & Melisaratos, 1983) Global Severity Index (GSI) as both alcohol use and prior mental health functioning have been linked to drug use (Lopes-Quintero et al., 2010; Borders et al., 2008; Booth et al., 2010). Although this study included data on participants not receiving formal treatment during the study period, many participants had been exposed to formal SUD treatment in their lifetime. Therefore, we included exposure to formal SUD treatment (including mutual-help groups) within the three-years prior to the baseline interview as an additional covariate to account for its possible influence on the use of stimulants.

2.5. Data Analysis

Descriptive statistics were calculated and presented for all the variables involved. Bivariate associations between religiosity items, SS summary scales, and outcomes of stimulant use

were examined using separate generalized estimating equations (GEE) with Time included. GEE was also used to examine the association between independent variables and dependent variables (likelihood of drug use and days of use over time) after controlling for covariates (PROC GENMOD in SAS/STAT version 9.3). Interactions between time and independent variables were also included if significant at a significance level of .05 to identify whether the associations between the independent variables of interest changed over time. Distributions of binomial and negative binomial were specified for any drug use and days of drug use with logit and log link respectively. GEE is an extension of generalized linear models that use quasi-likelihood estimation and is frequently used in longitudinal analysis involving data collected by repeated measures. A strength of GEE is that it allows for inclusion of all possible data in the analysis by not excluding participants who had missing data. In the current analysis, we fit a concurrent model where independent and dependent variables were collected at the same interview periods.

3. Results

Descriptive statistics

Table 1 presents descriptive statistics for demographics and clinical characteristics at baseline interview and at each of the follow-up interviews (for time-varying variables only). Study participants tended to be mostly younger, male, single, and white, with less than a high school education. In addition, 72% (n = 509) of participants reported an annual income below \$10,000. Table 1 also presents longitudinal changes in any 6-month methamphetamine, powder, and crack cocaine use over 36-months. At baseline, 49% of the sample reported using methamphetamine, with 57% and 65% using powder and crack cocaine respectively. The use of all stimulants declined over the 36-month period with 13% reporting to use methamphetamine, 23% powder cocaine, and 43% crack cocaine at the last interview. A similar trend was found for days of use for these substances, with reductions in the number of days using all three stimulants observed over the 36-month time period.

Bivariate analysis

A significant bivariate relationship was observed between two religiosity items “How religious do you feel?” and “To what extent do you consider yourself a religious person?” and methamphetamine use ($OR = 0.92$, $p < .05$ and $OR = 0.91$, $p < .05$, respectively) and powder cocaine use ($OR = 0.89$, $p < .01$ and $OR = 0.84$, $p < .01$, respectively) (Table 2). More frequent church attendance was also associated with lower likelihood of powder cocaine use ($OR = 0.94$, $p < .01$). Higher self-appraisal of religiosity and more frequent church attendance was also associated with fewer days of methamphetamine ($b = -0.16$, $p < .05$) and crack cocaine ($b = -0.08$, $p < .01$) use, respectively. Higher SS from drug users was also significantly associated with higher probability of using powder cocaine ($OR = 1.25$, $p < 0.01$), and more days of methamphetamine ($b = 0.13$, $p < .05$) and powder cocaine ($b = 0.18$, $p < .05$) use.

Multivariate analysis

Religiosity, social support, and stimulant use (yes/no) over 36-months

Methamphetamine: A significant interaction between time and the religiosity item “How religious do you feel you are?” was observed for methamphetamine use in the multivariate model after controlling for covariates (see Table 3). This finding indicates that the effect of this component of religiosity depends on time and vice versa. Specifically, the odds of methamphetamine use declined over time at all levels of this religiosity item (OR ranged from 0.63 to 0.77). For one unit increase in time, the odds of methamphetamine use decreased 37% to 23%, all with $p < .05$, depending on the religiosity level reported. On the other hand, the odds of methamphetamine use associated with this religiosity item changed over time, with participants feeling more religious showing the greatest odds of using methamphetamine at interview 6 (30-month, OR = 1.21, indicating that for one unit increase in this religiosity item, the odds of methamphetamine use increased 21%, $p < .05$) and at interview 7 (36 month, OR = 1.27, indicating that for one unit increase in this religiosity item, the odds of methamphetamine use increased 27%, $p < .05$). However, religiosity was not associated with time at earlier interviews. The items “To what extent do you consider yourself a religious person?” and “How often do you go to church?” were not significantly associated with the odds of methamphetamine use over time.

Participants reporting greater SS from drug users had greater odds of using methamphetamine (OR = 1.23, indicating that the odds of methamphetamine use increased 23% for one unit increase in SS from drug users, $p < .05$) while SS from non-drug users was not significantly associated with methamphetamine use.

Being from Arkansas or Kentucky (compared to from Ohio) and male was associated with greater odds of methamphetamine use, while being Black was associated with lower odds of use. Higher ASI legal composite scores and higher scores on the BSI-GSI scale were associated with greater odds of methamphetamine use.

Powder cocaine: After controlling for covariates, higher SS from drug-users was associated with greater odds of powder cocaine use (OR = 1.17, indicating that the odds of powder cocaine use increased 17%, $p < .05$, for one unit increase in SS from drug users); however an association was not found for SS from non-drug users. Time was also significant (OR = 0.83, $p < .05$) indicating a significant decline in powder cocaine use over the 36-month time period. Specifically, for one unit increase in time, the odds of powder cocaine use decreased 17%. Participants from Arkansas and Kentucky (compared to those from Ohio) and those of older age had lower odds of using powder cocaine, while being male, having a high school education or more was associated with more use. Higher ASI legal and alcohol severity scores were also associated with more use powder cocaine use over 36-months.

Crack cocaine: Religiosity items and SS summary scales were not significantly associated with crack cocaine use over 36-months. Participants from Arkansas and Kentucky as compared with those from Ohio and those with high school education or more had greater odds of using crack cocaine; while being Black, of older age, and having a prior SUD

treatment history was significantly associated with greater odds of using crack cocaine. Higher ASI legal, employment, and alcohol severity scales were also associated with greater odds of crack cocaine use. A higher score on the BSI-GSI scale was also associated with more use of crack cocaine.

Religiosity, social support, and days of stimulant use over 36-months

Methamphetamine: After controlling for covariates, the religiosity items were not significantly associated with number of days of methamphetamine use (Table 4). Higher SS from drug users was significantly associated with more days of methamphetamine use (regression coefficient, $b = 0.29$, $p < .01$). We found a significant interaction between time and SS from non-drug users ($b = -0.22$, $p < .01$). Specifically, higher SS from non-drug users was associated with fewer days of methamphetamine use towards later interviews (parameter estimates (b) in the log scale were -0.326 ($p < .05$), -0.552 ($p < .01$), -0.778 ($p < .01$) and -1.003 ($p < .01$) at 18, 24, 30 and 36 interviews respectively). In general, similar associations between covariates and days of methamphetamine use were observed as were found for any past 6-month use. However, gender and education were not associated with the number of days of methamphetamine use.

Powder cocaine: For days of powder cocaine use, the religiosity items were not significantly associated. However, higher SS from drug users was significantly associated with more days of powder cocaine use ($b = 0.18$, $p < 0.05$). Perceived social support from non-drug users was not significantly associated with days of powder cocaine use. Participants from Kentucky compared to those from Ohio, and of older age had fewer days of powder cocaine use over the 36-month time period. Participants who were Black, and who reported higher ASI legal and alcohol severity scores also had more days using powder cocaine.

Crack cocaine: Higher scores on the items “How religious do you feel you are?” and more frequent church attendance were associated with fewer days of crack cocaine use ($b = -0.10$, $p < .05$) and ($b = -0.11$, $p < .01$) respectively. However, SS was not significantly associated with days of crack cocaine use. In general, a similar pattern of association was found between most covariates and days of crack cocaine use as was found for crack cocaine use (yes/no). However, in contrast to any use, being male was associated with fewer days of crack cocaine use, while ASI employment severity was not.

4. Discussion

Overall, use of cocaine and methamphetamine declined over time, with only 12.5% of the remaining untreated sample using methamphetamine at the 36-month interview, and 23.3% and 42.9% using powder and crack cocaine, respectively. Thus the trajectory described in our previous report (Borders et al., 2008) continued its course through three years of follow-up.

We found mixed support for our first hypothesis that higher scores on the religiosity items would be associated with lower levels of stimulant use. As predicted, our bivariate analysis showed that components of religiosity were associated with lower odds of using

methamphetamine and powder cocaine but not crack cocaine. We also found that greater perceptions of being religious and higher frequency of church attendance were associated with fewer days of methamphetamine and crack cocaine use, respectively. In general, these findings are consistent with studies that show increased self-reported religiosity to be associated with lower severity drug use in college students (Gomes et al., 2013; Luk et al., 2013), adults in the general population (Kendler et al., 2003), and urban drug users (Staton-Tindall, Duvall, Stevens-Watkins, & Oser, 2013). For example, Staton-Tindall and colleagues (2013) interviewed 206 African American women and found that higher scores on a measure of religious well-being were cross-sectionally associated with fewer days of recent (past 30-day) cocaine use. Our bivariate findings also support prior qualitative research showing that when interviewed, rural drug users often report religious attendance, prayer, and the belief that God has the power to influence drug use to be important influences in deciding whether to cut down or achieve abstinence (Cheney et al., 2014).

However, after controlling for some powerful covariates, we did not find components of religiosity to be independently associated with the odds of stimulant use in our sample other than a statistically significant relationship between higher feelings of religiousness and greater odds of methamphetamine use in the final two study interviews. This finding was not expected and explanatory factors for this observed relationship remain unclear. It may be that these relatively small samples of remaining methamphetamine users feel religious but experience challenges in locating available treatment services (Carlson et al., 2010), fear stigma associated with receiving treatment (SAMHSA, 2007), and/or have been unsuccessful in reducing their drug use in response to informal (i.e., religious services) support services.

Our findings also showed that two of the three aspects of religiosity measured were associated with fewer days of crack cocaine use, but not methamphetamine or powder cocaine use, after controlling for the same covariates. This suggests that perhaps the extent to which one “feels religious” and higher frequency of church attendance may have stronger protective effects for frequency of crack cocaine use than for use of powder cocaine or methamphetamine. A study conducted by Staton-Tindall and colleagues (2013) lends partial support to this notion as they found higher indicators of religious well-being to be associated with fewer days of cocaine use but not marijuana among a sample of African American women. Although the study by Staton-Tindall and colleagues (2013) did not examine powder cocaine or crack cocaine separately, the findings suggest that some aspects of religiosity may exert a protective for some illicit drugs and not others. The present study extends this research by providing a first step in identifying a potential differential protective effect of two aspects of religiosity (extent to which one perceives oneself as religious and church attendance) on crack cocaine use in a sample of untreated rural drug users over a three-year period. Our findings, along with research showing that persons in recovery tend to report higher feelings of religious faith and affiliation, and better mental health outcomes (Pardini, Plante, Sherman, & Stump, 2000) suggest that religiosity may be important to reducing some substances and perhaps not others. However, explanatory pathways for this relationship among rural substance users remain largely unexamined. Thus, further research

may be needed to more clearly explicate the role of religiosity on longer-term stimulant use in this population.

We also found mixed support for our prediction that type of SS would be differentially associated with the odds and number of days of stimulant use over the three-year study period. Overall, SS from non-drug users was not associated with the odds or frequency of stimulant use in our bivariate analysis or after controlling for covariates. It is possible that this finding reflects the perceived challenges some drug users face when attempting to access positive sources of SS within their community. A recent qualitative study of rural cocaine users found that although this population reports having access to social networks of non-drug using individuals they (especially more severe drug users) often feel marginalized and isolated within these communities (Goldberg & Brown, 2009-2010), potentially serving to limit access to social support from more “positive” social networks.

However, we did find that SS from non-drug users was associated with fewer days of methamphetamine use, suggesting that more positive forms of social support may also serve as a protective factor against greater severity of methamphetamine use but not cocaine use. Indeed, perceived access to positive forms of social support has been shown to reduce the likelihood of past-year methamphetamine use in college students (Herman-Stahl et al., 2007). However, there are few studies examining the relationship between SS type and methamphetamine use in adults suggesting a need for additional research to understand factors contributing to this association, which is outside the scope of the present study. Our study does extend this literature to suggest that SS from non-drug users may serve as a protective factor for higher frequency methamphetamine use in a sample of untreated rural stimulants users.

In general, we found that higher SS from drug-users was associated with higher odds and frequency of stimulant use over time. After controlling for covariates, SS from drug users was associated with a greater likelihood and frequency of methamphetamine use and greater likelihood of powder cocaine use. This association has also been found in inner city adult drug user (Schroeder et al., 2001) which suggests that the presence of substance users in one's social network are a risk factor for continued stimulant use, and especially among rural users who may have less access to formal sources of support. Freely available sources of support for substance use such as mutual-help groups can play an important role in reducing one's substance use by helping to build more adaptive social networks (Kelly, Hoepfner, Stout, & Pagano, 2011a; Kelly, Stout, Magill, & Tonigan, 2011b). Thus, increasing awareness and access to mutual-help groups may be a needed public health effort to reduce stimulant use among rural users who may be resistant to seeking more formal SUD treatment.

Strengths and limitations

This study has several strengths and limitations. The strengths include study inclusion of three rural geographical regions of the U.S. which may enhance the generalizability of our findings. In addition, this study also included multiple assessments over a three year period allowing us to examine the potential influence of the variables of interest on stimulant use (and trajectories of stimulant use) over time. Limitations include the use of respondent-drive

sampling which may have biased our sample toward participants with stronger drug-using social networks due to the non-random nature of this design. Should this be the case, our results may not be generalizable to the larger population of stimulant users living in the rural counties of the study sites and larger United States. Further, the use of statistical significance tests may not be informative with non-probability samples. However, this limitation must be considered in the context of the potential challenges in using random sampling procedures with rural or drug using populations. The number of assessments administered in the present study may have also played a role in influencing, via assessment effects, outcomes over time (e.g., Kurtz, Surratt, Buttram, & Levi-Minzi, 2013). Participants were also required to have a verifiable address to participate in this study which may have further reduced the generalizability of our findings to homeless or marginally homed individuals. Participants in this study were also mostly male, single and white which may further limit the generalizability of study findings, although it is notable that 39% of the sample was female and almost 30% black. The data analyzed in this study were also collected about a decade ago so the degree to which the findings represent current self-reported religiosity, perceived SS, and stimulant use among drug users living in the study communities is unknown.

Summary and conclusion

In general, our bivariate findings show that higher religiosity is associated with lower odds and frequency of methamphetamine and cocaine use, suggesting that this informal source of support may be helpful for some individuals in reducing their drug use over a three-year period. After controlling for several covariates, our multivariate findings highlight the complex associations between religiosity and stimulant use among untreated rural stimulant users. For example, higher religiosity may serve as a protective factor for reducing the frequency of crack cocaine use over time, while serve as a risk factor for higher frequency of methamphetamine use among a relatively small sample of remaining users in the two final interviews. These findings suggest a need for further exploration of the potential effects of religiosity on long-term drug use in rural populations, and especially among those who continue to use methamphetamine and/or remain untreated over time. Our findings also highlight the potential influence of SS from drug users on the likelihood and frequency of methamphetamine and powder cocaine use over time among untreated rural users.

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Table 1
Descriptive statistics obtained at baseline and follow-up interviews for untreated rural stimulant users

Variables	N(%)					
	Baseline	6 months	12 months	18 months	24 Months	30 months
Total participants Untreated up to follow up interview						
	(n = 710)	(n = 603)	(n = 581)	(n = 575)	(n = 561)	(n = 563)
		(n = 503)	(n = 439)	(n = 405)	(n = 360)	(n = 334)
						(n = 296)
Independent Variables						
State of residence						
Arkansas	237 (33.38)					
Kentucky	225 (31.69)					
Ohio	248 (34.96)					
Gender						
Male	436 (61.41)					
Female	274 (38.59)					
Marital Status (n, %)						
Married/have partner	112 (15.77)					
Single	598 (84.23)					
Race						
Black	208 (29.30)					
White	482 (67.89)					
Hispanic	5 (0.70)					
Native America	4 (0.56)					
Other	11 (1.55)					
Age, mean (SD)	32.56 (10.35)					
Education						
< high school	432 (60.85)					
high school	278 (39.15)					
Prior SUD Tx at baseline						
Yes	142 (20)					
No	568 (80)					

	N(%)					
	Baseline	6 months	12 months	18 months	24 Months	30 months
Total participants Untreated up to follow up interview						
	(n = 710)	(n = 603)	(n = 581)	(n = 575)	(n = 561)	(n = 563)
		(n = 503)	(n = 439)	(n = 405)	(n = 360)	(n = 334)
ASI scores, mean (SD)						
Legal	0.17 (0.21)	0.11 (0.18)	0.09 (0.17)	0.07 (0.15)	0.06 (0.13)	0.08 (0.16)
Employment	0.58 (0.27)	0.59 (0.29)	0.56 (0.30)	0.57 (0.29)	0.57 (0.30)	0.58 (0.32)
Family	0.19 (0.20)	0.15 (0.18)	0.12 (0.18)	0.10 (0.16)	0.09 (0.16)	0.09 (0.16)
Alcohol	0.18 (0.19)	0.15 (0.17)	0.14 (0.15)	0.13 (0.14)	0.13 (0.15)	0.12 (0.14)
	0.86 (0.70)	0.71 (0.71)	0.62 (0.68)	0.52 (0.60)	0.49 (0.62)	0.44 (0.59)
BSI-GSI, mean (SD)						
Religiosity, mean (SD)						
Feel religious...	2.93 (1.17)	3.07 (1.26)	3.11 (1.26)	3.04 (1.18)	3.16 (1.24)	3.19 (1.27)
Religious person...	3.26 (1.40)	3.45 (1.40)	3.49 (1.36)	3.54 (1.35)	3.56 (1.34)	3.60 (1.35)
Attend church...	2.30 (1.60)	2.29 (1.56)	2.28 (1.52)	2.25 (1.50)	2.30 (1.60)	2.31 (1.52)
Social support, mean (SD)						
Non drug user	3.26 (0.57)	3.19 (0.54)	3.16 (0.52)	3.21 (0.47)	3.17 (0.51)	3.13 (0.46)
Drug user	2.91 (0.66)	2.79 (0.66)	2.73 (0.63)	2.77 (0.64)	2.73 (0.65)	2.70 (0.61)
Dependent Variables						
Meth use (% yes)	48.65	34.39	29.84	22.47	19.17	16.17
Cocaine use (% yes)						12.50
Powder						
	57.46	42.15	38.27	36.30	32.78	28.74
Crack						
	65.35	54.87	46.47	42.72	43.61	45.51
						42.90
Meth days, mean (SD)						
	3.56 (6.92)	2.11 (5.43)	1.67 (5.05)	1.43 (4.74)	0.82 (3.49)	0.67 (3.03)
Cocaine days, mean (SD)						
Powder	4.00 (7.25)	2.03 (5.26)	1.80 (5.18)	1.60 (4.99)	1.42 (4.61)	1.41 (4.19)
Crack	7.00 (9.56)	4.81 (8.86)	4.69 (8.88)	4.93 (9.27)	4.72 (9.04)	5.25 (9.37)
						4.92 (9.04)

SD = standard deviation; SUD Tx = substance use disorder treatment; ASI = Addiction Severity Index; BSI-GSI = Brief Symptoms Inventory - Global Severity Index. Drug-user = strength of perceived support from non-drug using individuals, non-drug-user = strength of perceived support from non-drug users.

Table 2

GEE models (controlling for Time) examining bivariate associations between religiosity, social support, and outcomes in untreated rural stimulant users.

Parameter Estimates						
Variables	$\hat{\gamma}$ Meth Use	$\hat{\gamma}$ Powder Use	$\hat{\gamma}$ Crack Use	$\hat{\gamma}$ Meth Days	$\hat{\gamma}$ Powder Days	$\hat{\gamma}$ Crack Days
Feel religious...	0.92 *	0.89 **	1.03	-0.07	-0.04	-0.18
Religious person...	0.91 *	0.84 **	1.02	-0.16 **	-0.05	0.02
Attend church	0.96	0.94 **	1.00	-0.07	-0.03	-0.08 **
Non drug user	0.92	0.92	0.91	-0.13	-0.04	-0.01
Drug user	1.00	1.25 **	1.00	0.13 *	0.18 *	0.08

Drug-user = strength of perceived support from non-drug using individuals, non-drug-user = strength of perceived support from non-drug users.

**
p < .01,

*
p < .05

$\hat{\gamma}$ odds ratio,

$\hat{\gamma}$ regression coefficient

Table 3
GEE models (concurrent) of past 6 month methamphetamine, powder cocaine, and crack cocaine use (yes/no) in untreated rural stimulant users

Variables	<u>Methamphetamine</u>		<u>Powder cocaine</u>		<u>Crack cocaine</u>	
	OR	95% CI	OR	95% CI	OR	95% CI
Time						
Feel religious...= 1	0.63 ^{**}	0.57, 0.71			0.88 ^{**}	0.85, 0.92
Feel religious...= 2	0.67 ^{**}	0.62, 0.72				
Feel religious...= 3	0.70 ^{**}	0.66, 0.74				
Feel religious...= 4	0.73 ^{**}	0.68, 0.79				
Feel religious...= 5	0.77 ^{**}	0.70, 0.85				
Religiosity						
Feel religious...			1.03	0.91, 1.17	0.98	0.90, 1.08
Baseline	0.94	0.81, 1.10				
6-month	0.99	0.87, 1.13				
12-month	1.04	0.92, 1.18				
18-month	1.09	0.96, 1.25				
24-month	1.15	0.98, 1.34				
30-month	1.21 [*]	1.00, 1.45				
36-month	1.27 [*]	1.02, 1.58				
Religious person...	0.93	0.83, 1.05	0.90	0.81, 1.00	0.97	0.89, 1.05
Attend church...	0.99	0.93, 1.08	0.96	0.90, 1.03	1.01	0.95, 1.07
Social support						
Non drug user	0.87	0.72, 1.05	0.88	0.72, 1.06	0.89	0.77, 1.01
Drug user	1.23 [*]	1.04, 1.45	1.17 [*]	1.01, 1.36	0.94	0.83, 1.05
State of residence						
Arkansas (ref. Ohio)	10.09 ^{**}	6.41, 15.88	0.51 ^{**}	0.35, 0.74	0.38 ^{**}	0.25, 0.57
Kentucky (ref. Ohio)	6.49 ^{**}	4.38, 9.63	0.36 ^{**}	0.26, 0.51	0.36 ^{**}	0.25, 0.51
Male (ref. female)	1.47 [*]	1.07, 2.02	1.61 ^{**}	1.21, 2.14	0.75	0.57, 1.01

Variables	Methamphetamine		Powder cocaine		Crack cocaine	
	OR	95% CI	OR	95% CI	OR	95% CI
Married/partner (ref single)	0.98	0.64, 1.50	1.10	0.76, 1.59	1.13	0.80, 1.62
Black (ref. not Black)	0.03**	0.02, 0.06	0.95	0.66, 1.38	3.68**	2.52, 5.37
Age	0.99	0.97, 1.01	0.94**	0.93, 0.95	1.06**	1.05, 1.08
High school (ref. < high school)	.074	0.54, 1.01	1.55**	1.16, 2.05	0.70*	0.53, 0.93
Prior SUD Tx at baseline (ref. no Tx)	0.94	0.65, 1.37	0.97	0.70, 1.33	1.63**	1.15, 2.31
ASI scores						
Legal	2.82**	1.56, 5.11	2.63**	1.50, 4.60	3.54**	2.19, 5.70
Employment	0.92	0.63, 1.36	1.16	0.80, 1.68	2.00**	1.38, 2.89
Family	1.16	0.62, 2.15	0.87	0.48, 1.58	1.26	0.79, 2.00
Alcohol	1.16	0.53, 2.51	3.39**	1.80, 6.36	7.20**	3.79, 13.68
BSI-GSI	1.44**	1.20, 1.74	1.16	0.97, 1.38	1.20*	1.01, 1.41

SUD Tx = substance use disorder treatment; ASI = Addiction Severity Index; BSI-GSI = Brief Symptoms Inventory - Global Severity Index.

**
p < .01,

*
p < .05

Responses to item "Feel religious..." were provided on a 5-point Likert scale ranging from 1 (not at all) to 5 (very).

Drug-user = strength of perceived support from non-drug using individuals, non-drug-user = strength of perceived support from non-drug users.

Table 4
GEE models (concurrent) of past 30-day (number of days used) methamphetamine, powder cocaine, and crack cocaine use in untreated rural stimulant users

Variables	Methamphetamine		Powder cocaine		Crack cocaine	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Time						
Time	0.37	-0.03, 0.78	-0.16**	-0.23, -0.09	-0.07**	-0.12, -0.02
Religiosity						
Feel religious...	0.04	-0.12, 0.21	-0.02	-0.17, 0.12	-0.10*	-0.18, -0.02
Religious person...	-0.12	-0.26, 0.02	-0.95	-0.21, 0.02	-0.02	-0.10, 0.04
Attend church...	0.04	-0.03, 0.13	-0.07	-0.14, 0.00	-0.11**	-0.16, -0.05
Social support						
Non drug user	0.57*	0.13, 1.01	-0.12	-0.32, 0.07	0.00	-0.15, 0.15
Drug user	0.29**	0.07, 0.52	0.18*	0.00, 0.36	0.09	-0.03, 0.22
Time × social support non drug user	-0.22**	-0.34, -0.10				
State of residence						
Arkansas (ref. Ohio)	2.95**	2.46, 3.44	-0.05	-0.38, 0.28	-0.04	-0.39, 0.31
Kentucky (ref. Ohio)	2.08**	1.61, 2.55	-0.51*	-0.93, -0.08	-0.75**	-1.13, -0.3
Male (ref. female)	-0.06	-0.48, 0.35	0.03	-0.33, 0.40	-0.45**	-0.72, -0.18
Married/partner (ref. single)	0.41	-0.17, 0.99	0.37	-0.19, 0.94	-0.01	-0.34, 0.32
Black (ref. not Black)	-4.00**	-4.63, -3.37	0.96**	0.56, 1.35	1.27**	0.96, 1.59
Age	-0.00	-0.02, 0.01	-0.01**	-0.06, -0.02	0.04**	0.02, 0.05
High school (ref. < high school)	-0.32	-0.70, 0.04	0.26	-0.10, 0.64	-0.29*	-0.54, -0.03
Prior SUD Tx at baseline (ref. no Tx)	-0.23	-0.69, 0.22	-0.07	-0.40, 0.25	0.15	-0.15, 0.46
ASI scores						
Legal	1.64**	1.02, 2.27	1.93**	1.31, 2.54	0.64**	0.19, 1.08
Employment	-0.23	-0.85, 0.38	-0.07	-0.48, 0.33	0.14	-0.19, 0.48
Family	-0.08	-1.10, 0.93	0.01	-0.60, 0.62	0.19	-0.23, 0.61
Alcohol	1.16**	0.54, 2.68	1.44**	0.84, 2.04	1.75**	1.31, 2.18
BSI-GSI	0.35**	0.09, 0.61	0.13	-0.04, 0.31	0.26**	0.09, 0.42

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SUD Tx = substance use disorder treatment; ASI = Addiction Severity Index; BSI-GSI = Brief Symptoms Inventory - Global Severity Index.
Responses to item “Feel religious...” were provided on a 5-point Likert scale ranging from 1 (not at all) to 5 (very).
Drug-user = strength of perceived support from non-drug using individuals, non-drug-user = strength of perceived support from non-drug users.
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