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**Drug Use and Social Support Outcomes in Probationers:
A Longitudinal Social Network Analysis**

**A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor
of Philosophy at Virginia Commonwealth University**

by

Anne Giuranna Rhodes

Masters of Science, Virginia Polytechnic Institute and State University, 1993

Bachelors of Science, Virginia Polytechnic Institute and State University, 1991

Director: Resa M. Jones, MPH, PhD

Associate Professor and Graduate Program Director

Division of Epidemiology, Department of Family Medicine and Population Health

Virginia Commonwealth University

Richmond, VA

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DRUG USE AND SOCIAL SUPPORT OUTCOMES IN PROBATIONERS: A LONGITUDINAL SOCIAL NETWORK ANALYSIS

By: Anne Giuranna Rhodes, M.S.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

Virginia Commonwealth University, 2014

**Director: Resa M. Jones, MPH, PhD
Associate Professor and Graduate Program Director
Division of Epidemiology, Department of Family Medicine and Population Health**

ABSTRACT

This study focuses on the social networks of probationers, who comprise the largest segment of the criminal justice population in the United States, but about whom there are few studies of network processes. It provides information on how elements of a probationer's social network change over time and can affect drug use. This study employs longitudinal analysis of the social networks for 251 substance abusers on probation to examine how these networks are influenced by an intervention designed to increase pro-social behaviors and how network changes impact drug use.

Baseline drug use of the probationers was examined according to the number of substances used in the last 6 months. Blacks were less likely to be polydrug users (aOR: 0.34, 95% CI: 0.14 to 0.84), while those using cocaine or heroin as their primary drug of choice were more likely to be polydrug users (aOR: 3.02, 95% CI: 1.32 to 6.94). Age at first illicit drug use was also significant, with those initiating drug use younger than 18 more likely to be polydrug users (aOR: 2.12, 95% CI: 1.01 to 4.46). The majority of probationers had drug user networks with the same number of persons in them over the 12-month follow-up period (82.5%), and perceived social support that also did not change (76.1%). Men were less likely to change their

drug user networks over time and older persons were less likely to have decreasing social support over time.

Those with low drug use that have increasing (aOR= 5.08, 95% CI: 1.09 to 23.75) and decreasing (aOR= 6.45, 95% CI: 1.35 to 30.85) drug user networks over time were more likely to be in the lowest drug using group compared to those with stable larger drug user networks.

Older persons were less likely to be in the drug use trajectory (aOR=0.96, 95% CI: 0.92 to 0.99), whereas those with high criminal risk were more likely to be in a stable drug use class compared to an increasing drug use class (aOR=2.52, 95% CI: 1.03 to 2.64).

The findings of this study indicate that changing the drug using networks of probationers may be difficult, given that most are stable over time and effective interventions to decrease substance use may need to target individual and structural factors, rather than social support and network composition. The finding that smaller networks that do change over time were associated with lower rates of drug use indicates that programs could also focus on mechanisms that determine how and why probationers choose drug using network members. Reducing drug using peers for corrections-involved populations may be difficult, but can lead to lower drug use rates which can also reduce recidivism.

Chapter 1 – Background

Introduction

This study is designed to contribute to a growing literature on social networks and their influence on substance use (1-7). It will focus on the social networks of probationers, who comprise the largest segment of the criminal justice population in the United States (8), but about whom there are few studies of network processes (9, 10). This study will provide information on how elements of a probationer's social network change over time and can affect drug use. The results of this study can help to inform the design of future interventions for this population.

This study will employ a longitudinal analysis of the social networks for 251 substance abusers on probation to examine how these networks are influenced by an intervention designed to increase pro-social behaviors and how network changes impact drug use. Social influence theory, which focuses on a person's behavior being learned through others that they know (12), will be explored in the context of probationer drug use and the persons who use drugs in a network over time. This study will use analysis techniques developed for repeated measures data, including growth mixture modeling (GMM) to examine changes in the drug user and social support networks of probationers over a 12-month period.

Previous Studies

The existing literature on social networks has explored factors that affect drug use over time, but mainly among non-correctional populations (2, 4, 13-16), who have different patterns of use than offenders (17). Social networks that are larger (15) and include a greater rate of supportive relationships (18) may be more likely to promote effective recovery. A study on the effects of changes in social networks on long-term alcohol use found that an intervention which increased support for abstinence in a person's social network also increased the number of non-

drinking days over a 2-year period (19). Another study found that subjects who entered opiate drug therapy had a 20% decrease in the proportional odds of having friends who used drugs over a six-month period and a 26% decrease in the proportional odds of having friends who injected drugs in the same time period (6).

Probation Population

Currently, 1 in 31 adults in the United States are under correctional supervision, with nearly 6 million on parole or probation and 2.3 million incarcerated in prison or jail (20). The probation/parole population has increased by over 3.5 million persons in the last 25 years. Over twice as many adults are on supervision as are incarcerated. This increase in the number of those involved in the criminal justice system has often been driven by tougher laws and sentences for drug offenses (21).

Substance use is a large problem among those involved in the criminal justice system. In 2002, 68% of inmates had substance abuse or dependence prior to incarceration (22). Of drug-involved offenders, only 13% to 32% report receipt of addiction treatment in prison (23, 24). Most drug-involved offenders return to the community without having received treatment in prison and many will relapse during the period of community reentry (25). The percentage of offenders successfully completing supervision was about 63 percent in 2008 (26). The majority of persons who do not complete probation usually fail to abide by release conditions; the most violated conditions are abstinence from substance use and participation in treatment (27).

Improving treatment interventions for offender populations is a critical public health need to reduce the use of incarceration in society (28). While both reduced drug use and increased participation in treatment have been linked to reduced rates of recidivism (25, 29, 30), the mechanisms for achieving these goals are unclear. Only a very small portion of persons under

community supervision receive substance abuse treatment services (31). A clearer understanding of the factors that contribute to drug use among probationers is important for utilizing scarce resources effectively.

Aims of Dissertation

The main goals of this study are:

- 1) to examine the social networks of the probationers, specifically how baseline network characteristics vary by type of drug user;
- 2) to determine how drug user and social support networks change over the 12-month follow-up period of the study and what factors influence these changes; and
- 3) to illustrate how drug use by the probationers over the follow up period is influenced by drug user networks and social support.

The findings from this study can provide information about how drug use for probationers is influenced by social ties to others and how these ties may change over time in response to intervention influences. These results can be important in considering how to approach drug use treatment for correctional populations.

Chapter 2 – Manualized Treatment Intervention Trial

A parent intervention study of treatment and probation supervision delivery systems provides an opportunity to study and apply social network methods while exploring offender outcomes for the current study. The parent study (R01 DA017729, National Institute on Drug Abuse; Taxman, PI) is a clinical trial of 251 drug-involved offenders who were randomly assigned to one of two conditions: seamless services of probation and substance abuse treatment at the probation office or referral to treatment in the community (32). The subjects were recruited from three probation offices, one in an urban area and two in suburban areas near Baltimore, Maryland. Interviews were conducted at baseline and then at 3-, 6- and 12-months post randomization; administrative data were collected to measure treatment participation and criminal justice outcomes.

Aims of the Field Trial

The aims of the parent study were:

1. To conduct a randomized block experiment to test the effectiveness of two models of delivering substance abuse treatment services to offenders and the impact on reducing recidivism and drug use and improving social adjustment among offenders;
2. To understand the differential impacts based on offender risk factors (e.g., propensity to engage in further criminal behavior) on treatment and criminal justice outcomes and to determine whether differences found between seamless and traditional systems are moderated by offender risk level;
3. To understand the differential treatment progress of different types of offenders participating in various treatment services; and

4. To examine levels of systems integration between the criminal justice agency and substance abuse treatment providers pre- and post-intervention and to use these measures of systems to examine offender outcomes over time.
5. To examine the impact of community on offender outcomes.

Participants in the Field Trial

The target population consisted of male and female probationers with pre-incarceration substance dependence who were at moderate-to-high-risk of recidivism. They were recruited at the probation office within one or two months of release or at the time they first reported for probation supervision. Inclusion criteria were:

- (1) 18 years old and speak English;
- (2) probable drug dependence as determined by a score of 1 or higher on the TCU Drug Screen II or mandated drug treatment;
- (3) substance use treatment as a mandated or recommended condition of probation;
- (4) at least six months left on probation sentence.

Potential subjects were excluded if they had probation conditions that prohibited them from participating in the protocol. The study protocol was approved by the Institutional Review Boards of Virginia Commonwealth University, George Mason University and Friends Research Institute.

Interventions of the Field Trial

The parent study design included random assignment of consenting offenders to either a Supporting Offenders to Avoid Recidivism and Initiate New Goals (SOARING) group (intervention) or the standard referral group (comparison) following completion of a baseline assessment. The study conditions are briefly described below:

SOARING group (Intervention). This condition integrated community supervision and addiction treatment through collaborative assessment, treatment orientation, planning, monitoring and feedback (including graduated reinforcers and sanctions). Participants received an introductory session with the Probation Agent/Officer (PO) and the study counselor. This session informed the client about the elements of the study intervention (e.g., orientation meeting, complementary assessments with PO and counselor, treatment planning session, etc.). After complementary individual assessments with the client, the PO and primary counselor conferred, shared pertinent data and agreed on important goals for the client. They then met together with the client in the treatment orientation and planning process and developed an appropriate treatment plan with the client. The PO, in consultation with the counselor, administered standardized graduated responses (negative and positive) to shape behavior. The nature of these responses was discussed with the client during the orientation process. The treatment planning process reached agreement as to the goals, type of reinforcers and objective verification methods. The offender participated in three group sessions: goals, communication with social networks, and cognitive-behavioral therapy. Offenders could graduate from the GOALS group after meeting 75 percent of their goals in a four week period.

Standard Referral (Comparison). Participants in this condition received supervision from a different supervision officer at the usual office (unintegrated) with traditional sanctions and research assessments (which previous studies suggest have their own intervention effect). Traditional supervision included, at minimum, face-to-face contacts and drug testing (e.g., random, observed, etc.) at a frequency in keeping with local standards. The comparison group was referred to outpatient substance abuse treatment in the community. In Baltimore County, the Health Department contracts with eight community treatment providers for outpatient and

intensive outpatient services. These existing services were the network for the Standard Referral group. The average services are 12 weeks in duration. In the Standard Referral condition, the grant-funded on-site assessor evaluated the offender for substance abuse dependency and then set up an appointment to begin treatment at one of the eight community provider sites.

Research respondents were assessed for level of recidivism risk as defined by a validated actuarial tool that the Maryland Division of Parole and Probation uses and then randomly assigned to one of the two groups through the existing criminal justice process. The experiment had an implicit social network context as the SOARING group received assistance with developing positive pro-social network connections and received one-stop shopping services (i.e. treatment, probation and drug testing in one location several times a week) whereas the control group was required to go to two locations at least twice a week (the probation office/drug testing in one place and treatment program in another). Study subjects in both conditions were monitored by the probation office on a regular basis, generally several times a month, and were required to be urine tested twice a week at the probation office. In the SOARING group, the probation officers joined the clinician to hold a weekly goals group to establish goals and identify progress. Subjects in this program were also offered cognitive behavior therapy once a week with a skills group once every other week. The SOARING intervention involved the clinician and the probation officer jointly running the “goals group” and working with subjects directly on treatment participation issues. The issues addressed during these groups included how to build pro-social networks that can support substance use recovery. Those assigned to the traditional group attended treatment in the community selected by the individual, where the scope of services range from basic alcohol and drug education to more intensive, evidence-based models.

Data Sources and Measurement

The main baseline and follow-up instruments used with all of the study respondents were adapted from those developed by the Criminal Justice Drug Abuse Treatment Studies (CJ-DATS1). These instruments included criminal and drug use histories, as well as an HIV-risk and mental health assessment (33). For this study, criminal risk was also measured (34), along with measures of treatment readiness (35) and criminal thinking (36). The core of the questionnaires came from the instrument package developed by Texas Christian University (TCU) for use in criminal justice treatment evaluations and modified for the CJ-DATS1 intervention studies (37). Measures of other variables were collected from standard instruments, including the TCU Drug Screen which measured drug dependence in criminal justice populations (38) and the Timeline Follow Back, which is a calendar-based instrument used to collect information on substance use over time and was also used to track incarceration and treatment pre-baseline and during follow up periods (39). Locator data to assist in later follow-up tracking were also collected.

The study used a number of instruments to collect data at baseline and follow-up for assessment of the main outcomes. These include the Orientation of Social Support (OSS), which measures the number of people in a social support network and the type of support (i.e. positive, use substances, engage in criminal behavior, etc.) (40); and the Community Assessment Inventory (CAI) which measures community supports available to the subject, including family inside and outside of the home, friends, and the neighborhood in general (41). The OSS and CAI were collected at baseline and at each follow-up.

The OSS asks the respondent to rank order people in importance in a number of areas including daily activities. More specifically, the OSS asks respondents the following questions:

1. Think through your day-to-day activities and the people you see from when you wake up until you sleep. List the initials of people you have contact with in order of how often you see them. The first person listed is the person you see most often.

2. Think of all the people that are important to you, including the people you do not see often. List, in order of importance, the initials of the people you have contact with. The first person you list is the person whose opinions and thoughts are most important to you.

3. List the initials of people who most accept you as you are. These are the people who accept both your best and worst points and who make you feel good about yourself. The person who most accepts you should be listed first.

4. List the initials of the people who are most willing to help you or do favors for you. The person who is most helpful should be listed first.

5. List the initials of the people you know who use drugs.

6. List the initials of the people you know who engage in criminal activity.

7. List the initials of the people you know who object to drug use by you or by others.

8. List the initials of the people you know who object to criminal activity by you or by others.

The OSS was modified for this study to include the relationship of each person listed by the subject (family, friend, other). This improvement to the instrument was designed to track changes in networks by type of relation to the study subjects over time. It allows us to examine how the relationships that are easier to alter (friends rather than family) change in response to treatment participation and continued substance use. It also allows us to characterize networks by the percentage of family in different types of networks.

In its initial validation study, the OSS was tested with two other measures of social support, the Social Support Questionnaire (SSQ) (42) and the Multidimensional Scale of Perceived Social Support (MSPSS) (43). This study found low correlations between the OSS and the SSQ (.018) and between the OSS and MSPSS (.064) but found that the OSS had higher correlations with drug use (as measured by the Addiction Severity Index) than the MSPSS and the correlations were equal between the OSS and the SSQ (.21, $p=.02$) (40). In a forward selection multiple regression examining the extent to which drug use could be explained by social support, only the OSS score entered the equation and explained 5% of the variation in drug use (40).

The CAI measures community supports available to the subjects, including family inside and outside of the home, friends, and their neighborhood in general. Questions include current living arrangements, status of children, whether others in the network use alcohol or drugs, the distance to the network members, and the networks member's knowledge of and attitudes towards the respondent's substance use. The CAI scale items assess the client's perception of support (or discouragement) for involvement in treatment and for associated behavior change. Likert responses (four choices, "agree strongly" to "disagree strongly") are used with a mix of negatively and positively phrased items, including whether they feel help is available from network sources, ease of talking to others about problems and understanding of treatment services by others.

In the initial validation study of the instrument, the CAI scales were found to have Cronbach's alphas of .85 (Support from partner/family living in home), .88 (Support from family outside the home), .79 (Support from friends), .85 (Support from Community) and .90 overall

(41). The CAI scores were also found to be predictive of treatment readiness, as measured by the TCU Motivation Scale (41).

Study Sample

The general baseline characteristics of the sample were: average age of 37.6 years (SD=5.2), 74.9% male; 30.1% Caucasian; all subjects were active substance abusers self-reporting preferred drug of choice to be: alcohol 10%, marijuana 21%, cocaine 23.5%, opiates 40.7%, other drug, 4.8%. On average, subjects reported having 10.5 prior arrests, 4 prior incarcerations, and 1.5 prior treatment experiences; with 70% ever attending a self-help group. The average educational attainment was 11th grade. At baseline, study participants had modest motivation to change, modest recognition that drugs are a problem, and had social networks that include an average of 5.6 people that are important in their lives, an average of 3.7 people willing to help them, and an average of 4 people with whom they used drugs. The follow-up rates for each wave were: 97% for 3-months, 94% for 6-months, and 90% for 12-months.

Recruitment occurred at the three sites, Baltimore City, Towson and Essex from 2007 to 2010. Close to half of subjects were recruited from the Baltimore site (n=121), about a third from the Essex site (n=79) and 20% from the Towson site (n=51). Three-month follow-up results show that 63% of the SOARING group initiated treatment compared to 37% of the control group ($\chi^2=15.41$, $p<.001$). The SOARING group took, on average, 29 days to initiate treatment. The preliminary study findings indicate differential treatment initiation rates in the three study sites across the two groups with the initiation into treatment for the SOARING group at Towson (Baltimore County) with 72%, Essex (Baltimore County) with 70% and Northwest (Baltimore City) with 60%. Across the control group, the average initiation rate was 37%, ranging from 32 to 46 %.

Chapter 3 – Social network correlates of Polydrug Use among Probationers

Abstract

This paper describes the functions, relations, and structures of the social networks of a sample of 251 probationers participating in a randomized field trial and how these vary according to drug use status at baseline. The number of persons in different types of networks is examined, including drug use and opposition to drug use networks, and the percentage of family in these networks is also analyzed along with the amount of social support available using the Community Assessment Inventory. Drug users were classified according to single (46.4%) or polydrug use (53.6%). Multivariate logistic regression models were utilized to examine the association between network and probationer characteristics and type of drug user. Black probationers were less likely to be polydrug users (aOR: 0.34, 95% CI: 0.14 to 0.84), while those using cocaine or heroin as their primary drug of choice were more likely to be polydrug users (aOR: 3.02, 95% CI: 1.32 to 6.94). Age at first illicit drug use was also significant, with those initiating drug use younger than 18 more likely to be polydrug users (aOR: 2.12, 95% CI: 1.01 to 4.46, Model 4). Polydrug use among probationers is not associated with network size, type, percent of family in networks or social support but appears to be influenced by race and drug use history. Individual probationer characteristics may affect drug use more than their social networks and treatment interventions need to examine effective means of addressing use by these characteristics.

Introduction

Currently, 1 in 31 adults in the United States are under correctional supervision, with nearly 6 million on parole or probation and 2.3 million incarcerated in prison or jail (20). The probation/parole population has increased by over 3.5 million persons in the last 25 years. This increase has often been driven by tougher laws and sentences for drug offenses (21). Substance use is a large problem among those involved in the criminal justice system. In 2002, 68% of inmates had substance abuse or dependence prior to incarceration (22). Of drug-involved offenders, only 13% to 32% report receipt of addiction treatment in prison (23, 24). Most drug-involved offenders return to the community without having received treatment in prison and many relapse during the period of community reentry (25). The percentage of offenders successfully completing supervision was 63% in 2008 (26). The majority of persons who do not complete probation usually fail to abide by release conditions; the most violated conditions are abstinence from substance use and participation in treatment (27). Criminal justice programs often target drug use reduction as an important step in the community re-integration process and an understanding of the personal and interpersonal factors that influence offenders' decisions to continue drug use, especially polydrug use, is important.

Much research on drug use practices among probationers is based on individualistic models of health behavior, which assume that a person's substance use is controlled by themselves (44). However, drug use is inherently social in nature and is often influenced by others. The utilization of the social network approach to examine the determinants of drug use may be particularly useful in this population as they may look to establish former social networks as they return to their community or they may have established crime networks. The

components of an individual's social network play a crucial role in generating and disseminating social influence (45).

Social networks have been conceptualized as having three main components: relations, structures, and functions (46). Network relations refer to the type of network members (e.g., family, friends, colleagues, alcohol/drug users, or sex partners) and trust in or closeness to these members. Network structures describe the relationships among the main person and two or more members and include size of the network, density, concurrency, and multiplexity (i.e., the different types of ties between network members (47). Network functions include social support and norms, which can influence behavior (45, 48, 49). Social support can take a number of forms, such as instrumental or emotional (50, 51), but there are two general types. Perceived social support is the type that a person believes they have access to their network; while enacted social support is comprised of the resources that are actually available to the person. In previous studies, perceived support has been more strongly linked to outcomes than enacted support (52, 53). Increased perceived social support has been associated with substance use reduction among drug users (2).

Norms, which are closely related to social support, are the validation and enforcement of beliefs and behaviors. A person may be influenced to adopt certain behaviors by social pressures and/or role models (54). Subjective norms are derived from beliefs about what people who matter to a person think they should do and from the motivation to comply with these beliefs (55, 56). They refer to people's perceptions of social pressure from network members. Descriptive norms refer to a person's perceptions of other people's behaviors (57). The actions of network members provide information that people may use in deciding how to behave.

Network relations have been found to influence drug use as well, with women likely to be influenced to initiate drug use if their partner uses drugs (47) and adolescents more likely to continue use if important peers are using drugs (57, 58). Network structures such as size of drug using networks has been associated with injection-related HIV risk behaviors (16) as well as the initiation of use of multiple illicit substances (59). A number of studies have shown that persons with drug-users in their social networks are more likely to start drug use themselves (60, 61).

Research also emphasizes the importance of informal social controls, including the social networks of substance abusers, on drug use (4, 9, 62). Data from Project START, a randomized trial that tested HIV interventions for men re-entering the community from prison, found that within 6 months of release, only about half of the sample had relatively consistent social ties (i.e., named the same persons in their networks over time) and that nearly 60% had negative social support (i.e., support that encouraged high-risk behaviors like drug use or discouraged pro-social behaviors such as employment) in their networks (63). This negative and inconsistent support, along with less structural stability (e.g., employment, housing) was associated with more substance use and increased recidivism (63).

A study of incarcerated women in Kentucky found that perceptions of social network support were significantly and negatively correlated with women's severity of substance use and criminal involvement (64). A study in Baltimore found that recent incarceration modified the effect of drug use on overdose probability (65). Recent incarceration was associated with a higher risk of overdose (65), with the social networks for those who overdosed having a higher number of injection drug users and a smaller number of family members. A study of women seeking alcohol treatment found a strong relationship between moderate or heavy drinking among social network members and the drinking patterns of the targeted women (14). Self-help

groups, like Alcoholics Anonymous, have been found to be effective in promoting abstinence through the mediating effect of social support (4). Social networks that are larger (15) and include a greater rate of supportive relationships (18) are more likely to promote drug abstinence.

Demographic characteristics have been shown to influence drug use and social network characteristics. The social networks of men and women are different, with women tending to have smaller networks with more family members (66). Gender also plays a role in substance use patterns, with women more likely to be influenced to initiate drug use by a partner and to have shorter drug use careers. The size of a person's social network has been shown to decrease with age (67), while substance use and treatment patterns vary with age, with older persons more likely to use alcohol and less likely to enter treatment and stay in treatment (17, 68). Racial disparities have been found in access to substance abuse treatment (69) and racial differences are also found in substance use patterns (70). African Americans have social networks with a higher percentage of family members than whites (71). Education levels have also been found to influence social network characteristics and drug use (57, 66, 70). Few studies have closely examined the collective influence of the three components of social networks on the continuation of drug uses among probationers.

This study describes the functions, relations, and structures of the social networks of 251 probationers participating in a randomized field trial and how these vary according to drug use status at baseline. We tested two hypotheses generated from the above literature review: (1) those who are single drug users will have fewer persons in their drug-using networks (lower subjective norms) at baseline than those who are polydrug users, and (2) those who are polydrug users will have less social support in their networks.

Methods

Study design and Subjects

The study is a field trial of 251 drug-involved offenders who were randomly assigned to two conditions: SOARING, which was seamless services of probation-substance abuse treatment at the probation office or control, which was traditional supervision with referral to treatment in the community (72). The subjects were recruited from three probation offices in eastern Maryland, one in an urban area and two in suburban areas. Interviews were conducted at baseline and then at 3-, 6- and 12-months post randomization. For this paper, baseline data collected from offender interviews were used.

Social Network Instruments

Social network data were collected by the Orientation of Social Support (OSS), which measures the number of people in a social support network and the type of support network (40) and the Community Assessment Inventory (CAI), which measures community supports available to the subject, including family inside and outside of the home, friends, and the neighborhood (41).

The OSS asks the respondent to rank order people in importance in seven different types of networks (40). These include: 1) frequency of contact, 2) importance to the person, 3) those who provide help, 4) those who accept the person for who they are, 4) those in their drug using network, 5) those in their crime network, 6) those who oppose their drug use, and 7) those who oppose their criminal activities. The person could list the initials of up to 14 persons for each question. The OSS was modified for this study to also include the relationship of each person listed by the subject (e.g., family, friend, other). A previous study found that the OSS was better

than other measurement scales in the measurement of social support and its relationship to treatment outcomes (40).

The CAI measures community supports available to the subjects. The CAI scale items assess the client's perception of support (or discouragement) for involvement in treatment and for associated behavior change. Likert responses (four choices, "agree strongly" to "disagree strongly") are used with a mix of negatively and positively phrased items, including whether they feel help is available from network sources, ease of talking to others about problems and understanding of treatment services by others. In the initial validation study of the instrument, the CAI scales were found to have reliabilities measured by Cronbach's alphas of .85 (Support from partner/family living in home), .88 (Support from family outside the home), .79 (Support from friends), .85 (Support from Community) and .90 overall (41). The CAI scores were also found to be predictive of treatment readiness, as measured by the Texas Christian University Motivation Scale (41). Scoring for the CAI is done by summing the responses for the questions in each scale, with the responses coded as 1=disagree strongly to 4=agree strongly, so that higher scale scores indicate more support for treatment and abstinence from using drugs.

Network Relations

Network relations were measured on the OSS and included the number of family members in each type of network: one's daily contacts, acceptance, helping, importance, drug and crime networks, and in the networks opposed to crime and drug use. From this, the percentage of the network that was family (as opposed to friends or other) was calculated for each person and each type of network. Family members have been found in previous studies to be both helpful to drug treatment and enabling of drug use (73, 74). For this analysis, the acceptance network was used as a measure of support as its definition (i.e., those who most

accept a person as they are, accept best and worst points and make a person feel good about themselves) related more directly to social support than the importance or helping networks.

Network Structures

Network structures were measured from the OSS and included the number persons in each type of network at baseline: one's daily contacts, acceptance, helping, importance, drug and crime networks, and in the networks opposed to crime and drug use.

Network Functions

Network functions included the descriptive norms of the number of drug users in one's social network, the subjective norms of the number of persons who opposed one's drug use, and the perceived support for substance abuse treatment as measured by the scales of the CAI, including the total CAI score, the partner/family in the home subscale, the family outside the home subscale, the friends subscale, and the community subscale.

Drug Use

The variables of interest include drug use at baseline, which was measured by a question on the intake interview that asked about the types of illicit drugs used in the past 6 months, supplemented by data from the cheek swab drug test done at baseline. The cheek swab was tested for seven different illicit substances – cocaine, amphetamines, methamphetamines, THC (marijuana), opiates, benzodiazepines and methadone. The questionnaire that accompanied the cheek swab also asked if the subject had a valid prescription for any of the substances. Because substance use was an inclusion criterion for the study, subjects were classified as either single or polydrug users, according to the number of illicit substance they reported using in the past 6 months and/or the number of substances they tested positive for in the cheek swab.

Confounders

Characteristics of the probationers that were analyzed to determine if they affected type of drug user and network characteristics included gender, race, age, education level, criminal risk, and drug of choice. Race was dichotomized (i.e., black; all other races), while age was examined both as continuous and categorical variable (i.e., under 35; 35 and older). Education level was analyzed by those who did not finish high school versus those who did. Criminal risk was measured using a 9-point scale that has been found to predict recidivism (34) .

Variables related to drug use were also examined, including age at first illicit drug use, which was derived from the main intake form, which had questions about the age at which the probationer began using each type of substance. For this analysis, those who began using illicit substances (all except alcohol) at an age below 18 were in one category, and all those who began using at 18 or older or who had never used illicit substances were put in the other category. Primary drug of choice was also examined from the baseline questionnaire, with categories for alcohol, marijuana, crack/cocaine, heroin (which included heroin mixed with other drugs), and all other drugs.

Analysis

Data were analyzed in SPSS version 17. Because the distribution of the network size variables was skewed, we used the median and the interquartile range (IQR: the 25th–75th percentile) to describe their distribution. We examined the functions, relations, and structures of drug users using logistic regression models to estimate both crude odds ratios (COR) and adjusted odds ratios (aOR) by type of drug use, which controlled for potential confounders.

In order to examine the interrelationships, we ran four sets of models: the first included the network function variables, the second included functions and relations, the third included functions and structures, and the fourth included functions, relations and structures.

Results

Descriptive Statistics

Table 3.1 presents the demographics of the sample by drug use category. There were 18 persons who did not report using any illicit substances in the past 6 months. Of these 18, two tested positive for illicit substances at the baseline cheek swab test, with one testing positive for one substance and one testing positive for two substances. The person testing positive for two substances was reclassified into a polydrug user according to their cheek swab results. Also, in the single drug use group (from the self-report results), 11 persons tested positive for 2 or more illicit substances at the baseline cheek swab and were reclassified as polydrug users. The 16 (6.4%) persons who reported no drug use and had no drug use in their cheek swabs were included in the single/no use group. A total of 51 persons who self-reported polydrug use only tested positive for one substance in the cheek swab, but they were classified as polydrug users because the cheek swab only tested for seven substances and was only accurate for a limited time period, depending on the substance used.

Among the 251 study subjects, 113 (45%) used a single drug and 138 (55%) used polydrugs in the past 6 months. Polydrug users were more likely to be white (the overall sample was 67% black, 32% white, and 1% other). Those using multiple drugs were also more likely to be 35 or older and to have high criminal risk. Polydrug users were also more likely to have cocaine (28.3% vs. 17.7%) or heroin (50.0% vs. 23.0%) as their primary drug of choice, whereas single drug users were more likely to have alcohol, marijuana or other drug as their primary drug of choice. Polydrug users were also more likely to initiate illicit drug use when they were younger than 18 (53.6% vs. 19.5%) than single drug users.

Network components

Table 3.2 presents the characteristics of network components in the two groups. The amount of perceived social support did not vary by drug use status. The descriptive norm of the number of drug users in one's network was significantly different for the groups, with polydrug users having more drug users (median of 3) than single drug users (median of 2). The subjective norm of the number of persons in one's network who oppose the subject's drug use did not differ among the two groups. Polydrug users had a higher median number of persons in their criminal networks (2) than those who were single drug users.

Single drug users also had a higher percentage of family in their drug-using networks (25% vs. 7 %) networks that opposed drug use (100% vs. 82%). The overall average daily contacts network for both groups had a median of 4 persons with an IQR of 3 to 6 persons.

Multiple Logistic Regression

Table 3.3 presents the results of the logistic regression models. Not all types of networks were used in the models, as there was a high degree of correlation among some of the types, including the help, acceptance, and importance networks. The adjusted models included variables for black race (dichotomous), age (continuous), criminal risk (high risk as the reference group), primary drug of choice (with all drugs other than alcohol and marijuana as the reference group), and age at first illicit drug use (with less than 18 as the reference group). Probationer age was explored as both a continuous and categorical variable in the adjusted models, but was not significant in any forms.

Model 1 was run using the network functions variables only, while Model 2 included the functions and the network relation variables. Model 3 included the functions and structures and Model 4 included all the network variable types: functions, relations, and structures.

None of the network variables were significant in the adjusted models. Race was significant in all of the models, with black probationers less likely to be polydrug users (aOR: 0.34, 95% CI: 0.14 to 0.84, Model 4). Primary drug of choice was also significant in all models, with those using cocaine or heroin as their primary drug of choice being more likely to be polydrug users (aOR: 3.02, 95% CI: 1.32 to 6.94, Model 4). Age at first illicit drug use was also significant in all of the models, with those initiating drug use younger than 18 more likely to be polydrug users (aOR: 2.12, 95% CI: 1.01 to 4.46, Model 4).

Discussion

The social networks of probationers with substance use issues do not appear to be associated with polydrug use, after adjustment for individual probationer characteristics. Race, primary drug of choice, and age at drug initiation had the largest associations with polydrug use in this study. The size of drug user networks and drug opposition networks, perceived social support for treatment and the amount of family in one's network were not associated with being a polydrug user.

This study found that some network associations with drug use found in non-criminal justice populations were not applicable in this probation sample. These included the amount of social support available, specifically support for treatment as measured by the CAI. It may be that the probationer population, which has been involved in the justice system for many years (average lifetime arrests = 10.5), is not as influenced by social support and may have less support available to them overall because of their criminal involvement. A study done in 2004 with nationally representative data found that social support was not a predictor of substance abuse treatment entry for those with criminal justice involvement, while it was a predictor for those without justice experience (77). Similarly, the percent of family in one's network did not

influence drug use in this population, although family has been found in other studies to influence drug use initiation and cessation (78, 79). Probationers may have fewer connections to family or may not involve them in their drug use decisions, especially older persons, and this sample had an average age of 37.6 years. This question will be explored further in future research, as the correlates of drug use over time are explored using the longitudinal data gathered in this study.

Race had a relationship to polydrug use, with blacks less likely to be polydrug users and whites more likely to use multiple illicit substances. The literature has mixed results in this area, with one study reporting blacks less likely to be polydrug users as adolescents (59) and another study finding black race associated with polydrug use among publicly funded clients (80). It may be that the interaction of criminal justice status and race may influence the amount of drug use. Future studies, which have populations with and without criminal justice involvement, should examine these interactions.

Both age at drug initiation and type of drugs used were associated with polydrug use. Those with heroin or cocaine as their drug of choice were more likely to be polydrug users than those who reported alcohol or marijuana or other drugs as their drug of choice. This is consistent with previous studies that have found use of hard drugs, including cocaine and heroin, to be associated with use of more substances over time and also increased criminal justice involvement (83).

Limitations of this analysis include the cross-sectional nature of the data with drug use and network characteristics captured at the same point in time. Causality and/or directionality of the associations cannot be determined, only an association between the characteristics. Most data are also self-report (although drug use was supplemented by biological testing data), which can

be subject to recall bias. In addition, as the original study was not designed to collect full social network information, the data do not comprise a full egocentric social network, where all ties to one person are explored and the relationships among the other persons in the network are also explored (84). Measures such as network density and multiplexity (the different types of ties between network members), which rely on data about other network persons' relationships with each other, are not available for this study and limit the amount of network information that can be used in the models. Also, the data available on those in the network are very limited. From the OSS, only the initials of the persons in the network and their relationship to the subject are available. The demographic characteristics of those in the network were not collected, which further limits the ability to fully describe the networks.

Also, the classification of those (n=16) who had no reported drug use in the 6 months prior to the baseline interview, into the single drug use group, is a limitation of the analysis, as these persons may not be single drug users. The resulting estimates in the study may be conservative because of their inclusion.

Substance abuse treatment history was also not addressed in this analysis. Many different types of treatment are available and self-report data was collected at baseline on some treatment variables. Dosage of treatment and time frames and duration of treatment were not available. Treatment may affect drug user networks, but this relationship cannot be assessed in a cross-sectional analysis. Future analyses could examine official treatment records and changes in networks over time.

Probationers, as a group, have been found to have higher rates of substance use and mental health issues than those not involved in the criminal justice system (85) but often do not receive adequate treatment for these issues (31). Substance abuse treatment is often a mandated

condition for supervision, with at least 50 percent of probation sentences including court ordered commitment to drug or alcohol treatment (24). Treatment interventions for this group may involve developing “pro-social” or “pro-abstinent” networks that encourage probationers to not use drugs (86). The results of this study demonstrate that these types of interventions may have little influence on substance use patterns for those with much criminal justice system involvement.

This study contributes to the growing literature on social networks and their effects on drug use. While links between subjective and descriptive norms and drug use have been established in the literature (48, 87), few studies have looked specifically at probationers and the characteristics of their social networks. Perceptions of support for and opposition to drug use are important elements in determining drug use patterns of probationers, a group which has significant drug abuse and dependency issues.

The number of substances used among probationers is associated with individual factors, including race and types of substance used, rather than with social network characteristics. To decrease drug use, which can lead to decreases in recidivism and crime (88), effective treatment interventions for offenders may need to target individual and structural factors, rather than social support and network composition.

Table 3-1: Single and Polydrug Use by Probationer Characteristics at Baseline

	Single/No Drug Users ¹ (N=113)	Polydrug Users ² (N=138)	P-value
Gender			
Male	84 (74.3%)	106 (76.8%)	0.65
Female	29 (25.7%)	32 (23.2%)	
Race			
Black	89 (78.8%)	78 (56.5%)	<0.01
White/Other	24 (21.2%)	60 (43.5%)	
Age			
Less than 35	54 (51.9%)	59 (40.4%)	0.07
35 or older	50 (48.1%)	87 (59.6%)	
Education			
Did not finish High School	60 (53.1%)	77 (55.8%)	0.67
High School or More	77 (55.8%)	61 (44.2%)	
Criminal Risk			
Moderate Risk	70 (61.9%)	66 (47.8%)	0.03
High Risk	43 (38.1%)	72 (52.2%)	
Age at Drug Initiation			
Less than 18	22 (19.5%)	74 (53.6%)	<0.01
18 or Older	91 (80.5%)	64 (46.4%)	
Primary Drug of Choice			
Alcohol	19 (16.8%)	6 (4.3%)	<0.01
Marijuana	36 (31.9%)	17 (12.3%)	
Cocaine	20 (17.7%)	39 (28.3%)	
Heroin	26 (23.0%)	69 (50.0%)	
Other	12 (10.6%)	7 (5.1%)	

¹ Single/no drug users reported use of no drugs or only one of the following substances in the 6 months prior to the baseline interview: marijuana, cocaine, heroin, methamphetamines, barbiturates, other opiates, amphetamines, tranquilizers, sedatives, GHB, ketamine, inhalants, street methadone, or other illicit substance for the purpose of getting high.

² Polydrug users reported use of 2 or more of the substances listed above in the 6 months prior to the baseline interview.

Table 3-2: Baseline Social Network Characteristics of Probationers by Drug Use Category

	Single/No Drug Users	Polydrug Users
	Median (IQR) ¹	Median (IQR) ¹
Network Functions		
Social Support: CAI Total Score	90 (86-95)	89 (85-94)
Partner CAI Subscale	19 (17-21)	19 (17-22)
Family CAI Subscale	20 (20-22)	20 (19-22)
Friend CAI Subscale	19 (18-21)	19 (18-21)
Community CAI Subscale	30 (27-33)	30 (29-32)
Number of Drug Users	2 (1-4)**	3 (1-5)
Number of Persons who Oppose Drug Use	3 (2-5)	3 (2-5)
Number of Persons in Crime Networks	1 (0,3)	2 (0,3)
Number of Persons who Oppose Crime	3 (2,5)	3 (2,5)
Network Relations		
Family in Daily Contacts	71% (33%-100%)	60% (33%-100%)
Family in Acceptance Network	83% (60%-100%)	80% (50%-100%)
Family in Helping Network	100% (57%-100%)	80% (50%-100%)
Family in Importance Network	86% (57%-100%)	80% (50%-100%)
Family in Drug Network	25% (0%-75%)*	7% (0%-50%)
Family in Oppose Drug Network	100% (50%-100%)*	82% (41%-100%)
Family in Crime Network	0% (0%-100%)	0% (0%-40%)
Family in Oppose Crime Network	83% (50%, 100%)	80% (50%-100%)
Network Structures		
# of Daily Contacts	4 (3-6)	4 (3-6)
# in Acceptance Network	4 (2-5)	4 (3-6)
# in Helping Network	3 (2-5)	3 (2-4)
# in Importance Network	5 (3-7)	5 (3-7)

* p< .05, ** p<.01

¹ Interquartile range (IQR):25th-75th percentile.

Table 3-3: Multiple Logistic Models for Social Network Characteristics and Type of Drug User

	Model 1 ^a	Model 2 ^b	Model 3 ^c	Model 4 ^d
Adjusted Odds Ratio (95% Confidence Interval)¹				
Network Functions				
CAI Total Score	0.99 (0.98 to 1.01)	1.01 (0.99 to 1.02)	0.99 (0.98 to 1.01)	1.00 (0.98 to 1.02)
# Drug Users	1.04 (0.94 to 1.15)	1.04 (0.90 to 1.20)	1.04 (0.93 to 1.16)	1.03 (0.89 to 1.19)
# Drug Oppose	0.91 (0.81 to 1.02)	0.89 (0.77 to 1.04)	0.90 (0.80 to 1.01)	0.89 (0.75 to 1.05)
Network Relations (Percent Family)				
Daily Contacts		0.75 (0.22 to 2.59)		0.76 (0.22 to 2.62)
Acceptance		0.91 (0.23 to 3.59)		0.92 (0.23 to 3.66)
Drug Using		1.01 (0.41 to 2.50)		0.97 (0.39 to 2.45)
Drug Oppose		0.82 (0.30 to 2.25)		0.83 (0.30 to 2.27)
Network Structures				
# Daily Contacts			0.98(0.87 to 1.10)	1.04 (0.91 to 1.19)
# Acceptance			1.06(0.93 to 1.19)	1.02 (0.87 to 1.19)
Demographics				
Black Race	0.48 (0.24 to 0.97)	0.34 (0.14 to 0.84)	0.48 (0.24 to 0.97)	0.34 (0.14 to 0.84)
Age	1.01 (0.98 to 1.04)	1.01 (0.97 to 1.05)	1.01(0.98 to 1.04)	1.01 (0.97 to 1.05)
High Criminal Risk	1.12 (0.60 to 2.08)	1.64 (0.80 to 3.37)	1.16 (0.62 to 2.17)	1.64 (0.80 to 3.37)
Heroin/Cocaine Primary Drug	3.47 (1.74 to 6.94)	2.92 (1.29 to 6.63)	3.51 (1.72 to 7.12)	3.02 (1.37 to 6.94)
18 or Older at First Drug Use	2.97 (1.54 to 5.76)	2.12 (1.01 to 4.46)	2.98 (1.54 to 5.80)	2.12 (1.01 to 4.46)

¹ Odds Ratio adjusted for age(continuous), race (black as the referent), criminal risk (high criminal risk was referent), primary drug of choice (cocaine/heroin was referent), and age of first illicit drug use (18 or older was the referent).

^a Model 1 = Network functions (social support, norms of behavior) only, adjusted for age, race, criminal risk, and primary drug of choice

^b Model 2 = Network functions and relations (family) only, adjusted for age, race, criminal risk, and primary drug of choice

^c Model 3= Network functions and structures (size of networks) only, adjusted for age, race, criminal risk, and primary drug of choice

^d Model 4 = Network functions, structures, and relations, adjusted for age, race, criminal risk, and primary drug of choice

Chapter 4 – Drug Use and Social Support in the Networks of Probationers: A Growth Mixture Model Analysis

Abstract

A field trial of an integrated probation and treatment intervention, including a component designed to decrease drug-using ties and increase support for drug treatment in the social networks of probationers, was conducted in Maryland between 2007 and 2010. This analysis examines changes in the drug user network size and the amount of perceived social support over a 12-month period for the 251 probationers and the factors that influence these changes, including the study intervention. Changes in drug user network size and social support scores were calculated over time and characteristics associated with change levels were explored. Latent classes for changes in drug user network size and the amount of social support perceived over the 12-month follow-up period were estimated using growth mixture models. Variables influencing class membership were examined, including whether the study intervention decreased drug user networks and increased social support over time. The study population was predominantly male (80%) and Black (69.5%), with an average of 10.5 prior arrests and over 75% having drug dependence. Three latent classes were found for drug user networks over time (i.e., Decreasing Drug User Networks (DDN), Stable Drug User Networks (SDN), and Increasing Drug User Networks (IDN)) and for social support (i.e., Decreasing Support Network (DSN), Stable Support Network (SSN), and Increasing Support Network (ISN)). Age was related to changes in social support networks, with increasing age associated with a lower likelihood of being in the SSN class compared to the DSN class (adjusted odds ratio (aOR)=.93, 95% confidence interval (CI): 0 .88 to 0 .98). Black probationers were less likely to have

decreases in drug user networks over time (aOR=.33, 95% CI: 0.13 to 0.84) than whites and males were less likely than females to be in the decreasing (aOR=0.35, 95% CI: 0.14 to 0.83) and increasing (aOR=0.36, 95% CI: 0.15 to 0.85) drug user network classes. Rates of change over time were different by study condition for the DSN class, with those in the intervention group more likely to start with lower support levels. The majority of probationers had stable social support and drug using networks over a 12-month period. These results indicate that drug using networks for probationers may not change quickly and that social support may be negatively associated with age. Interventions to change drug user networks and social support may be difficult in probationers and other factors related to drug use should be explored.

Introduction

Social network studies can assist with the design of interventions for those involved in the criminal justice system, who are at high risk for substance use, and other health issues (89, 90). The literature on offenders has identified that drug users on probation and parole may have a number of mechanisms that affect their return to incarceration and continued drug use, including social norms and the important people in their lives (10, 91, 92) .

Those on parole or probation currently comprise the largest segment of the criminal justice population in the United States, with over 4.7 million persons in these programs at the end of 2012, compared to 1.5 million persons in prisons in 2012 (8). Substance use is a large problem among those involved in the criminal justice system (22, 24). A study using 2002-2009 National Surveys on Drug Use and Health data found male probationers had substance use rates that were three times higher than the non-correctional population and also reported higher unmet need for substance use treatment than the non-correctional population (93).

The link between substance use and criminal justice system involvement has been established over decades of research. Individuals with substance use problems are much more likely to engage in all forms of crime than are non-substance users (94). The literature has shown that using substances or being arrested for a drug-related offense increases the likelihood of recidivism among probationers (88, 95) and that substance-abusing offenders are likely to continue to engage in behaviors that led to their initial contact with the criminal justice system if effective treatment is not received (96).

Changes over time in social network composition and support have been linked to changes in individual behaviors, including drug use (2). Perceived social support, which is a key social network function (45, 48) , has been significantly and negatively correlated with the

severity of substance use (2) and, for probationers, also negatively linked to criminal involvement (64). Self-help groups, like Alcoholics Anonymous, have been found to be effective in promoting abstinence through the mediating effect of higher friendship quality, more friend resources and greater support for abstinence from friends (4).

Drug use in a person's social network has been found to influence substance using behavior, with networks having a higher number of injecting drug users associated with an increasing risk of drug overdose (65). For those in the criminal justice system, support in their networks that encouraged substance use behavior has been associated with increased drug use and recidivism (63). While studies have examined how social networks influence factors that affect drug use and relapse (1, 3), less is known about how networks change over time and what characteristics are associated with network changes over time, especially for justice-involved populations. Influences on drug use and drug treatment may be different for offenders than those not involved in the criminal justice system, often because offenders are mandated to treatment programs (97, 98). A recent study of drug use trajectories over time for probationers found that age and drug use severity were significantly associated with increasing drug use over time (98), but the influence of drug users in the network has not been explored for this population.

This study uses data from a field trial intervention with probationers (32) that targeted reductions in drug use and recidivism through the utilization of contingency management and treatment that emphasized the formation of positive social network ties. The purpose of this study is to examine changes in drug user networks and social support networks over time to determine patterns of change over a 12-month period and what probationer characteristics are associated with these changes. Growth mixture models were developed to determine classes of change over time for drug user networks and social support. Variables influencing class

membership were explored, including the effect of the intervention on network changes over time. The specific hypotheses for this study are: 1) those in the intervention group are expected to decrease the size of their drug-using networks over time and increase the amount of positive social support available to them; and 2) those with high criminal risk at baseline are expected to have less change over time in drug user networks and social support than those with lower risk.

Methods

Sample and Intervention

A total of 251 female and male probationers with pre-incarceration substance dependence who were at a moderate to high risk of recidivism are included in this study. Probationers were recruited from three probation offices in Maryland between 2007 and 2010 at the time the probationer first reported for supervision.

The full study design has been described elsewhere (32), but briefly, an important part of the intervention, SOARING, was to encourage offenders with drug use problems to develop pro-social networks during their probation tenure through participation in group sessions that worked on establishing goals and communication methods with others. The treatment protocol consisted of an induction session, at least seven sessions of a contingency management-based goal-setting group, 18 sessions of cognitive behavioral group treatment, and six sessions of an hour-long group aimed at building social networks. There were a number of implementation issues with the intervention group, including the inconsistent use of sanctions by probation officers and delayed rewards because of scheduling issues for probationers (32). Because of these issues, follow up trajectories for the sample may be influenced by unmeasured factors. The control condition was exposed to referral to treatment in the community.

Data Collection and Measurement

Research assistants conducted in-person interviews with offenders at baseline, and at 3-, 6-, and 12-months post-baseline. Follow-up rates were 97% at 3-months, 94% at 6-months, and 90% at 12-months. Baseline data collection included a comprehensive subject history, with demographics and extensive substance use and criminal activity information.

Demographics

For this analysis, demographics collected on the self-report intake form were used, including race, gender, date of birth, and last completed grade of school. Race was dichotomized into those who were black versus those who were not black. Age was continuous and calculated from date of birth by subtracting the date of the birth from the baseline interview date. Education was operationalized as those who completed high school versus those who did not.

Criminal Risk

Criminal risk was measured by a baseline scale, developed by Austin (34) that has been shown to predict recidivism (34). The questions were as follows: (1) how many times have you been arrested before this current offense (worth up to 2 points); (2) how many times have you been convicted as an adult (worth up to 3 points); (3) do you have three or more present offenses (worth up to 1 point); (4) were you ever arrested before you turned 16 (worth up to 1 point); (5) were you ever incarcerated upon conviction (worth up to 1 point); and (6) have you ever escaped from a correctional facility (worth up to 1 point). Individuals could score a total of 9 points. Those scoring between 1 and 4 are considered moderate risk and those scoring 5 or more are considered high risk.

Drug Use

The severity of drug addiction was assessed by the TCU Drug Screen, an instrument that measures drug use dependence for correctional-based populations (99). Each participant was asked nine binary questions concerning drug dependency with “yes” responses were tallied to determine the TCU Drug Score, where a score of 3 or greater meets diagnostic criteria (100) for drug dependence.

Orientation of Social Support

Alemi’s Orientation of Social Support (OSS) was collected at baseline and each follow up time point to gather information on the members in different types of networks for the subject (40). The original OSS (n= 6 items) asks the respondent to rank order people (up to 14) in importance in six different types of networks. These networks include: 1) daily contact (contact), 2) importance to the person (importance), 3) those who provide help (help), 4) those who accept the person for who they are (acceptance), 5) those in their drug using network (drug users), and 6) those who oppose their drug use (drug opposition). The OSS was modified for the parent field intervention trial to include the relationship of each person listed by the subject (i.e., family, friend, other) and to assess two other networks: 1) those who engage in criminal activity and 2) those who oppose criminal activity. The original OSS has been shown to measure a person’s level of social support and this support’s relationship to treatment outcomes (40). Each network size ranged from 0 to 14 at each time point.

Community Assessment Inventory

The Community Assessment Inventory (CAI) measures community supports available to the subject with higher scores indicating more support for treatment and abstinence from using drugs (41). The CAI items (n=37) assess the client’s perception of support (or discouragement) for involvement in treatment and for associated behavior change on a 4-point Likert scale (i.e., “agree strongly, 4” to “disagree strongly, 1”). The four subscales in the CAI are: 1) the

partner/family in the home, 2) family outside the home, 3) friends, and 4) community. Both negatively and positively phrased items are used to assess whether the subject feels help is available from network sources, ease of talking to others about problems and understanding of treatment services by others. The CAI subscales have been found to be reliable and predictive of treatment readiness (41). For this analysis, the CAI total score was utilized, which has a range of 72 to 146.

Analyses

Data come from all four waves of the study. Characteristics of the study participants at baseline were analyzed including gender, race, age, education, lifetime arrests, criminal risk, and recent drug use. The median and interquartile ranges (IQR), which are the 25th and 75th percentile values, were examined for the baseline OSS networks of daily contacts, acceptance, drug users, and drug opposition, because of their distributions, which range from 0 to 14.

The social networks characteristics at each time point were analyzed to determine their distribution and changes over time. Change scores for drug users in the network were calculated by subtracting the number of drug users in time period (t-1) from those in time period (t). These change scores are described using medians and IQR. For social support, the CAI total score and the subscale score means with standard deviations were examined at each time point.

To examine change patterns over time in social support and drug user network size, growth-mixture modeling (GMM) was utilized, which is a statistical procedure for operationalizing change over time that captures individual differences in change trajectories and permits the study of variables that exert effects on the rate of change (101). Analyses were conducted using Mplus version 5 (102). GMM allows the identification and prediction of

unobserved subpopulations with longitudinal data and it allows different classes of individuals to vary around different mean growth curves within each latent class (103).

Latent class mixture models were estimated to determine groups of individuals with similar patterns of change in drug network size and social support over time. Models with varying numbers of latent classes were fit. Missing data were utilized through the full information maximum likelihood method, which uses missing at random estimation procedures to produce accurate and efficient parameter estimates with missing data (104). Figure 4.1 presents a picture of the theoretical model that was estimated for each hypothesis. In this model, N represents the social network characteristic measured at each time period, including the drug user network size from the OSS and the amount of social support from the CAI total scale. The study condition (COND) is hypothesized to influence both the intercept or starting value (I) and the slope, or rate of change of over time (S) of the network characteristics and influence membership in the latent class, C , which can influence both starting values and trajectories over time (105).

Data on the social network characteristics were first analyzed with a univariate growth model to determine the rate of change over time. For the drug network size, Poisson models were generated, as network size was a count variable, with a range from 0 to 14. Latent classes were then estimated for each characteristic, with models estimated for different numbers of latent classes and compared utilizing tests of model fit based on recommendations from previous simulation studies (106) and examining the charts of estimated and sample trajectories over time for each class. The model fit tests included the Bootstrapped Parametric Likelihood Ratio Test (BLRT), which looks for improvement in each model over a model with one fewer class; the Sample Size Adjusted Bayesian Information Criterion (saBIC), where lower values generally

indicate a better fit; entropy, which is a measure of classification uncertainty; and the latent class probabilities, which provide information on the likelihood of an individual being assigned to one class over the others. These probabilities are provided in a matrix, with values close to 1 preferred for the congruent classes and close to 0 preferred for the non-congruent classes.

Once the number of latent classes was selected, a multinomial regression was run to determine which subject characteristics influenced class membership. Race (black=1, white/other=0), age (continuous), gender (male=0, female=1), criminal risk score at baseline (moderate risk=0, high risk=1), educational status (less than high school=0, high school or more=1), TCU drug score (<3 =0, 3 or more=1) and study condition (control=0, treatment=1) were examined together in one model for drug user class and one model for social support class. Study condition effect was also examined over time for each latent class. Intercept and slope coefficients were calculated for the effect of study condition by latent class.

Results

The general characteristics of the sample of 251 probationers at baseline are provided in Table 4.1. Participants were predominantly male (74.9%) and non-white (68.9%). All subjects were active substance users prior to baseline, with an average TCU Drug Screen score of 6, indicating dependence. Less than half graduated from high school (45.2%) and the average number of lifetime arrests was 10.5, with almost half scoring in the high range for criminal risk (45.6%). At baseline, the probationers had a median of 4 persons in their contact and acceptance networks, with 3 persons in their drug using and drug opposition networks.

Table 4.2 presents the social network characteristics over time, with change scores for the OSS networks. For the study population, there was a decrease of 1 person in the median change score for the contact and drug user networks from baseline to the 12-month follow-up.

Acceptance and drug opposition networks did not exhibit overall differences in the change scores. Total perceived social support, as measured by the CAI score, increased from baseline to the 6-month follow-up and then remained stable with an overall increase of 11.2 points from baseline to 12-months, mainly from increases in family and community support levels.

Latent Class Models: Development

The fit statistics for the latent class models with classes 1 through 4 are given in Table 4.3. Models with classes greater than 4 were estimated but had classes with no observations in them. For the number of drug users in the network, the 3 class drug user model appeared to be the best fit, with the lowest saBIC and equivalent entropy and BLRT scores. An examination of the medians for the 3 class drug user model by study condition (Figure 4.2) shows three distinct trajectories for drug using networks over time: 1) those who began with a larger number of drug users in their networks at baseline and decreased significantly over time (Decrease Drug Network, DDN); 2) those who had a median level of drug users in their networks at baseline and had a small decrease over time (Stable Drug Network, SDN); and 3) those who had a low number of drug users at baseline and had slight increases over time (Increase Drug Network, IDN).

The 3 class social support model also appeared to be the best fit. Mean CAI friend scale scores by study condition show trajectories for support over time (Figure 3) that follow these patterns: 1) those who started with a higher level of support and decreased over time (Decrease Support Network, DSN); 2) those who started with an average level of support and did not change over time (Stable Support Network, SSN); and 3) those who started with an average level of support and increased support over time (Increase Support Network, ISN).

Associations with Latent Classes

The results of the multinomial regression analyses to determine variable associations with membership in the 3 class drug user model and 3 class social support model are provided in Table 4.4. The reference class for the drug user model was the stable drug user class. Black persons were less likely to be in the decreasing drug user network class (aOR: 0.33, 95% CI: 0.13 to 0.84) compared to the stable drug user class, while males were less likely to be in either the decreasing (aOR: 0.35, 95% CI: 0.15 to 0.83) and increasing (aOR: 0.02, 95% CI: 0.15 to 0.85) class than the stable drug user class. For the social support class model, the reference group was those with stable social support over time. As age increased, persons were less likely to be in the decreasing social support class (aOR= 0.93, 95% CI: 0.88 to 0.98) than the stable support class. Those who were drug dependent at baseline were less likely to be in the increasing support class (aOR= 0.86, 95% CI: 0.77 to 0.97) than the stable support class.

The results of the final model, which examined the effects of study condition on the latent class trajectories over time, are given in Table 4.5. For drug user network size, study condition did not significantly affect size or rate of change over time in any of the classes. For social support, the study condition had an effect on both the intercept and slope for the decreasing support class, with the intervention group having a lower baseline support score in this group (3.80 points lower) and a higher rate of growth from the control group. Those in the intervention group began with lower social support at baseline and had slower growth in social support over time than the control group.

Discussion

This analysis examined changes in drug user networks and perceived social support for probationers in an intervention field trial and found patterns of change over time in these network characteristics. In particular, the largest class of probationers had stable drug user

networks and stable social support over the one-year follow up period of the study. Smaller groups, less than 25% of the sample, had increases or decreases in their network characteristics, but less than 6% of the sample had decreases in their drug using networks and only 9.5% reported increases in social support over time. The intervention did not affect drug user networks over time but those in the intervention group did have lower rates of growth in social support over time than those in the control group.

Drug User Networks

While 3 classes of change in drug user networks were found, the majority of probationers had stable drug user networks over the 12-month period following baseline, indicating that it may be difficult to change these networks with a short-term intervention or an intervention that does not involve changes in location. For probationers, structural factors, including neighborhood characteristics and housing availability, may influence networks and behaviors (107, 108). A recent study found that the cessation of injection drug use was associated with relocation to areas of less social deprivation (109), while a study of the current dataset found that the availability of drugs in the probationer's neighborhood influenced the use of illegal substances (110). There is also evidence that bi-directionality exists between drug use and network composition, with changes in individual drug use affecting the amount of drug use in a network over time and network drug use affecting individual drug use over time (1). A recent study on alcohol use and social networks found that the number of heavy drinkers in a college student's network influenced alcohol consumption and norms about drinking (3), which indicates that additional information about the persons in the network may be needed to analyze change over time.

Both gender and race influenced latent class membership for change in drug user networks over time. Those of black race, who were the majority of the study population, were less likely to be in the decreasing drug user network class than their white/other race counterparts. Previous studies of race and social networks have found that black persons have more family members in their networks (71), which may make it more difficult to alter networks over time. Males were less likely to be in either the decreasing or the increasing drug user classes compared to females, indicating that men may have more stable networks over time that could be less susceptible to change.

The relationship between the drug use networks and substance use over the follow-up time period should be explored to determine if the latent classes developed for drug use networks affect substance use and what potential covariates may affect this relationship. A latent class analysis of drug use trajectories for these data has demonstrated varying patterns of use over the follow up period, with age and criminal risk factor influencing class membership (98).

Social Support

One important finding of this analysis was that older persons were more likely to have increasing social support over time, indicating that age may assist with the formation of pro-social ties. Other studies have found that younger persons tend to have larger networks (67), but that they also tend to be more influenced by peers in the initiation of substance use (3).

The other important finding was that those in the intervention group had lower baseline rates of social support than those in the control group, indicating potential issues with randomization in this population. While this study adjusted for baseline measures to control for these baseline differences, for future probationer studies, matched randomization, which pairs

persons to be randomized based on a set of blocking variables, may be useful to ensure that baseline network characteristics are similar between the study groups.

Criminal justice populations have different factors associated with engagement in substance abuse treatment than non-correctional populations. Non-offenders have been found to have social support linked to receipt of treatment (14, 60), whereas support was not associated with treatment in the criminal justice population (77). Self-help groups, such as Alcoholics Anonymous, have been found to change social networks over time by decreasing pro-drinking social ties (5). Additional analyses of these probationer data using information about participation in self-help groups during the follow-up period may assist in understanding social support mechanisms over time.

Limitations

The study sample for this analysis was limited to those recruited for the main trial which was probationers with substance use issues who had conditions for probation that required treatment and had a certain level of criminal risk. These results may not be generalizable to the whole probation population. The small sample size also limited analyses, especially with estimating larger numbers of latent classes. The sample was predominantly black and male, but this is reflective of the probationer population, but may not allow for conclusions to be drawn about women probationers and those who are not black, as they are small portions of the study sample.

The small sample size also affected the types of analyses that could be conducted. Because there were 3 probation offices where the site took place and multiple probationer officers who implemented the study, characteristics of the site and officers are important in

considering the results. Having a larger sample size to perform hierarchical analyses or using site and/or officer to stratify the analyses would have been ideal, but would have produced very small comparison groups. Almost half of subjects were recruited at one site (48.2%) in an urban area, while the rest were from suburban areas (51.8%).

When examining intervention effects, fidelity of implementation is an important consideration. Probationer officers did not have caseloads specifically dedicated to persons from the SOARING group; thus, those in the control condition could have received some intervention related messages or content. Further, there were issues with adherence and session attendance because of probation office regulations that have been documented elsewhere (32). These are issues that are often inherent in criminal justice field trials (111) and may have diluted the effects of the intervention.

The data collected on social network characteristics were also limited, as the main goal of the study was reduced drug use and recidivism using a contingency management framework, based on reinforcing positive behaviors and discouraging negative ones. Only the number of persons in each type of networks and their relationship (i.e., family, friend, or other) to the index person was known. Additional data on the drug use and criminal status of the network members would be useful for future studies, as would information on the relationships among the persons in the network.

Conclusions

This study provides information about the networks of drug using probationers and their stability over time using growth mixture modeling, which allowed for the identification of distinct classes of drug user networks and social support networks over time. This typology of

networks can be useful for understanding how those involved in the criminal justice system organize social ties and influence and how this may differ from non-correctional populations. Because the majority of probationers have substance use issues, but are often not receiving treatment (31), programs to address substance use should consider that most persons in this study had stable drug user and social support networks over time. Male probationers may have less ability to change their drug user networks over time and younger persons may need to learn how to increase social support in their networks. Future studies should examine changes in networks for this population over a longer period of time and determine what factors influence stability and change in these networks.

Table 4-1: Baseline Probationer and Social Network Characteristics

Characteristic	Percent	
% Male	74.9%	
% Non-white	68.9%	
% Completed High School	45.4%	
	Mean	Standard Deviation
Age	37.6	11.5
Lifetime Arrests	10.5	11.1
Criminal Risk Score	5.1	1.5
TCU Drug Score	6.0	2.7
	Median	IQR*
Persons in contact network	4	(3,6)
Persons in acceptance network	4	(3,5)
Persons in drug using network	3	(1,4)
Persons in drug opposition network	3	(2,5)

* IQR = Interquartile Range, the 25th and 75th quartiles

Table 4-2: Change Scores for Drug Use Network Size and Social Support over 12-Month Follow-Up Period

Social Network Characteristic	Δ Score 3-Months – Baseline¹	Δ Score 6-Months - Baseline¹	Δ Score 12- Months - 6-Months¹	Δ Score 12-Months – Baseline¹
	Median (IQR)²			
Contact Network	0(-2,1)	0 (-2,1)	0(-1,1)	-1 (-3,-1)
Acceptance Network	0(-2,1)	0(-1,1)	0(-1,1)	0 (-2,1)
Drug User Network	0(-2,1)	0(-1,1)	0(-2,0)	-1 (-3,0)
Drug Opposition Network	0 (-2,1)	0 (-1,1)	0(-1,1)	0(-2,1)
	Baseline	3-Months	6-Months	12-Months
	Mean (Standard Deviation)			
Total CAI Score	89.8 (6.1)	98.7 (7.7)	102.4 (14.1)	101.2 (10.3)
Partner/Spouse	19.4 (2.8)	18.4 (2.5)	20.7 (4.0)	18.8 (2.9)
Family outside Home	20.6 (2.4)	22.9 (3.2)	24.3 (4.9)	23.6 (3.6)
Community	30.3 (4.1)	34.9 (4.9)	35.9 (8.4)	35.1 (5.3)
Friends	19.6 (2.5)	20.3 (2.4)	21.5 (3.3)	20.7 (2.3)

¹Δ Scores are differences in number of persons in network between later time period and earlier time period

²IQR= interquartile range (25th and 75th percentiles)

Table 4-3: Fit Statistics and Latent Class Probabilities for Growth Mixture Models for Drug User Networks and Social Support

Statistic	Drug User Networks				Social Support Available			
	Number of Classes				Number of Classes			
	1	2	3	4	1	2	3	4
saBIC ¹	3935	3875	3840	3828	4731	4724	4749	4710
Entropy	1	0.8	0.8	0.8	1	0.5	0.8	0.7
<u>BLRT²</u>								
X ²		67.2	42.1	18.4		14.1	22.8	4.4
Degrees of Freedom		3	3	3		3	3	3
P-value		0.0	0.0	0.0		0.0	0.5	1.0

¹ saBIC = Sample Size Adjusted Bayesian Information Criterion

² BLRT= Bootstrapped Parametric Likelihood Ratio Test

Table 4-4: Multivariate Multinomial Regression Models: Factors Associated with Latent Class Membership for Drug User Network Size and Social Support

	Decreasing Compared to Stable Drug Network	Increasing Compared to Stable Drug Network	Decreasing Compared to Stable Social Support	Increasing Compared to Stable Social Support
	Adjusted Odds Ratio ¹ , 95% Confidence Interval			
Male Gender	0.35 (0.14 to 0.83)	0.36 (0.15 to 0.85)	0.72 (0.24 to 2.18)	0.64 (0.33 to 1.25)
Age (in years)	0.97 (0.94 to 1.01)	1.00 (0.96 to 1.03)	0.93 (0.88 to 0.98)	1.00 (0.98 to 1.03)
Black Race	0.33 (0.13 to 0.84)	0.63 (0.26 to 1.56)	1.74 (0.52 to 5.84)	0.64 (0.33 to 1.26)
High School Graduate	1.29 (0.53 to 3.15)	0.92 (0.38 to 2.23)	1.05 (0.35 to 3.17)	1.43 (0.76 to 2.70)
High Criminal Risk	1.30 (0.50 to 3.38)	0.69 (0.26 to 1.85)	1.06 (0.33 to 3.40)	1.02 (0.51 to 2.03)
Drug Dependent	0.97 (0.84 to 1.15)	0.86 (0.73 to 1.01)	0.96 (0.78 to 1.18)	0.86 (0.77 to 0.97)

¹ Referents: Males, Black Race, Graduated High School, High Criminal Risk (Score > 4), and Drug Dependent (Score > 2)

Table 4-5: Growth Mixture Model Results for Latent Class Models with Study Condition

	DDN (n=20)	SDN (n=207)	IDN (n=24)
Percent of Sample	8.0%	82.5%	9.5%
Beta (Standard Error)			
Intercept	4.6 (1.5)*	2.4 (1.2)*	0 (6.6)*
Slope	-1.1*	-0.10	.9*
Intercept*Study Condition	1.3	1.10	1.20
Slope*Study Condition	0.0	0.00	0.12
	DSN (n=14)	SSN (n=191)	ISN (n=46)
Percent of Sample	5.6%	76.1%	18.3%
Intercept	26.2 (1.6)*	20 (.46)*	19.6 (.94)*
Slope	-2.2 (.40)*	0.03 (.12)	1.2 (.26)*
Intercept * Study Condition	-3.8*	-0.16	0.24
Slope * Study Condition	.62*	0.01	-0.07

DDN = Decreasing Drug User Networks, SDN = Stable Drug User Networks, IDN = Increasing Drug User Networks
DSN = Decreasing Social Support, SSN = Stable Social Support, ISN = Increasing Social Support

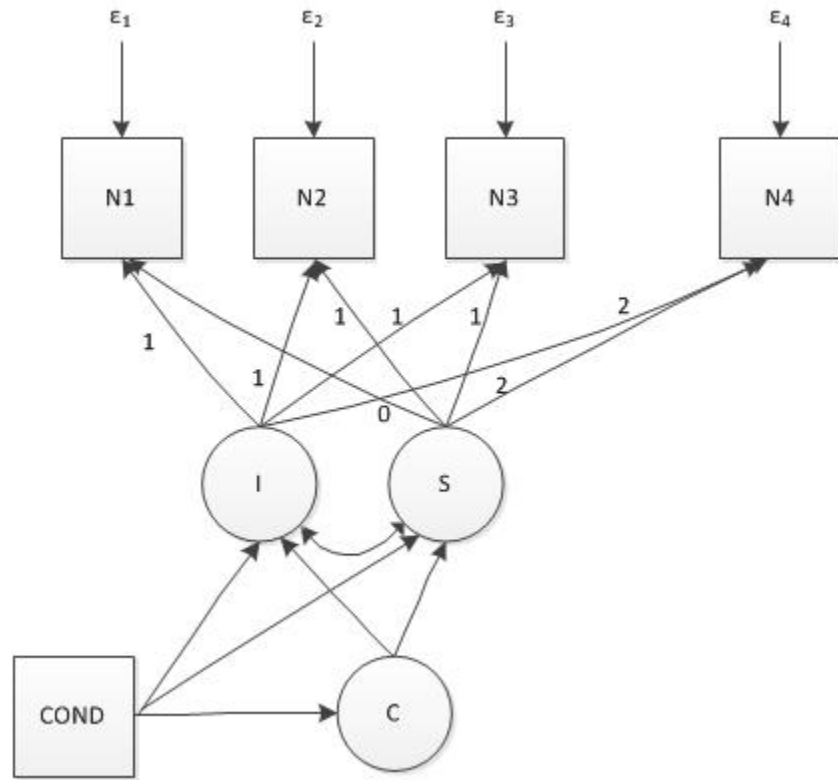


Figure 4-1: Latent Growth Mixture Model for Drug User Networks and Social Support

N represents the social network characteristic measured at each time period, either drug use network size or amount of social support available. I is the intercept or beginning value and S is the slope or rate of change over time. COND is the study condition, intervention or control, which is hypothesized to influence both I and S and also influence membership in the latent class, C.

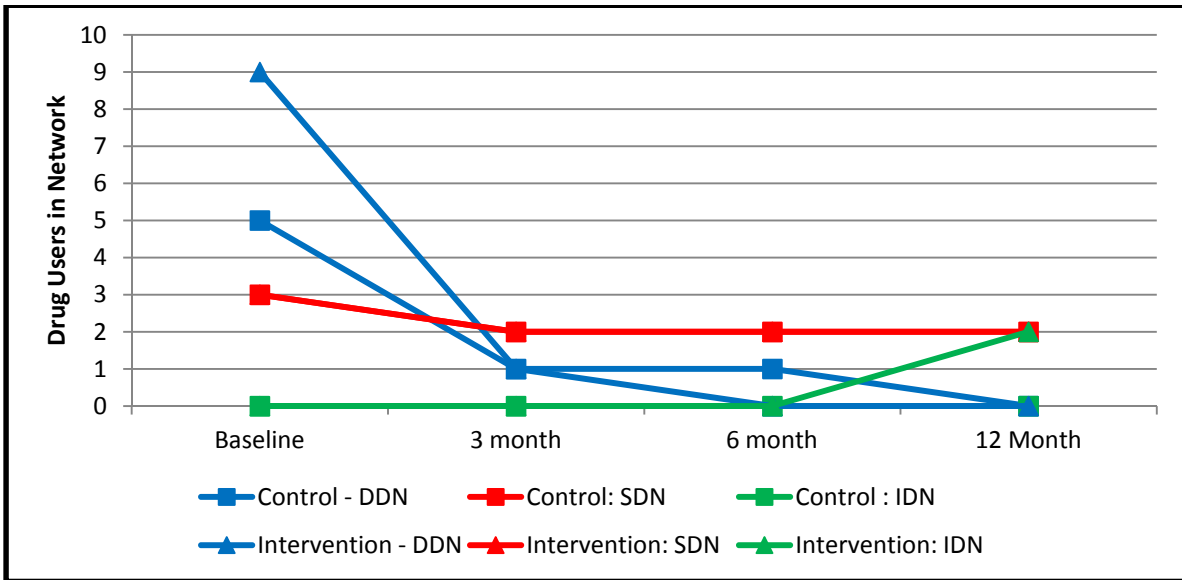


Figure 4-2: Median Drug Network Size by Study Condition and Latent Class Membership
 DDN = Decreasing Drug User Networks, SDN = Stable Drug User Networks, IDN = Increasing Drug User Networks

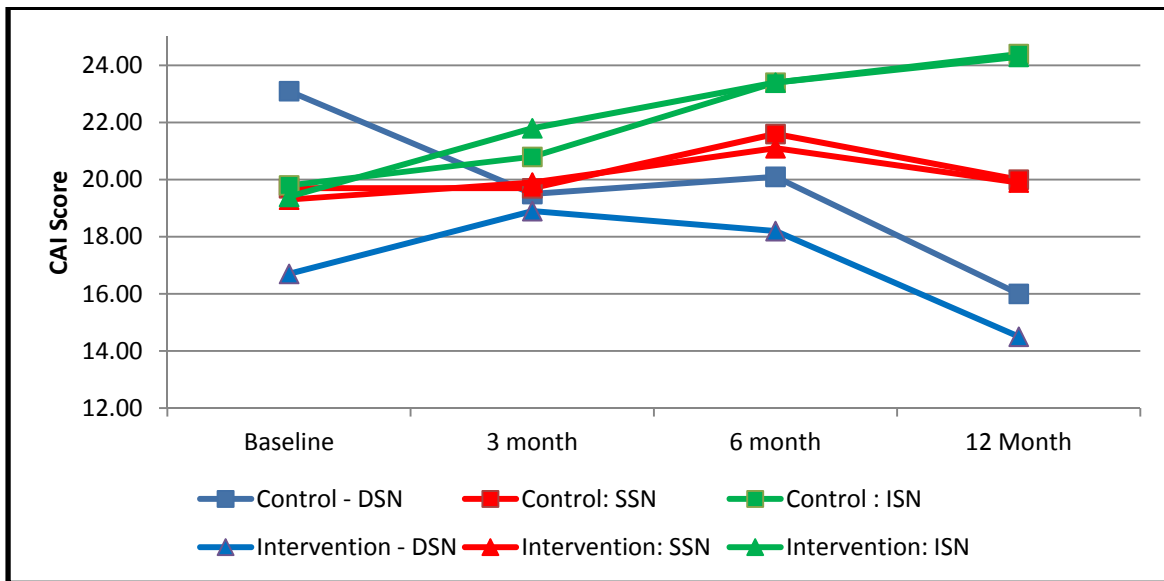


Figure 4-3: Mean Social Support Scores by Study Condition and Latent Class Membership
 DSN = Decreasing Social Support, SSN = Stable Social Support, ISN = Increasing Social Support

Chapter 5 – Network Changes and Drug Use in Probationers: A Test of Social Influence Theory

Abstract

Previous studies have found evidence for social influence theory (12) in explaining drug use in the context of a person's social network (1, 11), but no studies have examined this theory for those involved in the criminal justice system. Hard drug use (any illicit substance except for marijuana) and social network patterns over a 12-month period were examined for a sample of 251 probationers from a field trial conducted in Maryland between 2007 and 2010. The effects of growth classes of drug user network size and social support on probationer drug use trajectories were estimated. Overall drug use declined over the study period from 64% using drugs at baseline to 35% using at the 12-month follow-up. Those with high criminal risk had increased drug use rates at the 12-month follow-up compared to those with moderate risk (43.5% vs. 27.2%), as did those with baseline drug dependence compared to those without dependence (38.8% vs. 10.8%). Those 35 and older also had higher drug use rates at the 12-month follow-up compared to those under 35 (42.3% vs. 35.0%). Multinomial regressions did not show differential effects of social support on drug use trajectories over time. Those with both increasing (aOR=5.08, 95% CI: 1.09 to 23.75) and decreasing (aOR=6.45, 95% CI: 1.35 to 30.85) drug user networks over time were more likely to be in the lowest drug using group compared to those with stable drug user networks. An increase in age (by years) was associated with a lower likelihood of being in the lower drug use trajectory (aOR=0.96, 95% CI: 0.92 to 0.99) whereas those with high criminal risk were more likely to be in a stable drug use class than an increasing drug use class compared to those with moderate criminal risk (aOR=2.41, 95% CI: 1.03 to 2.64). Because those with both increasing and decreasing drug user networks also had

smaller networks, drug user networks that were smaller and changed over time were associated with lower rates of drug use over time than larger, more stable drug user networks. Interventions should aim to decrease drug user networks and more accurately capture social support for this population.

Introduction

Probationers comprise the majority of persons in the criminal justice system and about 1 in 61 adults in the United States were on probation at the end of 2012, compared to 1 in 696 who were incarcerated in federal or state prisons (8). Almost half of probationers received their sentences because of drug or alcohol specific offenses and substance use among probationers has been found to lead to recidivism and violations of probation (88, 95).

The composition of a person's social network has been shown to affect substance use over time (3, 5, 16, 90). Networks, which can influence a number of different risky behaviors (65, 112, 113), may provide social support or other mechanisms that encourage or discourage certain behaviors. While many studies have examined the networks of those with substance use issues (2, 13), the unique challenges of those who are also involved in the criminal justice system have not been as fully explored.

Social networks that are larger (15) and include a greater rate of supportive relationships (18) have been found to decrease drug use. A study on the effects of changes in social networks on long-term alcohol use found that an intervention that increased support for abstinence in a person's social network also increased the number of non-drinking days over a two year period (19). Social support for treatment has been found to be a predictor for desistance in drug use over time in non-correctional populations (4, 13, 60), but its influence for those who cycle in and out of the criminal justice system and may have a variety of mandated conditions and controlled environments, is less clear (90).

Research on social networks for probationers is limited. Qualitative studies done in correctional populations have found that social support is important in reducing substance use and recidivism. For example, a study of incarcerated women that conducted in-depth interviews

found decreased perceptions of social support were associated with increases in drug use and criminal activities and that the size of the network was also negatively correlated to drug use (63). Another study involving adult male probationers (N=50) with recent incarceration found that, while network composition changed considerably before and after incarceration, the amount of support for treatment from the networks did not change (88).

A large cross-sectional study reported that those in the criminal justice system have different predictors of entry into substance abuse treatment than those not in the system, and that social support for criminal justice populations did not affect entry into treatment (77). A study of probationers in Delaware and Kentucky found that those who had used cocaine or crack were more likely to have accessed any type of substance abuse treatment (12-step, voluntary, or mandated) than those using other drugs and those arrested for a drug offense were also more likely to access any treatment than those not arrested for drug crimes (114).

Social influence theory argues that drug use results from interactions with others who model this behavior and those people who are more important to a person may have increased influence (12). This theory has been cited in studies of adolescent drug use and the initiation of different types of substance use (115, 116). Criminal justice system involvement, however, and its interaction with social influence on drug use, has not been examined over time.

This study is designed to test social influence theory for drug users over time, in a population of probationers. This study has two aims: 1) to determine if the number of drug users and the amount of social support available in the social networks of probationers affect drug use over a 12-month time period and 2) to determine what individual probationer characteristics influence changes in drug use over the 12-month period. It is hypothesized that decreases in the

number of drug users and increases in social support over time in the network will lead to decreases in drug use over time by the probationer.

Methods

Study Design

The current study uses data originally collected as part of a randomized clinical trial (RCT) conducted with probationers from three parole and probation offices located in two Maryland jurisdictions from 2007 through 2010. The RCT tested the effectiveness of a seamless model for probationer drug treatment. Study participants (N=251) were randomly assigned to the SOARING condition where drug treatment was part of their probation supervision or to the control condition, which was a traditional model where they were referred to treatment within the community. Eligibility criteria required that study participants had to be on probation with substance abuse treatment as a stipulation of their sentence. Participants were excluded if they were part of a specialized probationer officer caseload (such as gangs or sexual offenders), or had less than six months left on their sentence.

The study protocol was approved by the Institutional Review Boards at Virginia Commonwealth University, George Mason University, and Friends Research Institute. All persons in the study participated in the informed consent process. Data were collected on study participants at baseline, which was at or shortly after their first visit to the probation office, and at 3-, 6-, and 12-months after baseline.

One important part of the intervention arm design was the development of pro-social networks that encouraged support for substance use treatment and discouraged substance use. Six group sessions were conducted with the probationers and a significant other in the intervention arm that worked on identifying problem areas the significant other and offender

wanted to work on together and established agreements about ways in which the significant other could help the offender be successful on supervision.

Probationer Characteristics

Participant characteristics collected at baseline included race, gender, age, education level and age at first arrest. Education level was dichotomized into those finishing high school and those who did not, while age was grouped into those under 35 and those 35 and older. Ages for first arrest and drug use were divided into those under 18 and those 18 and older. Criminal risk was also measured, using a six item scale that has a range of scores from 0 through 9, with higher scores indicating an increased risk for recidivism (34). Drug dependence was assessed through the Texas Christian University Drug Screen, a nine-item dichotomous questionnaire that has been validated for use in correctional populations, with higher scores indicating an increased chance of substance use dependence (99). Those with a criminal risk score over 5 were classified as high risk, while those with a TCU drug score of 3 or higher were classified as drug dependent.

Social Network Instruments

Social network data were collected by a modified Orientation of Social Support (OSS), which measures the number of people in a network and the type of support network (40). For this analysis, the number of persons in one's drug user network was utilized. The probationer could name up to 14 persons in each type of network, including drug users. OSS data collected were collected at baseline and at each follow up time point.

The Community Assessment Inventory (CAI) was used to measure perceived positive social support available to the probationer. The CAI measures community supports available to the probationer, including family, friends, and the neighborhood (41). The CAI scale items assess the client's perception of support for involvement in substance abuse treatment and

behaviors associated with drug use cessation. Items included questions on whether the probationer felt help was available from network sources, ease of talking to others about problems and understanding of treatment services by others. The CAI scales have been found to be reliable and predictive of treatment readiness, as measured by the Texas Christian University Motivation Scale (41). For this analysis, the total CAI scale score, with 37 items, was utilized. Total scores generally range from 72 to 146, with higher scores indicating more perceived positive support.

Drug Use

At baseline, drug use history data were collected, including age at initiation of drug use for each of 20 types of drugs, including alcohol and tobacco. Data were collected at all four time points on days of probationer drug use, using a timeline follow back method, which has been shown to be a reliable measure of substance use (39, 117). The timeline follow back is a calendar assisted structured interview that cues memory so that accurate recall is enhanced. For 180 days prior to the baseline interview and for each day of the follow-up periods, respondents reported whether they used each type of drug. The timeline follow back also collected data on the subject's location each night in the time period (e.g., home, prison, hospital, treatment center, etc.).

Hard drug use was defined as use of any of the 20 drugs except tobacco, alcohol, and marijuana. Age at initiation of hard drug use was calculated by taking the minimum age across the ages reported for first drug use for all drugs except tobacco, alcohol, and marijuana. Days of hard drug use during each time period were calculated adjusting for incarceration time. Because this was a probation population, the possibility of being incarcerated during the baseline and follow-up periods was significant. Hard drug use is significantly curtailed during periods of

incarceration. Hard drug use days were adjusted for each time period by calculating the percentage of hard drug use days that occurred while the subject was not incarcerated or hospitalized or in a residential treatment facility. This percentage was multiplied by 90 to obtain a standardized number of drug use days in a 90 day time frame, since each follow up period could vary in the number of days that were recorded on the timeline follow back.

An example for a person who used hard drugs for 10 days in a 120 day follow up period and was incarcerated for 20 days during that period:

$$\# \text{ of hard drug use days over 90 day period} = [10/(120-20)] * 90 = 9$$

Changes in Drug Use, Drug Users, and Social Support

In a previous analysis using data from this study, three growth trajectories were found for both drug user network size over time and for the amount of perceived social support (118). We found 3 classes for drug user changes over time: 1) those who began with a larger number of drug users in their networks at baseline and decreased significantly over time; 2) those who had a median level of drug users in their networks at baseline and had a small decrease over time; and 3) those who had a low number of drug users at baseline and had slight increases over time. We found 3 classes also for change in social support: 1) those who started with a higher level of support and decreased over time; 2) those who started with an average level of support and did not change over time; and 3) those who started with an average level of support and increased support over time.

To estimate changes in drug use over time, a similar latent class analysis was done, using information from another study of these drug use data (98), which found 5 latent classes for drug use trajectories over the 12-month follow-up period. A 5 class model was estimated for change

in hard drug use days over time. The latent class analysis was conducted in Mplus Version 5 (102).

Analysis

Sample characteristics were examined at baseline, including percentages for race, gender, high criminal risk, drug dependence, and those reporting more than 4 drug users in their networks. Distributions for age, education level, age at first arrest, and age at first hard drug use were also analyzed. The percentage of the sample using hard drugs was examined at each follow up time point by probationer characteristics to determine which variables might be associated with changes in hard drug use over time.

Models

To test the theory of social influence, which posits that a person's behavior is influenced by who they associate with, a multinomial regression was run which examined the influence of the drug user change classes on the hard drug use change classes, and a regression was run for the influence of the social support change classes on the hard drug use change classes. The outcome variable in these regressions was the drug use latent growth classes, which had 5 levels. The referent level for drug use was latent growth class 5, the high using, increasing class. For the drug user model, where the latent growth class variable of drug users in the network was a determinant, the reference group was the stable drug user group (n=207). For the social support model, where the latent growth class variable of perceived social support was a determinant, the reference group was the stable support group (n=191). Both models were adjusted for potential confounders that were determined in the bivariate analysis. All multinomial models were estimated in SPSS Version 20 (119).

Results

Table 5.1 presents baseline characteristics. Over two-thirds were male and the majority of the probationers were black, with an average age of 36.9 years and over three-fourths had indications of drug dependence. The average age of drug initiation was 19.7 years and first arrest was similar, at 20.4 years. Close to 40% reported 4 or more drug users in their networks at baseline. The average education level was below high school graduate at 11.3 years of school. The large majority of persons were in the stable drug user network class (82.5%), with less than 20% in the increasing and decreasing networks. For social support networks, 17.6% were in the increasing support class, with the majority (76.1%) in the stable support class.

Bivariate analysis results of hard drug use at each follow up period are given in Table 5.2. Those 35 years and older were more likely to use hard drugs at each time period, with only 25% of those under 35 reporting hard drug use at the 12-month follow-up versus 42.25% of those 35 and older. Those with a drug dependence score of 3 or more were also more likely to use hard drugs at each time period, with 70.56% of those with scores over 3 using hard drugs at baseline compared to 24.32% of those with scores less than 3. Those with high criminal risk had a higher likelihood of using hard drugs at all of the follow up time points, but not at baseline, compared to those with moderate risk. Conversely, females (75.41%) were more likely to use hard drugs at baseline than males (60%) but the difference was not significant during the follow up time periods. Those who were over 18 at first arrest (69.06%) and over 18 at first drug use (78.3%) were also more likely to be using hard drugs at baseline than those first arrested over 18 (57.14%) and who first used drugs at over 18 (53.1%), but these differences were not sustained through all follow up periods, except for age at first drug use which was still significantly different at the 3-month follow up.

Results of the growth classes over time for drug use are given in Figure 5.1. The 5 classes for drug use are: Class 1 (35.9%), those starting with low drug use and decreasing to no drug use; Class 2 (5.6%), those with average use at baseline and decreases over time; Class 3 (18.7%), those with high drug use at baseline and large decreases over time; Class 4 (23.1%), those with high drug use at baseline and stable use over time; and Class 5 (16.7%), those with high drug use over all time periods, with some increase. Most classes had decreases in drug use between baseline and the 3-month follow-up, but these decreases were not sustained over time for all classes.

The results of the multinomial regressions are given in Tables 5.3 and 5.4. The models that examined drug use and drug user networks are given in Table 5.3, with Adjusted Odds Ratios (aOR) and 95% confidence intervals (CI). Probationers who were in the increasing (aOR=5.08, 95% CI:1.09 to 23.76) or decreasing (aOR=6.43, 95% CI: 1.34 to 30.73) drug user networks were more likely to be in the lowest drug user class compared to those with stable networks, while those with drug dependence at baseline were less likely to be in the lowest drug user class (aOR=0.83, 95% CI: 0.72 to 0.95) than the high, increasing drug use class compared to those without drug dependence. The only other significant results were in the high, stable drug use class where those with high criminal risk were more likely to be in this class (aOR=2.58, 95% CI: 1.23 to 5.39) than the increasing drug use class compared to those with moderate criminal risk. An increase in age was associated with a decreased likelihood of being in the high stable drug use class (aOR=0.97, 95% CI: 0.94 to 0.99) compared to the increasing drug use class.

The increasing drug user class had an average of 0 drug users in the network at all time periods except the 12-month follow-up, where there was an average of 1 drug user in the

network. The decreasing networks were also smaller, with an n average of 4 persons at baseline, with decreases to 0 persons by 12-months. In contrast, the stable drug user networks had 2 to 3 persons in them throughout the study period.

Table 5.4 presents the results of the multinomial regression models of drug use change on social support change classes. While none of the social support classes were significant, the same probationer characteristics were significant in these models as in the drug user network models, with those who were drug dependent at baseline less likely to be in the lowest drug user class (aOR=0.86, 95% CI: 0.75 to 0.99) compared to those who were not drug dependent, and those with high criminal risk more likely to be in the high stable drug use class (aOR=2.60, 95% CI: 1.24 to 5.46) than those with moderate criminal risk. An increase in a year of age was also associated with an increased likelihood of being in the increasing drug user class compared to the high stable use class (aOR=0.97, 95% CI: 0.94 to 0.99).

Discussion

This is the first study to examine the theory of social influence in the networks of the probationer population over time and the findings indicate that drug user networks that are smaller and change over time may be associated with lower rates of drug use. Social support did not influence drug use changes over time, which is different from previous longitudinal studies in non-correctional populations which have found that increases in social support over time are associated with decreases in drug and alcohol use (2, 3, 19). Cross-sectional studies of those involved in the criminal justice system have also found that increased perceived positive social support is linked to decreased drug use and increased substance use treatment (64, 90).

Probationer Characteristics

While increasing age has previously been associated with decreasing criminal activity (76, 120), this study demonstrated that increases in age for probationers were associated with a higher likelihood of increases in drug use over time. A previous analysis of this data also showed that increased age was associated with higher social support over time (118). While older probationers may have more social support in their networks, it does not appear that this support is linked to decreased drug use.

Baseline drug dependence was also linked to increased drug use over time, with those classified as drug dependent at baseline being less likely to be in the low drug use class over time. While those with drug dependence were the majority of the population in this study (84.3%), they were more likely to start out with higher drug use levels at baseline.

Criminal risk also influenced drug use trajectories over time, with those in the high criminal risk group more likely to be in the high stable use group than in the high increasing use group. This indicates that those with high criminal risk may be less likely to have changes in drug use over time and may be less influenced to change drug use patterns than those with moderate criminal risk. Previous assessments of risk have shown links between high levels of risk and continued substance use (83). Recidivism has also been linked to continuing substance use (92, 95) and treatment resources are often not available for offenders (28, 31).

Drug User Networks

This analysis found that those with smaller and changing drug user networks over time were more likely to be in the low, decreasing drug use class while those with stable drug user networks were more likely to be in any of the other drug using classes, which all had higher drug use rates over time. This indicates that drug user networks which changed over time and were very small (less than 3 people) were associated with decreases in probationer drug use over time.

Other studies have found that reductions in drug using networks are associated with decreased drug use (1,2, 88) in both correctional and non-correctional populations, but this is the first study to support this finding in a cohort of probationers over time. Decreasing the number of drug users in a probationer network could be an important tool in reducing drug use and recidivism.

Social Support

While this is one of the first studies to look at the impact of drug user networks and social support on probationer drug use employing longitudinal data, the findings of no relationship between social support over time and drug use are not consistent with previous studies on non-correctional populations (13, 60) and indicate that support may operate differently in the networks of probationers and not influence drug use. This population is highly drug-involved, with over 60% reporting hard drug use in the 6 months prior to the baseline interview and also very criminally-involved, with an average of 10.5 prior arrests. This sample may be less susceptible to the influence of social support for changing drug behaviors. This population had an average age of 37.6 and a study that examined the factors that influence criminal activity among probationers found that older probationers had different responses to social bonds than their younger counterparts. In particular, as probationers aged and had a spouse, they were more likely to commit crimes than those who were younger (121). This may indicate that the social support perceived by older probationers may encourage illegal activities, as networks may be more likely to support drug use and crime.

Other measures of support may be more important for this population, including relationships to criminal justice and treatment personnel. In a recent randomized trial of a collaborative behavioral management intervention for parolees, the relationship between the probationer and their officer was found to positively impact outcomes of drug use and arrests

over a 9-month follow-up period, with those in the treatment group having significantly higher rapport with their officers than those in regular parole (122). A recent study of probationers with co-occurring substance abuse and mental health disorders found that professional persons made up a large percentage of the probationer networks and that these professionals, specifically clinicians, exerted influence on probationer behavior regarding violations (9).

Limitations

There are a number of limitations that must be considered when interpreting this study. The original study was not designed to collect full social network information; thus a number of network measures were not collected. As a result, the data do not comprise a full social network, where all ties to one person are explored and the relationships among the network persons are also explored (84). From the OSS, only the initials of the persons and their relationship to the subject are available. In particular, for this analysis, knowing the criminal justice status of network members would have been useful for examining change over time. While data were collected on crime networks, these data were limited and did not provide information about whether a network member was on probation, or incarcerated or any criminal history.

Another limitation is the use of self-report data for drug use, which can be subject to recall bias. The use of the timeline follow back method has been found to mitigate this effect, especially in studies of substance use (39, 117). Cheek swab samples were also collected in this study, which tested for a limited number of drugs in a limited time frame, but there was good congruence found between biological results and self-report (110). The 12-month time frame for follow up is also a limited time to examine changes in drug use and social networks, as the literature has indicated that persons may have long cycles of use and abstinence (123).

The sample size is also a limitation, as analyses could not be stratified by site to determine what differences might exist among the 3 recruitment sites to explain differences in drug use and drug user networks.

Conclusions

Social influence theory does appear to operate in the drug using networks of probationers, with those who have smaller networks that change over time being more likely to have lower rates of drug use over time. The focus of probation is often on the individual offender and ensuring that mandated conditions are being met, including abstinence from drug use (125). Specific programs to elicit information from probationers on their patterns of and reasons for spending time with drug using network members would provide guidance on how to work with offenders to reduce drug use.

Table 5-1: Probationer Demographic, Social Network and Drug Use Variables at Baseline

Characteristic	Percent
Male	74.9%
Black	68.9%
High Criminal Risk	45.3%
TCU Drug Dependence	84.3%
Drug User Network Classes	
Decreasing Drug User Network	8.0%
Stable Drug User Network	82.5%
Increasing Drug User Network	9.5%
Social Support Classes	
Decreasing Social Support	5.6%
Stable Social Support	76.1%
Increasing Social Support	18.3%
Mean (Standard Deviation)	
Age	36.8 (11.5)
Education Level	11.3 (1.7)
Age at First Hard Drug ¹ Use	19.7 (7.8)
Age at First Arrest	20.4 (8.1)
Average Perceived Social Support	89.8 (6.1)

¹Hard Drug Use includes use of cocaine, heroin, methamphetamines, barbiturates, other opiates, amphetamines, tranquilizers, sedatives, GHB, ketamine, inhalants, street methadone, or other illicit substance (not marijuana) for the purpose of getting high. It does not include alcohol or tobacco

Table 5-2: Hard Drug Use at Baseline, 3-Month, 6-Month, and 12-Month Follow-Up by Probationer Characteristics

Characteristic	Hard Drug Use ¹ Percentage			
	Baseline	3-Month	6-Month	12-Month
Overall	63.74%	41.83%	35.86%	34.66%
<u>Gender</u>				
Male	60.00%	40.53%	35.26%	31.58%
Females	75.41%*	45.90%	37.70%	44.26%
<u>Age</u>				
Under 35	41.67%	26.85%	26.85%	25.00%
35 and older	80.28%*	53.52%*	42.96%*	42.25%*
<u>Race</u>				
Black	64.67%	44.31%	34.52%	34.13%
White/Other ²	61.90%	36.90%	36.53%	35.71%
<u>Education</u>				
Less than High School	63.50%	40.87%	36.50%	32.85%
Graduated High School	64.03%	42.98%	35.09%	36.84%
<u>Criminal Risk³</u>				
Moderate	62.50%	33.09%	29.41%	27.21%
High	65.21%	52.17%*	43.48%*	43.48%*
<u>TCU⁴ Drug Dependence Score</u>				
<3	24.32%	8.11%	8.10%	10.81%
3 or more	70.56%*	47.67%*	40.65%*	38.78%*
<u>Age at First Arrest</u>				
< 18	57.14%	37.50%	33.93%	34.82%
18 or older	69.06%*	45.32%	37.41%	34.53%
<u>Age at First Hard Drug Use</u>				
< 18	53.10%	35.86%	32.41%	32.41%
18 or older	78.30%*	50.00%*	40.57%	37.73%

* p < .05, ¹Hard Drug Use includes use of cocaine, heroin, methamphetamines, barbiturates, other opiates, amphetamines, tranquilizers, sedatives, GHB, ketamine, inhalants, street methadone, or other illicit substance (not marijuana) for the purpose of getting high. It does not include alcohol or tobacco

² Percent of other race was < 1% in this sample and was combined with white for analyses

³ Criminal Risk scale, range 0-9, with scores > 4 indicating high risk

⁴ TCU = Texas Christian University (Drug Dependence scale, range 0-9, with >2 indicating dependence)

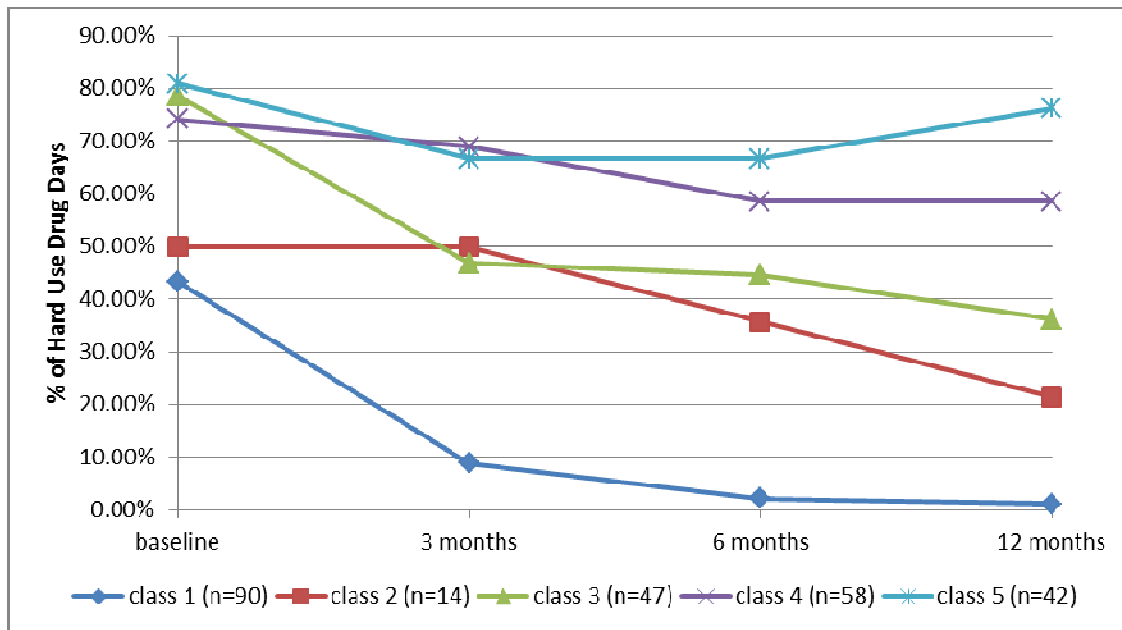


Figure 5-1: Average Percent of Drug Use Days by Estimated Latent GrowthClass for the 12-Month Study Period: 5 Class Model Results

Class 1 = low, decreasing drug use, Class 2 = average, decreasing drug use, Class 3 = high, decreasing drug use, Class 4 = high, stable drug use, Class 5 = high, increasing drug use.

Table 5-3: Social Influence Model of Drug Use for Probationers: Multinomial Regression of Drug Use Changes on Changes in Drug User Networks

	Low Drug Use Class (1) Compared to High User Class (5)	Moderate Drug Use Class (2) Compared to High User Class (5)	High User Decreasing Class (3) Compared to High User Class (5)	High User Stable Class (4) Compared to High User Class (5)
Adjusted Odds Ratio¹, 95% Confidence Interval				
Increasing Drug User Network Class ²	5.08 (1.09 to 23.76)	3.05 (0.39 to 23.83)	0.93 (0.13 to 6.90)	1.87 (0.32 to 10.81)
Decreasing Drug User Network Class ²	6.43 (1.34 to 30.73)	1.88 (0.15 to 23.11)	0.46 (0.04 to 5.28)	0.68 (0.09 to 5.10)
Age (in years)	1.02 (0.99 to 1.05)	0.98 (0.94 to 1.02)	0.99 (0.97 to 1.03)	0.97 (0.94 to 0.99)
High Criminal Risk	1.45 (0.71 to 2.93)	1.26 (0.43 to 3.70)	1.48 (0.69 to 3.18)	2.58 (1.23 to 5.39)
Drug Dependent	0.83 (0.71 to 0.95)	0.88 (0.71 to 1.09)	0.95 (0.82 to 1.11)	1.04 (0.90 to 1.22)

¹ Referents = Age (in years), Criminal Risk = High Criminal Risk (Risk Score > 4), Drug Dependence at Baseline (Drug Score > 2)

² Reference group for Drug User Network = Stable Drug User Network (n=207).

Table 5-4: Social Influence Model of Drug Use for Probationers: Multinomial Regression of Drug Use Changes on Changes in Social Support

	Low Drug Use Class (1) Compared to High User Class (5)	Moderate Drug Use Class (2) Compared to High User Class (5)	High User Decreasing Class (3) Compared to High User Class (5)	High User Stable Class (4) Compared to High User Class (5)
Adjusted Odds Ratio¹, 95% Confidence Interval				
Increasing Social Support Class ²	2.05 (0.75 to 5.62)	0.44 (0.05 to 4.06)	1.43 (0.46 to 4.43)	1.06 (0.33 to 3.36)
Decreasing Social Support Class ²	1.11 (0.25 to 4.97)	0.78 (0.07 to 8.17)	0.61 (0.10 to 3.87)	0.68 (0.13 to 3.63)
Age (in years)	1.02 (0.99 to 1.05)	0.98 (0.94 to 1.03)	0.99 (0.97 to 1.03)	0.97 (0.94 to 0.99)
High Criminal Risk	1.45 (0.72 to 2.91)	1.28 (0.44 to 3.75)	1.49 (0.69 to 3.22)	2.60 (1.24 to 5.46)
Drug Dependent	0.86 (0.75 to 0.99)	0.88 (0.71 to 1.10)	0.95 (0.82 to 1.11)	1.04 (0.90 to 1.21)

¹ Referents = Age (in years), Criminal Risk = High Criminal Risk (Risk Score > 4), Drug Dependence at Baseline (Drug Score > 2)

² Reference group for Social Support Network = Stable Support Network (n=191).

Chapter 6 – Summary

This dissertation analyzed the social networks of 251 probationers from a field trial of integrated probation and treatment services in Maryland. The main goals of this study were to: describe the social networks of the probationers by drug user type and over the 12-month follow up period, to examine changes in drug user and social support networks over the study period, and to test social influence in this group of probationers by examining the effect of changes in drug user networks and changes in social support on changes in drug use over the 12-month time frame. The effect of the intervention on the changes in drug user and social support networks was also examined, as were probationer characteristics that influenced changes in drug user networks, social support, and drug use over the study period.

The initial paper found that social network characteristics did not vary by type of drug user, but that race and drug use history were important factors in being a polydrug user at baseline, with white/other race persons and those who had cocaine and/or heroin as their drug of choice and initiated drug use at a younger age being more likely to use multiple illicit substances. While drug initiation age and drug choice were both found in previous studies to affect polydrug use (59, 78, 80), the race finding was not the same as all studies, and may require further exploration.

A closer focus on specifics of the social networks and their changes over time demonstrated that majority of the probationers had stable drug user (82.5%) and perceived social support (76.1%) over the 12-month follow up period. Males were less likely to have changes in their drug user networks over time than women and blacks were less likely to have decreases in their drug using networks over time than whites/other race. Males have been found to have

smaller, more consistent networks over time in non-correctional populations (66), while blacks have been documented to have more family in their networks than whites, and more consistent ties over time (71). Those with drug dependence were less likely to have increasing social support over time, while increases in age indicated a lower likelihood of decreasing social support. Those in the intervention group had lower social support at baseline than those in the control group.

Drug use trajectories over time were linked to age, drug dependence, and criminal risk, with those with high criminal risk having high stable drug use over the 12-month time period, and those with drug dependence less likely to have low drug use over time. Increasing age was linked to higher increasing drug use over time. Those who had smaller, drug user networks that changed over time were more likely to have low drug use over time than those with larger stable drug user networks.

This is the first study to examine drug use and specific social network characteristics of probationers over time. The findings from this study demonstrate that probationers, who are at high risk for recidivism and substance use, do not have highly variable networks over a 12-month period. Social support as measured in this study, which has been shown to reduce drug use in many non-correctional populations (4, 19), does not appear to affect probationer drug use. Other ways to measure social support for this population may be warranted, as qualitative studies have found that offenders cite increased social support as a reason for decreasing substance use and decreased criminal activity (63). Factors not included in this study that may affect drug use and networks over time, include interactions with criminal justice and treatment personnel who are often frequent contacts for probationers (9). Future studies should examine relationships

between probationers and these types of network members, to determine if and how they influence drug use and recidivism.

While drug use days were adjusted for times of incarceration in this study, a closer look at patterns of incarceration for probationers is warranted, as these times in a controlled environment could impact future drug use and network ties over time (83). Over 60% of the population was incarcerated at some point during the study period and understanding how networks and social support change, as incarceration occurs, would be important for designing network interventions that could be tailored for different levels of recidivism.

This study provides evidence that the social networks of probationers are influenced by justice characteristics, including criminal risk, and by substance dependence. Because this population was very justice-involved and engaged with corrections (an average of 10.5 prior arrests) and drug-involved, the results demonstrate that those with extensive criminal and drug histories may not have networks that are easily changed. These types of offenders may not respond to traditional probation services (82) but may need interventions that address criminal, as well as, drug-using peers and how to change the influence of these peers.

In short, future directions for research should include more extensive network data collection on probationers to determine additional characteristics of network members, including drug use patterns, importance and proximity to the probationer, and their criminal justice status. These elements would allow for additional analysis of more specific influences and how networks function to support or discourage drug use. Also, the inclusion of both probationers and non-criminal justice persons in the same study would allow for the examination of how corrections status may affect social support and network composition and change over time.

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ABRIDGED VITA

Anne Giuranna Rhodes was born on November 4, 1969 in Lansdale, PA and is an American citizen.

EDUCATION

Virginia Commonwealth University, Richmond, VA
PhD, Epidemiology, expected graduation May 2014

Virginia Polytechnic Institute and State University, Blacksburg, VA
M.S., July 1993, Agricultural and Applied Economics (GPA: 3.9)
B.S., May 1991, Agricultural and Applied Economics (GPA: 3.8)

EXPERIENCE

Director, HIV Surveillance Unit (July 2013 – present)
Virginia Department of Health, Division of Disease Prevention

Health Care Services Analyst (January 2011 – July 2013)
Virginia Department of Health, Division of Disease Prevention, HIV Care Services

Senior Research Associate (September 2008 – December 2012)
George Mason University

Senior Research Associate (September 2000 – August 2008)
Research Specialist Senior (November 1993 to September 2000)
Survey and Evaluation Research Laboratory (SERL)
Virginia Commonwealth University

PUBLICATIONS

O'Connell DJ, Swan H, Martin SS, Surratt HL, Visher CA, Leukefeld C, Taxman FS, Rhodes AG. (2013). A Continuum of Care Model for HIV in Correctional Settings. In Sanders B. et al (eds), *Crime, HIV, and Health: Intersection of Criminal Justice and Public Health Concerns* (pp. 255-274). New York: Springer.

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