Does Race/Ethnicity Moderate the Relationship Between Substance Use Disorder Diagnosis and the Receipt of Substance Use Disorder Services for Males in the Juvenile Justice System?

by

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ABSTRACT

Juvenile offenders suffer from substance use disorders at higher rates than adolescents in the general public. Substance use disorders also predict an increased risk for re-offending. Therefore, it is important that these juveniles, in particular, receive the appropriate substance use disorder treatment. The present study used logistic regression to test whether race/ethnicity would moderate the match between substance use disorder diagnosis and the receipt of a substance use disorder related service in a sample of male, serious juvenile offenders. Results showed that among those with a substance use disorder diagnosis, there were no race/ethnicity differences in the receipt of the appropriate service. However, among those without a substance use disorder diagnosis, non-Hispanic Caucasians were more likely to receive substance use service than were Hispanics or African-Americans. Post-hoc analyses revealed that when using a broader definition of substance use problems, significant differences by race/ethnicity in the prediction of service receipt were only observed at low levels of substance use problems. These findings shed light on how race/ethnicity may play a role in the recommendation of substance use disorder services in the juvenile justice system.

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INTRODUCTION

Overview

The American juvenile justice system was formed out of the adult corrections system at the beginning of the 20th century with the intention of (1) offering an increased focus on rehabilitation, (2) saving children and adolescents from the stigma associated with criminal conviction, and (3) protecting children who would otherwise be sent to adult corrections (Butts & Mears, 2001). The mission of the juvenile justice system has been, since its beginning, to protect the youth in its custody, to protect the community, and to engage in interventions that reduce crime (Butts & Mears, 2001). Today's juvenile justice system includes a multitude of different persons and agencies that are responsible for the care and treatment of juvenile offenders. This includes judges, civil advocates, probation officers, public defenders, and district attorneys, as well as others. Legislation enacted in the early 1900's gave juvenile justice judges and prosecutors the ability to use wide discretion when handling delinquent adolescents (Butts & Mears, 2001). These characteristics were intended to distinguish the juvenile justice system from both the adult criminal court and the adult correctional system (Grisso, 2008).

Due to age, cognitive abilities, and other factors, juveniles are deemed to be less mature than adults, and therefore require a different method for managing criminal behavior (Lipsey, 1999; Steinberg & Scott, 2003). United States case law has consistently demonstrated a focus on the rehabilitative aspects and the potential for juvenile offenders to change (Slobogin, 1999). In *Kent v. United States*, the Supreme Court reasoned that the juvenile court may provide less due process to adolescents, but only because it should have a *greater* concern in the rehabilitation of juvenile offenders (*Kent v. U.S.*, 1966,

emphasis added). The Supreme Court further states that the juvenile court is responsible for determining, "The likelihood of reasonable rehabilitation of the juvenile…by the use of procedures, services and facilities currently available to the juvenile court" (*Kent v. U.S.*, 1996, p. 567). Subsequently, *In re Gault* the Supreme Court emphasized that the juvenile court's mission should be to help, not solely to punish, delinquent adolescents (*In re Gault*, 1967).

However, in response to a growing number of serious and violent crimes perpetrated by adolescents in the 1960's and 1970's, policymakers across the United States began developing stricter laws, more serious punishments, and diminishing judges' judicial discretion in the treatment of juvenile offenders (Grisso, 2008). Subsequently, in the latter part of the 20th century the United States was introduced to the "get-tough" movement in the juvenile justice system (Bilchick, 1998; Butts & Mears, 2001). Scott & Steinberg (2008) characterize this time as one of "moral panic," as the public responded to juvenile crimes with "exaggerated perceptions about the magnitude of threat" (p. 18). Rather than a concentration on treatment and rehabilitation, the courts focused on increased punishment and treating delinquent juveniles like adult criminal offenders (Slobogin, 1999). Sentencing moved from *offender*-based considerations to *offense*-based considerations, which seemed to warrant stricter punishments and favoring incarceration (Behnken, Arredondo, & Packman, 2009). However, efforts to reduce juvenile crime through the use of incarceration has served only to remove the delinquent youth from the community, but does not address the issues that led to their delinquency (Carney & Buttell, 2003). Lipsey (1999) addresses the discrepancy between emerging legislation and the juvenile justice system's original mission in saying, "Political forces increasingly

press in the direction of punitive approaches, while the historical orientation of the court has been rehabilitative" (p. 142).

The effects of the get-tough movement have somewhat waned as both Federal and State legislatures across the country reconsider the legislation passed over the last 30 years (Steinberg, 2008). The Supreme Court's decision in *Roper v. Simmons* reflected this movement by holding that the death penalty constitutes "cruel and unusual punishment" under the 8th Amendment for persons less than 18 years of age (*Roper v. Simmons,* 2005). In *Roper v. Simmons* (2005), the Supreme Court reasoned that "[An adolescent's] own vulnerability and comparative lack of control over their immediate surroundings mean juveniles have a greater claim than adults to be forgiven for failing to escape negative influences in their whole environment" (p. 1186). In addition, public support as of late has been encouraging, with more people calling for increasing the rehabilitative efforts for juvenile offenders (Steinberg, 2008; Scott & Steinberg, 2008). This trend back to the original juvenile justice system's mission, at least in theory, should afford adolescents in the juvenile justice system opportunities for rehabilitation over simply being incarcerated. However, the gaps between research and rhetoric, science and practice, and theory and reality still exist (Steinberg, 2008).

Substance Use Disorders and the Juvenile Justice System

The newer and stricter laws enacted during the "get-tough" movement, and the years following, resulted in a surge of adolescents coming in contact with the juvenile justice system and adult correctional facilities. Each year there are about 2.5 million juvenile arrests in the United States; and it is estimated that over 100,000 adolescents are in the custody of juvenile detention centers at any given moment, with minority

adolescents making up the bulk of youths within the system (Teplin, Abram, McClelland, Dulcan, & Mericle, 2002; Grisso & Underwood, 2003). A majority of juvenile offenders meet criteria for at least one mental disorder, with many meeting criteria for two or more concurrently (Grisso & Underwood, 2003). It is estimated that there are somewhere between 60-80% of youths experiencing some form of mental health problems (Stewart & Trupin, 2003; Grisso, Barnum, Fletcher, Cauffman, & Peuschold, 2001; Grisso, 2008; Shufelt & Cocozza, 2006). This number is significantly higher than that for youths in the U.S. general population, which is only about 15-20% (Grisso, 2008).

Substance use disorders often precipitate the problematic behavior that causes an adolescent to come in contact with, as well as continue to be involved in, the juvenile justice system (Schubert, Mulvey, & Glasheen, 2011; Mason & Windle, 2002; Farabee, Shen, Hser, Grella, & Anglin, 2001). Schubert and colleagues (2011) found that the presence of substance use disorders moderates the relationship between certain risks (e.g., negative peer influence, parental substance use, etc.) and re-arrest and gainful activity, especially for males. In addition, the combination of substance use disorders and mental health disorders are particularly powerful in moderating the relationship between certain risk markers and re-arrest, antisocial activity, and gainful activity (Schubert et al., 2011).

Alcohol and drug use are especially strong predictors of criminal behavior for several reasons. First, criminal behavior is inherent for adolescents when buying, possessing, and using drugs or alcohol. In addition, these behaviors often involve membership in an antisocial peer group, who may support criminal offending (Fergusson, Swain-Campbell, & Horwood, 2002). Furthermore, the need to purchase illicit substances may require the adolescent to become involved with the drug distribution market where

they may engage in, or be party to, systematic violence (White, 1997). Second, intoxication effects from drug and alcohol use increase delinquent behavior due to impaired judgment and decision-making resulting from the effects of drug and alcohol (Kreek, Nielsen, Butelman, & LaForge, 2005). Third, substance abuse likely interferes with normal development (e.g., through education problems and weakened social bonds, as well as the more lasting effects on the development of brain structures that regulate behavioral, emotional, and cognitive processes), resulting in a pattern of antisocial behavior (Hussong, Curran, Moffitt, Caspi, & Carrig, 2004; Ford, 2005). Fourth, consistent substance use may create a need for income that can be met through criminal behavior (Chassin, 2008). Finally, substance use may prevent an adolescent from "maturing out" of criminal behavior due to an inability to successfully transition into more mature, adult roles (Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997; Chen & Kandel, 1995).

Need-Service Matching

Treatment literature has shown that certain service interventions can reduce delinquency for youth with substance use disorders in the juvenile justice system (Grisso, 2008). Treatment and mental health diversion programs for juvenile offenders have been associated with statistically significant reductions in the number of offenses committed by juveniles after completion of treatment (Lipsey, 1999; Lipsey, 2009; Behnken et al., 2009; Cuellar, McReynolds, & Wasserman, 2006; Altschuler, Armstrong, & MacKenzie, 1999; Townsend, Walker, Sargeant, Vostanis, Hawton, Stocker, & Sithole, 2009). Previous research has also shown the effectiveness of substance abuse specific treatment for adolescents with substance use disorders, with substance use disorder treatment being

associated with a reduction in the likelihood of committing a criminal offense (Farabee et al., 2001), as well as decreased alcohol and drug use (Henggeler, Halliday-Boykins, Cunningham, Randall, Shapiro, & Chapman, 2006; Chassin et al., 2009).

The current study focuses on the match or mismatch of services based on the needs of the individual (Mulvey, Schubert, & Chung, 2006; MacKinnon-Lewis, Kaufman, Frabutt, 2001; Mears, 2001). Most intervention programs operate by providing a standard protocol of services to each individual in that program (Smith & Marsh, 2002). These "one-size-fits-all" services are most commonly provided based upon availability, rather than on the needs of the individual (MacKinnon-Lewis et al., 2001). Smith & Marsh (2002) found that matching services to the individual's diverse needs contributes positively to client retention, satisfaction, and positive outcomes. In addition, matched individuals are more likely than non-matched individuals to complete treatment and show improvements in mental health (McLellan, Grissom, Zanis, Randall, Brill, & O'Brien, 1997; McLellan & McKay, 1998). Need-service matching has also proven especially effective in the treatment of substance abuse and dependence, as matched services in this area have resulted in improvements to primary and overall drug use (Friedmann, Hendrickson, Gerstein, & Zhang, 2004; Marsh, Cao, Guerrero, & Shin, 2009; Smith & Marsh, 2002).

Treatment services in the juvenile justice system should take special care to target the specific characteristics and problems of the adolescent offender (Altschuler et al., 1999; Slobogin, 1999; Steinberg, 2008). Delinquent youths who fail to have their needs addressed are considerably more likely to reoffend, ultimately placing an even greater burden on both the juvenile justice system and, eventually, the adult criminal system

(Mears, 2001). In order to look at the relationship between service-need matching in the juvenile justice system, Andrews & Bonta (2006) created the Risk, Need, and Responsivity (RNR) model to explain the possible positive impact of services when they attend to youths' level of risk to reoffend, their individual needs, and characteristics relevant to their treatment amenability. Risk refers to the difference between high- and low-risk individuals. The need principle includes factors predictive of criminal conduct, such as substance abuse. Finally, the responsivity principle relates to factors of the individual's learning style and abilities, such as mental health functioning. Vieira and colleagues (2009) tested the RNR model and found that the matching of the youth's specific needs and responsivity factors are related to a decreased likelihood of recidivism. Specifically, they found significant differences between the high-matched, moderately-matched, and low-matched groups (Vieira, Skilling, & Badali, 2009). The rates for the group's reoffending were 27.3%, 42.5%, and 76.2%, respectively (Vieira et al., 2009). These findings suggest that regardless of youths' criminal history, the greater the match between need/responsivity and services lead to greater reduction in the number of new convictions.

In addition, Carney & Buttell (2003) looked at the success of the "wraparound services" model. This model approaches services in a comprehensive way and accounts for the varying individual needs of each juvenile offender. They found that youths involved in wraparound services missed school less, were suspended less, and did not run away from home as frequently as youths not involved in wraparound services (Carney & Buttell, 2003). In addition, the participating youths were less assaultive and less likely to be picked up by the police after involvement (Carney & Buttell, 2003). These findings

suggest that youths who receive these wraparound services are less likely to engage in subsequent at-risk and delinquent behavior.

However, involvement with the juvenile justice sector has been associated with a decreased likelihood of specialty mental health outpatient and inpatient service receipt (Hazen, Hough, Landsverk, & Wood, 2004; Chassin, 2008). In general, youths in the juvenile justice system tended to have a decreased likelihood of receiving substance use disorder services, relative to youths in other sectors of care (Johnson, Cho, Fendrich, Graf, Kelly-Wilson, & Pickup, 2004; Hazen et al., 2004; Walrath, Sharp, Zuber, & Leaf, 2001. Garland and colleagues (2005) note that referral rates from the juvenile justice system to formal substance use related services are much lower than expected, especially given the high level of substance abuse in this population.

Today, many states, though not all, have adopted more structured methods for screening and assessment (Mulvey & Iselin, 2008). These methods are typically provided to judges by specially trained probation officers (Grisso, 2008). The information gathered from these instruments inform the court of the adolescent's current and past mental state, as well as the need for placement in the appropriate service. Therefore, there is reason to believe that decision-makers in the juvenile justice system have the appropriate information to make informed decisions pertaining to service recommendation.

Whether or not race/ethnicity moderates the extent of matching between treatment need and service receipt within the juvenile justice system has not been thoroughly studied. However, minority adolescents in need of mental health services in other sectors of public care have been shown to be referred to fewer services than are non-Hispanic Caucasian adolescents, even when exhibiting the same amount of need (Garland, Hough,

Landsverk, & Brown, 2001). African-Americans and Hispanics, especially, are less likely to receive court ordered mental health care in these other sectors (Garland & Besinger, 1997; Yeh, McCabe, Hurlburt, Hough, Hazen, Culver, Garland, & Landsverk, 2002; Leslie, Landsverk, Ezzet-Lofstrom, Tschann, Slymen, & Garland, 2000; Garland et al., 2001; Wells, Hillemeier, Bai, & Belue, 2009). Garland et al. (2001) go so far as to say that, in general, "Race or ethnicity may be a stronger predictor of specific service sector involvement than is the presence or absence of a diagnosable mental health problem" (p. 136).

Racial/Ethnic biases in substance use disorder service recommendation may exist, and persist, due to the thoughts and attitudes of decision-makers in the juvenile justice system. For example, beliefs about the causes of criminal behavior may cause a judge or probation officer to recommend substance use disorder services more frequently to non-Hispanic Caucasians than African-Americans or Hispanics. Often there is an assumption that "the youthful transgressions of white middle-class children do not sum up their characters or determine their future," while criminal behavior in minority adolescents are attributed to innate characteristics or environments that are not amenable to treatment (Fitzgerald, 1996, p. 517). These characteristics include family background, negative peer groups, and neighborhood conditions surrounding the offender's home (Breda, 2001). This belief may also cause decision-makers to assume that substance use disorder intervention alone is too lenient a response for a minority adolescent's criminal behavior and simply incarcerate these adolescents instead of recommending services (Breda, 2001). If decision-makers in the juvenile justice system assume that minority youth are less amenable to services or that they are less likely to benefit from services than non-

Hispanic Caucasians, then it is likely that they will choose to recommend non-Hispanic Caucasians for substance use disorder services more often than African-Americans or Hispanic adolescent, despite the needs of the individual (Garland & Besinger, 1997; Slobogin, 1999; Breda, 2001).

The Current Study

This current paper is influenced by a study conducted by Mulvey, Schubert, & Chung (2006) that looked at service receipt after court involvement within the juvenile justice system in the Pathways to Desistence Study (Pathways to Desistance Project; Mulvey, Steinberg, Fagan, Cauffman, Piquero, Chassin, et al., 2004). Results from this study showed that youths with higher cumulative risk (a combination of mean scores from domains such as prior criminal behavior, antisocial attitudes, parental deviance, association with antisocial peers, school difficulties, mood/anxiety problems, and substance use problems) received a greater number of services across several service settings (e.g., adult correctional facilities, juvenile correctional facilities, etc.; Mulvey et al., 2006). In addition, youths with significant substance use problems were five times more likely to receive a drug/alcohol related service in detention centers (Mulvey et al., 2006). This relationship was only marginally significant the adult correctional facilities and the YDC/ADJC, and was not significant in the contracted residential setting. (Mulvey et al., 2006).

The current study expands on the results of Mulvey and colleagues (2006) in terms of need-service matching. This study hypothesizes that the relationship between substance use disorder diagnosis and the match to the appropriate substance use service will be moderated by race/ethnicity (see Figure 1). It is hypothesized that for both models

Hispanics and African-Americans will be matched less frequently based on their needs than non-Hispanic Caucasians to the appropriate services (see Figure 2).

The current study is the first, to our knowledge, to test how race/ethnicity may moderate the relationship between substance use disorder need and the receipt of the appropriate services in the juvenile justice system. The findings of the current study will help to shed light on the current practices of service recommendation in the juvenile justice system as it pertains to racial/ethnic differences. In addition, this study carries important policy implications for the treatment of substance use disorders in the juvenile justice system, such as improved methods of assessment, required service setting placement congruent with the adolescent's need, and increasing the services provided at each setting. Lastly, because substance use disorder treatments have been shown to decrease adolescent criminal behavior, this study is one of the first steps in understanding what factors may reduce recurrent criminal behavior in adolescents.

METHOD

The Original Study

Participants. Participants from the current study are a sample drawn from a two-site, longitudinal study on desistance in serious juvenile offenders called Pathways to Desistance (Mulvey et al., 2004). The sites chosen for this project were Philadelphia, PA and Phoenix, AZ. The study began in 2000, with follow-ups occurring each 6 months for 36 months. From then, follow-ups were conducted every 12 months until the study reached its conclusion in March of 2010 at the 84-month follow-up.

Recruitment. Adolescents were selected for potential enrollment after a review of the court files in Philadelphia and Phoenix. They were included as potential participants if they were found to be adjudicated delinquent or found guilty of a serious criminal offense. Crimes eligible for the study included all felony offenses (except those of less serious property crimes), misdemeanor weapons offenses, and misdemeanor sexual assault. In order to maintain heterogeneity in the sample, the proportion of male juveniles with drug offenses was capped at 15% of the sample for each site. This was done because drug law violations represented a significant proportion of offenses committed by this age group. However, all females meeting age and crime eligibility and all youth who were being considered for trial in the adult system were considered for enrollment. The final sample of enrolled participants was 1,354 adolescents who were between the ages of 14 and 17 years old at the time of their committing offense.

Recruitment biases. At the start of the study, approximately 10,461 adolescents were approached to take part in the study. Those who did not have sufficient court data (n=1,272) were filtered out. In addition, eligible participants who were first petitioned on

an eligible charge, but adjudicated on a lesser charge were dropped from enrollment (n=5,392). Of those then eligible to participate, 1,354 participants were enrolled and 2,443 individuals were not enrolled. There were several significant differences between the adjudicated enrolled and the adjudicated not enrolled. The enrolled group was younger at the adjudication hearing (M = 15.9 vs. 16.1), had more prior court petitions (M = 2.10 vs. 1.50), appeared in court for the first time at an earlier age (M = 13.9 vs. 14.2), and included more females (14.0% vs. 9.0%). There were also racial/ethnic differences in the enrolled group, with a larger proportion of non-Hispanic Caucasian offenders and fewer African-American offenders in the enrolled group than in the not enrolled group.

Procedure. Informed assent/consent was obtained from the juveniles and their parents/guardians at the baseline interview. Youths in the juvenile system completed their baseline interview within 75 days of their adjudication hearing; youths in the adult system completed the baseline interview within 90 days of either (a) the decertification hearing to determine whether the adolescent will remain in adult court or be sent back to juvenile court (Philadelphia) or (b) the adult arraignment hearing where the youth is presented with the charges and enters a plea of guilty or not guilty (Phoenix).

After the baseline interview, participants were asked to complete a series of "time-point" interviews. The time-point interviews include a standard set of measures that are administered at 6-month intervals and during the 3 one-year follow-ups. Equal measurement for participants was achieved by calculating the time-point interviews based on the date of the baseline interview. The window of opportunity for collecting the time-point interview ranged from 6 weeks prior to the follow-up target date and 8 weeks after

the follow-up target date. If the interview was not completed within this time frame, the interview was considered missed and no further attempts were made to interview the participant until the next scheduled time-point interview. Interviews were conducted in a location where the adolescent felt most comfortable. Locations included the adolescent's home (53.0%), a private room within the institutional placement facility (36.0%), or other public place (11.0%).

Trained interviewers read each item in the interviews aloud and respondents generally responded aloud. In situations or sections of the interview where privacy was a concern, a portable keypad was provided as an option to obtain a non-verbal response. Participants were paid between $50 & $150 for their participation over the data collection waves.

The Current Study

Participants. Participants for the current study were drawn from the larger Pathways to Desistance sample. The current subsample (N=638) was comprised of only males who (1) had complete data on self-reported service receipt at both the 6- and 12-month time-point interviews, (2) had complete data on self-reported substance use disorders at baseline, and (3) identified themselves as non-Hispanic Caucasian, African-American, or Hispanic at baseline (see Figure 3 for the flowchart of eligibility). Participants who did not meet these criteria were excluded from the analyses.

A series of analyses were conducted to determine if there were any significant differences between those included in the final subsample and those who were excluded (see Table 1). The included sample had a significantly larger proportion of Hispanics and had significantly higher rates of prior criminal behavior than the excluded sample.

Measures. The measures used in the current study were collected as a part of a larger interview battery administered in the longitudinal study described above. Descriptive statistics for the variables in the current subsample are presented in Tables 2 & 3.

Adolescent demographics. Adolescents self-reported their age at baseline (M=16.6). Adolescents also self-reported on their ethnicity through the following: (1) "Do you consider yourself to be Latino or Hispanic?" (Yes or No) and (2) a choice between White, African-American/Black, Asian, Native American, or some other race. For the current study, only non-Hispanic Caucasians, Hispanics, and African-Americans were included. For this subsample, 20.7% of participants identified as non-Hispanic Caucasian, 41.1% of participants identified as Hispanic, and 38.2% identified as African-American.

Two dummy coded variables were created in order to compare the three groups. The first dummy code assigned a value of "0" to Hispanics and non-Hispanic Caucasians, and a "1" to African-Americans. The second dummy code assigned a value of "0" to African-Americans and non-Hispanic Caucasians, and a "1" to Hispanics. Because non-Hispanic Caucasians received a "0" for both dummy coded variables, they became the reference group. This choice was made so that the results would indicate whether or not status as a specific minority affects the relationship between service need and service receipt. Using these dummy coded variables together allows the first dummy coded variable to compare African-Americans to non-Hispanic Caucasians and the second dummy coded variable to compare Hispanics to non-Hispanic Caucasians.

Adolescent substance use disorder. Adolescent substance use disorders were measured by the Composite International Diagnostic Interview (CIDI; World Health Organization, 1990). The CIDI is a comprehensive, fully standardized diagnostic interview that assesses mental disorders according the Diagnostic and Statistical Manual, Third Ed., Revised (3rd ed., rev.; DSM–III–R; American Psychiatric Association, 1987). The CIDI is a self-report measure that assesses a range of different mental health disorders, which are called modules. The substance use disorder group in this study was created by choosing those who, over the past year at baseline, suffered from any of the following: alcohol abuse, alcohol dependence, drug abuse or drug dependence.

For the purpose of this study, substance use disorder was dichotomized as either "yes, suffered from any disorder in the past year" or "no, did not suffer from any disorder in the past year." If the participant suffered from a substance use disorder in the past year they were assigned a value of "1". If the participant did not suffer from a substance use disorder they were assigned a value of "0". Based on this method of classification, 36.1% of participants were diagnosed with a substance use disorder. This rate is higher than rates in the general adolescent population (which range from about 6.4-11.4%, see, e.g., Merikangas, He, Burstein, Swanson, Avenevoli, Cui, et al., 2010), but lower than those found in some other juvenile offender samples, where as many as 50.7% of males suffered from a substance use disorder. However, this may be explained by differences in measurement tools, populations, and study location (Teplin et al., 2002; Washburn, Teplin, Voss, Simon, Abram, & McClelland, 2008). Although prevalence rates for this subsample are lower than some other samples of juvenile offenders, this study did find similar rates of substance use disorder by race as Teplin and colleagues, with African-

Americans being diagnosed the least and non-Hispanic Caucasians being diagnosed the most (Teplin et al., 2002).

At baseline, two slightly different versions of the CIDI were used due to changes implemented by the CIDI authors at Harvard. For this reason, 58 participants in the subsample were administered an older version of the CIDI at baseline. However, the slight differences in the versions of the CIDI produced no significant differences on the Substance Use Disorder variables (see Table 4). The CIDI has been deemed both reliable and valid (Wittchen, 1994). Test-retest findings across several days for alcohol and drug disorder showed moderate agreement (kappa=0.78 and 0.64, respectively; Wittchen, Lachner, Wunderlich, & Pfister, 1998).

Service receipt. Adolescents self-reported services in both residential and community-based social service settings through the use of a modified version of the Child and Adolescent Services Assessment (CASA; Burns, Angold, & Costello, 1992). The CASA was developed to assess the receipt of mental health and substance use disorder services by children and adolescents ages 8 years to 18 years. Service receipt for drug and/or alcohol treatment was reported if the adolescent stayed in a service setting for more than six days. Service receipt was defined as any service received that includes efforts to identify, diagnose, or treat any emotional, behavioral, or substance use-related problems. The adolescent responded “yes” or “no” as to if they had received the service type within the 6-month period assessed. If the participant responded that they received a substance use disorder service in the past year they were assigned a value of “1”. If the participant did not receive a substance use disorder service in the past year were assigned a value of “0”.

Service types that constituted service receipt were those that could be considered to be "professional" services, which included (1) sessions with a psychologist, counselor, or social worker, (2) mental health treatment group, (3) partial hospitalization or day treatment program, (4) in home counseling, (5) sessions with a counselor or special teacher at school, and (6) special school program outside of class. Participants only endorsing the following services were not included: (1) visit to emergency room, (2) sessions with a priest, minister, clergy or healer, and (3) community support groups or self-help groups. Using this classification system 38.6% of participants received a substance use disorder service.

The CASA has been deemed both reliable and valid. Test-retest reliability varies with the intensity or intrusiveness of the service, with the most intensive services (e.g., inpatient, out-of-home, juvenile justice detention center) reporting very high reliability (Cohen's Kappa = 0.91, 0.92, and 0.84 over 3 months, respectively). In addition, the investigators of the Pathways to Desistance Project used official records at the Philadelphia site and compared them to the CASA responses (Mulvey et al., 2006). The records system, entitled the ProDES information system, tracks service receipt for youths in the juvenile justice system. The investigators found high agreement between the information in the ProDES system and the CASA responses regarding the occurrence and timing of the receipt of services, with self-reported stays in settings other than jail and detention facilities being corroborated 96% of the time. There was also high agreement in the timing of residential facility stays, with a 97.0% agreement regarding intake and discharge month (with a two-month discrepancy in the reports allowed for; 90.0% if only one month allowed). Although there is no access to a similar system in Phoenix, the

investigators found it reasonable that these results would generalize to the Phoenix site as well.

Prior criminal behavior. Prior criminal behavior is a composite variable created from age of 1st arrest, number of prior court petitions, aggressive offending, and income-related offending variables and has a composite mean of 0. Age of 1st arrest (range: -18 to -9; the age was multiplied by -1 so that the younger the participant was at first arrest, the higher his score would be) and number of prior court petitions past year at baseline (range: 0-4) were gathered from court records at baseline. Both aggressive offending (range: 0-1) and income-related offending (range: 0-1) were taken from self-reports at baseline. The composite is comprised of the mean of the standardized scores on the four measured variables. To derive this composite, the Pathways to Desistance investigators performed confirmatory factor analysis (CFA) on the full sample (n=1,354). The CFA resulted in significant indicator loadings and showed good model fit. A CFI that approaches 1 indicates acceptable fit and a RMSEA less than 0.05 shows good fit. The CFI and RMSEA for this composite were 0.99 and 0.04, respectively, showing good fit.

Power Analysis

To determine the effect sizes that the models would be able to detect, power analyses were conducted using G*Power 3 (Faul, Erdfelder, Lang & Buchner, 2007). For the test of the gain in prediction of substance use disorder receipt, over and above covariates and interaction terms, from the interaction between substance use disorder need and race/ethnicity in the trimmed model there is sufficient power (>.97) to detect a moderate (Odds Ratio=2.5) and a large effect (Odds Ratio=4.3), but the power to detect a

small effect (Odds Ratio=1.5) is .38, below the traditional benchmark of acceptable power.

RESULTS

Descriptive Statistics and Correlations

Descriptive statistics for all variables in the subsample included in the model are displayed in Tables 2 (entire subsample) and 3 (by race/ethnicity). First, considerations pertaining to normality of the data were assessed for each variable. Normally distributed variables have skewness values less than 2 and kurtosis values around zero (Cohen, Cohen, West, & Aiken, 2003). All variables were within the limits of acceptable skewness and kurtosis values, and therefore the assumption of normality was met.

Several race/ethnicity differences in the study variables were observed. First, the rates of having a diagnosis of substance use disorder were 45.5% for non-Hispanic Caucasians, 30.2% for African-Americans, and 37.3% for Hispanics. There was a significant difference between non-Hispanic Caucasians and African-Americans (χ^2(df)=9.00(1), p=.003), with non-Hispanic Caucasians being diagnosed with a substance use disorder more often than African-Americans. No significant differences were observed between Hispanics and non-Hispanic Caucasians for rates of substance use disorder diagnosis.

Second, rates for substance use disorder service receipt for non-Hispanic Caucasians, African-Americans, and Hispanics were 49.2%, 35.1%, and 36.5%, respectively. Significant differences for both African-Americans and Hispanics compared to non-Hispanic Caucasians were observed (χ^2(df)=7.91(1), p=.007 and χ^2(df)=5.77(1), p=.016, respectively) showing that non-Hispanic Caucasians are more likely to receive substance use disorder services.

Table 5 displays correlations among the study variables. Correlations involving one of the variables dummy coded by race/ethnicity controlled for the effect of the other so that they were interpretable. Tetrachoric correlations were used for correlations between two dichotomous variables. Pearson correlations were computed between two continuous variables. Both the tetrachoric and Pearson correlations were zero order because there were no covariate control variables.

There were several significant correlations worth noting, including a significant correlation between substance use disorder diagnosis and prior criminal behavior (r=.382, p<.000) and age at baseline (r=.167, p<.000). These correlations show that having a substance use disorder is related to increased prior criminal behavior, as well as being older. In addition, age was significantly and negatively correlated with receiving a substance use disorder service (r=-.186, p=.000), showing that as participants got older, they were less likely to receive substance use disorder services.

Problems of multicollinearity occur when independent variables within a regression model are highly correlated. Highly correlated independent variables may cause regression coefficients to change appreciably in magnitude and/or sign, making them unreliable and difficult to interpret. Therefore, the relationships among predictor variables and covariates were assessed for high correlations. Tetrachoric correlations between race/ethnicity and site were high. Being Hispanic and being at the Phoenix site were positively correlated (r=0.46, p=.034). Being African-American and being at the Phoenix site were negatively correlated (r=-0.66, p=.029). For this reason, site was not included in the main analysis. Other correlations between study variables revealed that no serious multicollinearity problems (correlation values exceeding .500) should occur.

The Race/Ethnicity Moderation Hypothesis

Preliminary analyses. A preliminary logistic regression analysis was conducted to test whether there were any significant covariate by predictor interactions in predicting substance use disorder service receipt (see Table 6). In order to achieve this, the variables and interactions were entered in blocks. The first block contained the covariates (age and prior criminal behavior). The second block contained the predictors of interest (substance use disorder diagnosis and the dummy coded race/ethnicity variables). The third block contained the interactions of interest (the interactions between substance use disorder diagnosis and the dummy coded race/ethnicity variables). The final block included all other covariate/predictor interactions (e.g., the interaction between age and prior criminal behavior). This was done in order to test for any significant interactions between covariates to the analysis of interest. None of the additional interactions reached significance at the $p \leq .05$ level, and therefore were not included in the final model.

Main analysis. A total of five variables and two interactions were included in the final model. The main analysis was accomplished by entering the covariate, predictor, and interaction variables in blocks predicting substance use disorder service receipt. The first block included the covariates of age and prior criminal behavior. The second added substance use disorder diagnosis and the dummy coded race/ethnicity variables. The third and final block included the two interactions representing race/ethnicity by substance use disorder.

Results from the logistic regression analysis are shown in Table 7. A Wald test that produces a significant result shows whether the null hypothesis can be rejected. In this model, the Wald test showed a marginally significant relationship at the $p < .10$ level

between the interaction of substance use disorder diagnosis and race/ethnicity, specifically pertaining to the comparison between Hispanics and non-Hispanic Caucasians (z=3.74, p=.053). No significant interaction comparing African-Americans to non-Hispanic Caucasians was found. The B value estimates the amount of increase or decrease, depending on the sign, of the independent variable with each one unit increase of the dependent variable. In this model B (S.E.)=0.89 (0.454). However, because these values are in log odds units, they are often difficult to interpret. It is more useful to interpret the odds ratio, which is the ratio of the odds of an event occurring in one group to the odds of it occurring in another group. In this model, the Odds Ratio=2.41, p=0.53 (95% C.I.=0.99-5.86). The odds ratio showed that diagnosis interacted with race/ethnicity in such a way that non-Hispanic Caucasians were almost 2½ times more likely to receive substance use disorder services than were Hispanic participants.

In order to probe this interaction, comparisons of rates for service receipt and substance use disorder diagnoses by race/ethnicity were assessed (see Table 8). These results showed that 43% of non-Hispanic Caucasians and 44% of Hispanics with substance use disorders received substance use disorder services. There was no significant difference by race/ethnicity for participants who were diagnosed with a substance use disorder and received a service. The same non-significant relationship was found for African-Americans who had a substance use disorder and received a service (39.2%). However, 54% of non-Hispanic Caucasians and 32% of Hispanics *without* substance use disorders also received substance use disorder services. A chi-square test of the differences showed that the difference in participants not diagnosed with a substance use disorder by race was significant (χ^2(df)=10.1(1), p=.002). Similarly, a significant

difference was found for African-Americans without a substance use disorder who received a service (33.3%; χ^2(df)=9.41(1), p=.003). These findings show that non-Hispanic Caucasians without substance use disorders were treated more often than their Hispanic and African-American counterparts, suggesting overtreatment of non-Hispanic Caucasians.

In order to assess for outliers in the logistic regression, a classification table and plot were produced. The classification table shows the number of cases where the observed values of the dependent variable (substance use disorder service receipt) have been correctly predicted. In a perfect model, the overall percent correct would be 100%. This model correctly classified cases 63.2% of the time, above 50%, which would be attributable to chance. The classification plot provided a visual demonstration of correct and incorrect predictions. This plot was used to spot potential outliers. No outliers were observed through this method. Second, a casewise list that produces a list of cases that didn't fit the model well was used to further assess for outliers. Cases on this list are considered outliers. No outliers within two standard deviations were observed. Finally, DFBETAS was used to also determine the presence of influential data points. DFBETAS is a measure of standardized change in the regression coefficient when a case is deleted. Values greater than the absolute value of one indicate influential cases (Neter, Wasserman, & Kutner, 1989). There were no DFBETAS values in the dataset that exceeded the recommended critical value of one.

Post-hoc analyses

Site. In order to determine if the difference in overtreatment rates was due to race/ethnicity and not site, subsequent analyses were conducted separately for each site

(see Tables 9 & 10). These analyses produced a marginally significant substance use disorder by race/ethnicity interaction, specifically for African-Americans compared to non-Hispanic Caucasians in the Philadelphia site (z=3.53, p=.060, Odds Ratio=5.05). In addition, a similar pattern of service receipt to the main model was observed in this model. Whereas 41.2% of non-Hispanic Caucasians and 36.5% of African-Americans with substance use disorders received a substance use disorder service, 71.4% of non-Hispanic Caucasians and 32.5% of African-Americans without substance use disorders received a substance use disorder service (see Table 11). The significant difference between service receipt for non-Hispanic Caucasians and African-Americans who did not have a substance use disorder (χ^2(df)=8.53(1), p=.004) again suggest overtreatment of non-Hispanic Caucasians in the juvenile justice system. Although the logistic regression analysis for the Phoenix site was not significant, the trend of overtreatment of undiagnosed non-Hispanic Caucasians was still observed. In Phoenix, 50.0% of non-Hispanic Caucasians who did not have a substance use disorder received services. Rates of service receipt were lower for African-Americans and Hispanics (41.2% and 36.7%, respectively; see Table 12).

Substance use problems. In addition, post-hoc analyses looked at substance use problems as a predictor for service use. This variable was computed similarly to the variable used in the study by Mulvey, Schubert & Chung's (2006) and included social consequences from both drugs and alcohol, as well as dependence symptoms from drug or alcohol use (but did not include substance use disorder diagnosis). This variable was entered into the logistic regression model in place of substance use disorder in order to

test whether or not the interaction between race/ethnicity and substance use problems would also be significant when predicting substance use disorder service receipt.

Results from these logistic regression analyses show that when substance use problems is used as a predictor instead of substance use disorder diagnosis, the effect of the interaction between the substance use variable and race/ethnicity disappears (see Tables 13 & 14). In order to understand why the variable substance use problems eliminated the significant effect from the original analysis, the logistic regression was further looked at by using the SPSS macro MODPROBE (Hayes & Matthes, 2009), which allows for logistic regression results to be assessed using the Johnson-Neyman technique (Johnson & Neyman, 1936). The Johnson-Neyman technique is useful because it identifies regions in the range of the moderator variable where the effect of the focal predictor on the outcome is statistically significant and not significant (Hayes & Matthes, 2009). However, this technique does not allow for testing the interactions between the race/ethnicity dummy coded variables and substance use problems all at once. Therefore, two separate models were run, one comparing African-Americans and non-Hispanic Caucasians and another comparing Hispanics and non-Hispanic Caucasians.

When using the Johnson-Neyman technique, results showed that for African-Americans, compared to non-Hispanic Caucasians, differences in service receipt due to race/ethnicity only occurred at low levels of reported substance use problems (from 3.36-5.16), but the relationship was not significant at high levels of substance use problems or when no substance use problems were reported (see Table 15). For Hispanics compared to non-Hispanic Caucasians, there were also significant differences by race/ethnicity at low levels of reported substance use problems (from 1.90-7.14), but again were not

significant at high levels of substance use problems or when no substance use problems were reported (see Table 16).

Service Setting. Service setting may also affect service receipt in the juvenile justice system. Therefore, service setting was looked at in an exploratory, post-hoc analysis. Service settings include time spent at an adult correctional facility (jail or prison), detention center, juvenile correctional facilities (Pennsylvania Youth Development Centers/Arizona Department of Juvenile Corrections), contracted residential treatment center, and a contracted residential treatment with a focus on mental health. When assessing match to the appropriate services by substance use disorder diagnosis, the juvenile correctional facilities showed the best match with 57.1% of adolescents with a substance use disorder receiving services and only 31.1% of adolescents without a substance use disorder receiving services (see Table 17). In addition, low percentages of service receipt in adult correctional facilities and both general and mental health specific contracted residential settings suggest undertreatment of substance use disorders especially in these settings.

Because substance use problems differ significantly by race/ethnicity when predicting substance use service receipt only at low levels of substance use problems, this variable was separated into three categories. These include (1) participants reporting no substance use problems, (2) participants whose substance use problems fall within the regions of significance, and (3) participants who reported high substance use problems above the regions of significance. Similar trends of service use by setting as with substance use disorder diagnosis were observed with these three levels of the substance use problems variable (see Table 18). The findings show that juvenile correctional

facilities showed the best match and other service settings showed a lack of treatment in general.

Service use in each service setting was also assessed for adolescents diagnosed with a substance use disorder by race/ethnicity (see Table 19). However, looking at race/ethnicity, service setting, and substance use variables created small cell sizes, which prevented conducting meaningful tests of significance. Although tests of significance were not conducted, there were some trends worth noting. Adult correctional facilities, general contracted residential settings, and contracted residential settings with a focus on mental health show overtreatment of non-Hispanic Caucasians as compared to minority adolescents. When making these same comparisons using substance use problems as the predictor rather than substance use disorder diagnosis, there appears to be overtreatment of non-Hispanic Caucasians in both the adult correctional facilities, as well as the general contracted residential setting (see Table 20).

DISCUSSION

The present study sought to explore the relationship between substance use disorder diagnosis and the receipt of substance use disorder services in a sample of serious juvenile offenders in the juvenile justice system. This study builds on previous research by Mulvey and colleagues (2006) who found that youths with higher cumulative risk received a greater number of appropriate services. The current study expands on this literature by examining how this relationship differs by race/ethnicity. Specifically, this study looked at whether the match between substance use disorder diagnosis and the receipt of the appropriate service intervention differs between non-Hispanic Caucasians and Hispanics and between non-Hispanic Caucasians and African-Americans. This study hypothesized that Hispanics and African-Americans with substance use disorders would receive less substance use disorder services than non-Hispanic Caucasians.

The first finding from the current study showed undertreatment of substance use disorders in the juvenile justice system, as well as the finding that both African-American and Hispanic adolescents received less substance use services than did non-Hispanic Caucasian adolescents. Furthermore, race/ethnicity proved to be a moderating factor between substance use disorder diagnosis and substance use disorder service receipt in that there was a marginally significant difference in service receipt between non-Hispanic Caucasians and Hispanics. However, when similarly comparing non-Hispanic Caucasians to African-Americans, no significant difference in the analysis predicting service receipt from the interaction of diagnosis and race/ethnicity was found.

In order to better understand the meaning of these findings, substance use disorder service receipt was examined for those with and without a substance use disorder

diagnosis. Surprisingly, these analyses revealed that for adolescents diagnosed with a substance use disorder, service receipt was not dependent on race/ethnicity, as similar rates of service receipt were found for each of the three racial/ethnic categories who received a substance use disorder diagnosis (about 40% of adolescents in each group received the appropriate service). Instead, the major driving factor in the interaction between substance use disorder and race/ethnicity were participants who were *not* diagnosed with substance use disorder. Rates differed significantly between non-Hispanic Caucasians and Hispanics, as well as for non-Hispanic Caucasians and African-Americans, who were not diagnosed with a substance use disorder and received a substance use disorder service. In both of these comparisons, non-Hispanic Caucasians who did not have a substance use disorder diagnosis were more likely to receive a substance use disorder service. These results suggest that we are not observing under-treatment of racial/ethnic minorities, as hypothesized, but rather over-treatment of non-Hispanic Caucasians

Substance Use Problems vs. Substance Use Disorder Diagnosis.

Further analyses suggest that substance use problems, as opposed to substance use disorder, may provide a clearer picture of why differences were observed in service receipt among the different racial/ethnic groups. When predicting substance use disorder service receipt from substance use problems, there is a pattern of overtreatment of non-Hispanic Caucasians only for adolescents who report low levels of substance use problems. However, when substance use issues are clear (i.e., when no substance use problems are reported or when a high number of substance use problems are reported), there is no difference in service receipt by race/ethnicity. This suggests that it is within

this ambiguous margin of subclinical substance use disorders that race/ethnicity may play a role in the recommendation of adolescents for substance use disorder services.

The finding that there are differences in race/ethnicity at specific levels of substance use problems suggests that racial/ethnic biases may play a role in service recommendation. When adolescents exhibit no substance use problems or high substance use problems, the decision of whether or not to recommend an adolescent to services is clear. This is likely because it would be a misallocation of resources to recommend services for adolescents who do not exhibit any substance use problems, as well as a disservice to adolescents with high substance use problems to deny some type of substance use disorder treatment.

However, when service need is less clear (i.e., for adolescents who exhibit low substance use problems), there is an opportunity for racial/ethnic biases to influence decision-making. This type of problem can occur in an institution like the juvenile justice system, which is characterized by enormous discretion and little accountability in dispositions, for several reasons. First, the American Bar Association (ABA) Model Code of Judicial Conduct does not provide many guidelines for the Juvenile Court on appropriate adjudications and dispositions for adolescents in the system, in addition to acknowledging that judges in these types of courts work "outside the context of their usual judicial role as independent decision makers of issues of fact and law" (American Bar Association, 2007; Bendetto Neitz, 2011, p. 119). Second, judges in the juvenile justice system are able to decide dispositions and placements based on both legal factors (prior criminal behavior, nature of offense, etc.) and non-legal factors (motivation for treatment, family circumstances, etc.; Tomkins, Slain, Hallinan, & Willis, 1995).

Although none of these factors may overtly take race into account, the subjectivity involved in decision-making creates the possibility for race/ethnicity to be taken into account covertly. In making a decision a judge may outwardly cite extraneous factors (such as family dynamic) that appear facially neutral as to race/ethnicity, yet underlying those reasons are hidden and racially biased motivations. Finally, judges in the juvenile justice system are rarely required to articulate the basis for a decision and appellate courts seldom reverse juvenile court decisions, showing very little oversight and accountability for dispositions (Tomkins et al., 1995; Bendetto Neitz, 2011).

This country is well aware of issues regarding the overrepresentation of minority adolescents in the juvenile justice system. Congress passed the Juvenile Justice and Delinquency Prevention Act (JJDPA) in 1974 to encourage improvement in juvenile justice practices, and specifically addressed the problem of disproportionate minority confinement (42 U.S.C. § 5633-223-22, 1974 & Supp. 2002). However, no act of Congress has addressed the treatment of substance use disorders in the juvenile justice system as it pertains to racial/ethnic minorities. The current findings suggest that this problem is a concern, as there is disproportional substance use disorder treatment of minority adolescents in the juvenile justice system.

The CIDI as a Diagnostic Tool

Another explanation for the finding that there is overtreatment of substance use disorders in the juvenile justice system is that this study's diagnostic tool, the CIDI, is inaccurately diagnosing substance use disorders in the population and failing to identify substance use disorders where they occur. The CIDI may be inappropriate for children of this age and/or education level. There is evidence for both these assertions. First, most

validity studies on the CIDI were conducted with participants who were over 18 years of age, and many with the mean age being somewhere in the mid-30's (Kessler, Andrews, Mroczek, Ustun, & Wittchen, 1998; Ustun, Peters, Pull, Saunders, Smeets, Stipec, et al., 1997; Andrews & Peters, 1998). Without a representative sample of similarly aged individuals, it would be difficult to determine if this measure is valid when used with adolescents. In a study by Merikangas and colleagues (2010), the CIDI was shown to have good concordance with clinical interviews when using the CIDI with adolescents ages 13-18. However, Merikangas et al. (2010) used a modified version of the CIDI that adjusted wording and appropriateness of questions for adolescents. An unmodified CIDI may not be able to correctly capture mental health and substance use disorders in children and adolescents.

Kessler and colleagues (1998) found that even adults can have comprehension problems and confusion with questions that are seemingly straightforward. This fact may be especially relevant to diagnosing substance use disorders in a sample of juvenile offenders whose education and intelligence levels are likely lower than those of adolescents in the general population (for the full sample, the mean IQ score was 84.52, a standard deviation lower than average intelligence). Issues of comprehension could cause incorrect responses to questions, and therefore incorrect diagnosis.

In addition, the CIDI may not properly account for the fact that disorders present themselves differently in adolescents, or confuse age normative behaviors with a diagnosable disorder (Grisso, 2008). Martin & Winters (1998) note several limitations in using DSM criteria for diagnosing substance use disorders in adolescents. In the substance dependence diagnosis, for example, the DSM-IIIR criteria requires several

symptoms for diagnosis that are not commonly experienced in adolescent substance use, such as withdrawal and substance-related medical problems, because these symptoms take years of heavy drinking to occur (Martin & Winters, 1998). When diagnosing substance abuse, symptoms may relate to age inappropriate behaviors, such as driving while intoxicated, which is likely to occur only in adolescents over 16 and adolescents who have access to a vehicle (Martin & Winters, 1998). In short, the CIDI may not be the best diagnostic tool for predicting service receipt, and its use as a predictor in this study may account for the overall lack of match between substance use disorder diagnosis and the receipt of the appropriate service, as well as the apparent overtreatment of non-Hispanic Caucasians in this sample of juvenile offenders.

Overtreatment of Subclinical Substance Use Problems.

However, if there is overtreatment of substance use disorders in the juvenile justice system, the effects of treating subclinical substance use disorders may be positive or negative. On the one hand, treatment of subclinical substance use disorders juvenile justice system may be beneficial. Many juveniles who were not diagnosed with a substance use disorder still misuse substances and may benefit from substance use disorder treatment services. Treating subclinical substance use problems may prevent the progression of substance use problems to full-blown substance use disorders in these especially at risk adolescents. Furthermore, studies have shown that even being diagnosed with a subclinical substance use disorder leads to other problematic behaviors, such as criminal conduct and suicide (Esposito-Smythers & Spirito 2004). In addition, treatment of subclinical disorders has proven effective for other types of mental disorders, such as depression and anxiety (Fergusson, Horwood, Ridder, & Beautrais,

2005). Therefore, treatment of substance use problems in adolescents who fall short of being diagnosed with a substance use disorder may result in positive outcomes for the adolescent and help meet the goals of the juvenile justice system (e.g., decreasing recidivism) by treating cases of problematic substance use, regardless of diagnosis. It is also possible that adolescents with low levels of substance use problems are more likely than adolescents who are diagnosed with substance use disorders to benefit from treatment services. Rather than recommending services for adolescents who may be more difficult to treat or less likely to improve, resources could be focused where they may have the greatest potential success, in adolescents who only exhibit low levels of substance use problems.

On the other hand, there may be adverse consequences in treating adolescents who do not meet criteria for a diagnosable substance use disorder. First, using resources to treat those who are not actually diagnosed with a disorder may further strain an already financially strapped system. Resources may be being mismanaged by neglecting to treat juveniles with an identified and diagnosed disorder and instead treating adolescents whose substance use is problematic, yet do not suffer from a clinical mental disorder. In addition, treatment services might be most beneficial to adolescents with the highest severity and who may have the most to gain through recovery from a substance use disorder.

There may also be iatrogenic effects of substance use disorder treatment in adolescents who are not diagnosed with a substance use disorder. Iatrogenic effects, which are unintentional, harmful effects of treatment or intervention, have been observed in many types of intervention programs, including those specifically designed for

substance use disorders (Dishion, McCord, & Poulin, 1999; Werch & Owen, 2002). These effects might manifest themselves in different ways. Adolescents who do not have a substance use disorder diagnosis may feel they are being labeled negatively, which could result in further instances of problematic behaviors. In addition, adolescents who believe they have a substance use disorder when they do not may result in a self-fulfilling prophecy in which they begin to engage in further substance use and misuse behaviors.

Study Site

In this study, site is an important variable to consider when interpreting results. While juvenile justice systems across the country are likely similar in some aspects, there are procedural and legal differences (e.g., AZ is more likely than PA to send juveniles to adult court), population differences (e.g., more African-Americans at the PA site and more Hispanic-Americans at the AZ site), and treatment differences (e.g., differences in the availability and types of treatments offered in service settings). However, testing the models separately by site suggested that the pattern of race/ethnicity moderation was maintained at each site. This further suggests that the original significant results were not due to differences in study sites and reinforces the interpretation that differences in service receipt were due to an interaction between substance use disorder diagnosis and race/ethnicity.

Service Setting

Finally, there is a possibility that service setting plays a role in the disparate treatment of minorities in the juvenile justice system. Results from this study show some evidence for this conclusion. The findings suggest that the most inaccurate distribution of service receipt happens in the adult correctional facilities and in general contracted

residential settings. Previous research has shown a general lack of treatment services in adult correctional facilities, as well as there being a higher number of minorities in these settings (Mulvey, Schubert, & Chung, 2006). Results from this study seem to suggest that not only is there undertreatment in these settings, but that minorities with substance use disorders and substance use problems are especially undertreated as compared to non-Hispanic Caucasians. However, the current sample was not large enough to confidently state this finding as true.

Limitations and Future Directions

It is important to note the limitations of the current study. First, this study relied heavily on self-report data, and with this method comes the chance of inaccurate information. However, Mulvey and colleagues (2006) noted that adolescents had little motivation to not be honest in their various self-reports. Second, this study is not representative of the entire juvenile justice system. This study looks at a specific group of adolescents, serious juvenile offenders, at two different sites. Furthermore, the study's drug crime cap of 15% may create an unrepresentative sample of the Philadelphia and Phoenix juvenile justice systems, particularly with regard to substance use disorder diagnosis and treatment. Finally, although this study attempted to take into account confounding variables, such as age and prior criminal behavior, it is possible that other unmeasured or untested factors could affect disposition and service placement.

Future research directions should include looking at the validity of using the CIDI in this unique population. Validity studies on age and cognitive abilities of adolescents, as well as within the juvenile justice system, could improve diagnostic measurement tools

in general. Researchers could also study the diagnosis of substance use disorder in adolescents under new DSM-V criteria.

Additionally, future research could address the efficacy of treatment of substance use disorders in subclinical populations, and its effect on later substance use diagnosis and reoffending. Another topic for future research may include a study of the perceptions of decision-makers (e.g., judges, probation officers) who make treatment decisions regarding juvenile offenders. It may be that these variables that were not assessed play a role in how the system makes decisions about service recommendation.

Finally, although this study was restricted in its ability to assess the role service setting has on service receipt, future research with bigger sample sizes may be able to address this relationship. It may be that the juvenile's placement in a specific facility limits the availability of certain services, or that a certain placement does not offer a substance use disorder service at all.

Summary and Conclusions

Despite the limitations, the current study contributes to the literature on service use in the juvenile justice system by showing the role substance use disorder diagnosis, as well as race/ethnicity, play in service recommendation. In summary, the current findings suggest that the majority of adolescents with substance use disorders in the juvenile justice system fail to receive substance use disorder treatment services and that more emphasis on assessing substance use disorder treatment need and appropriate targeting of substance use disorder treatment receipt is warranted. In addition, Hispanic and African-American adolescents not diagnosed with a substance use disorder are less likely to receive substance use disorder services than their non-Hispanic Caucasian counterparts.

Furthermore, non-Hispanic Caucasians are only more likely than Hispanics and African-Americans to receive services when they exhibit low levels of substance use problems. These conclusions show the need for more research to understand what factors drive treatment decisions, whether what appears as overtreatment is due to poor validity of diagnostic measures, racial/ethnic biases, and whether there are positive or negative effects of providing substance use treatment to adolescents who do not meet substance use disorder diagnostic criteria.

The treatment of substance use disorders is especially important in this population. Not only are untreated juvenile offenders who suffer from substance use disorders (diagnosed or subclinical) at risk for the continuation and manifestation of substance use disorders (respectively), but they are also at greater risk for reoffending. Without proper treatment, substance use problems and criminality may cycle throughout the adolescent's life, resulting in long-term negative life outcomes. Prevention of repeat offending requires that adolescents in the juvenile justice system are getting the services they need, and that these services prove efficacious. The results of this study provide an early step in achieving this goal.

Table 1.

Comparing Included to Excluded Participants.

	Included		Excluded			
	N	**Mean (SD)**	**N**	**Mean (SD)**	**t**	**p-value**
Age (at baseline)	638	16.6 (1.08)	532	16.5 (1.16)	1.70	.089
Prior criminal behavior (composite at baseline)	638	.048 (.648)	714	-.040 (.666)	2.46	.014*
	N	**%**	**N**	**%**	**χ^2**	**p-value**
Ethnicity: 1=Non-Hispanic Caucasian 2=Hispanic 3=African-American	638	20.7% non-Hispanic Caucasian; 41.1% Hispanic; 38.2% African-American	532	17.5% non-Hispanic Caucasian; 28.9% Hispanic; 43.4% African-American; 10.2% Other	74.1	.000*
Mental health disorder diagnosis (past year at baseline)	638	7.1%	512	10.4%	3.96	.046*
Substance use disorder diagnosis (past year at baseline)	638	36.1%	489	36.6%	.037	.848
Mental health disorder service receipt (past year)	638	24.9%	532	28.9%	2.40	.121
Substance use disorder service receipt (past year)	638	38.6%	411	39.8%	.203	.652

Table 2.

Descriptive Statistics for Subsample Participants.

	N	Min.	Max.	Mean (SD)	Skewness (SE)	Kurtosis (SE)
Age (at baseline)	638	14.2	19.5	16.6 (1.08)	-.293 (.097)	-.770 (.193)
Prior criminal behavior (composite at baseline)	638	-1.31	2.08	.048 (.648)	.567 (.097)	-.101 (.193)
	N	**%**				
Ethnicity: 1=Non-Hispanic Caucasian 2=Hispanic 3=African-American	638	20.7% Non-Hispanic Caucasian; 41.1% Hispanic; 38.2% African-American				
Substance use disorder diagnosis (past year at baseline)	638	36.1%				
Substance use disorder service receipt (past year)	638	38.6%				

Table 3.

Descriptive Statistics for Subsample Participants by Race/Ethnicity.

	Non-Hispanic Caucasian (N=132)	**African-American** (N=262)			**Hispanic** (N=244)		
	Mean (SD)	**Mean (SD)**	**t** [a]	**p-value**	**Mean (SD)**	**t** [b]	**p-value**
Age (at baseline)	16.5 (1.00)	16.7 (1.11)	-1.95	.052	16.5 (1.08)	-.309	.758
Prior criminal behavior (composite at baseline)	.014 (.681)	-.001 (.593)	.223	.824	.118 (.680)	-1.41	.158
	%	**%**	**χ^2** [a]	**p-value**	**%**	**χ^2** [b]	**p-value**
Substance use disorder diagnosis (past year at baseline)	45.5%	30.2%	9.00 [c]	.003	37.3%	2.37	.123
Substance use disorder service receipt (one year after baseline)	49.2%	35.1%	7.91 [d]	.007	36.5%	5.77	.016 [e]

[a]T-tests or chi-squares compare African-Americans to non-Hispanic Caucasians; [b] T-tests or chi-squares compare Hispanics to non-Hispanic Caucasians. [c]African-Americans showed significantly less substance use disorder diagnoses. [d]African-Americans showed significantly less substance use disorder service receipt. [e]Hispanics showed significantly less substance use disorder service receipt.

Table 4.

Comparing CIDI Versions.

CIDI Disorder (past year at baseline)	Versions 1.04-1.05 N	Versions 1.04-1.05 %	Versions 1.06 and Higher N	Versions 1.06 and Higher %	χ^2
Alcohol abuse	58	7.9% Diagnosed	580	12% Diagnosed	1.19
Alcohol dependence	58	7.1% Diagnosed	580	10% Diagnosed	.829
Drug abuse	58	17.6% Diagnosed	580	25.9% Diagnosed	2.41
Drug dependence	58	13.7% Diagnosed	580	8.6% Diagnosed	1.22
Substance use disorder (total)	58	35% One or more	580	45% One or more	2.13

**p<.01, *p<.05, † p<0.1

Table 5.

Correlations Between Independent Variables, Covariates, and Outcome Variables.

	1	2	3	4	5	6	7
1. Substance use disorder (12 months before baseline)	1						
2. Age (at baseline)	.167**	1					
3. Ethnicity (African-American vs. non-Hispanic Caucasian)	-.118**	.077	1				
4. Ethnicity (Hispanic vs. non-Hispanic Caucasian)	-.063	.011	-.657**	1			
5. Prior criminal behavior	.382**	-.006	-.009	.059	1		
6. Substance use disorder service receipt	.091	-.186**	-.108**	-.096*	-.033	1	
7. Site (Phoenix)	.087*	-.121**	-.660*	.460*	.072	.039	1

**p<.01, *p<.05, † p<0.1. All correlations involving one of the dummy coded variables controlled for the effect of the other(s) so that they were interpretable. Tetrachoric correlations were used for correlations between two non-dummy coded dichotomous variables. All correlations not involving dummy coding or two dichotomous predictors were zero-order correlations.

Table 6.

Preliminary Testing of Covariate Interactions in Predicting Substance Use Disorder Service Receipt.

					95% C.I.	
	B	**S.E.**	**Wald**	**Odds Ratio**	**Lower**	**Higher**
Block 1:						
Age	-.359**	.077	21.5	.698	.600	.813
Prior Criminal Behavior	-.112	.128	.763	.894	.695	1.15
Block 2:						
Substance Use Disorder	.499*	.195	6.519	1.65	1.12	2.42
African-American (vs. Non-Hispanic Caucasian)	-.452*	.223	4.10	.636	.411	.985
Hispanic (vs. Non-Hispanic Caucasian)	-.467*	.225	4.32	.627	.403	.974
Block 3:						
Substance Use Disorder x African-American	.693	.457	2.29	2.00	.815	4.90
Substance Use Disorder x Hispanic	.878†	.454	3.74	2.41	.988	5.86
Block 4:						
Substance Use Disorder x Prior Criminal Behavior	.300	.311	.934	1.35	.734	2.48
African-American x Prior Criminal Behavior	-.659†	.397	2.76	.517	.238	1.13
Hispanic x Prior Criminal Behavior	.102	.374	.074	1.11	.531	2.31
Age x Prior Criminal Behavior	.067	.148	.204	1.07	.800	1.43
Age x Substance Use Disorder	-.352†	.205	2.96	.703	.471	1.05
Age x African-American	-.164	.229	.510	.849	.542	1.33
Age x Hispanic	-.233	.232	1.01	.792	.503	1.25
Constant	1.88	3.26	.333	6.56		

**p<.01; *p<.05; † p<.1; Table shows results for each block as it was entered.

Table 7.

Logistic Regression Predicting Substance Use Service Receipt from Substance Use Disorder Diagnosis.

	B	S.E.	Wald	Odds Ratio	95% C.I. Lower	95% C.I. Higher
Block 1:						
Age	-.359**	.077	21.5	.698	.600	.813
Prior criminal behavior	-.112	.128	.763	.894	.695	1.15
Block 2:						
Substance use disorder	.499*	.195	6.52	1.65	1.12	2.42
African-American (vs. non-Hispanic Caucasian)	-.452*	.223	4.10	.636	.411	.985
Hispanic (vs. non-Hispanic Caucasian)	-.467*	.225	4.32	.627	.403	.974
Block 3:						
Substance use disorder x African-American	.693	.457	2.29	2.00	.815	4.90
Substance use disorder x Hispanic	.878†	.454	3.74	2.41	.988	5.86
Constant	6.41	1.35	23.6	609.1		

**p<.01; *p<.05; † p<.1; Table shows results for each block as it was entered.

Table 8.

Percentage of Participants who Received Treatment (by Diagnosis).

	Non-Hispanic Caucasians	African-Americans	χ^{2a}	Hispanics	χ^{2b}
Diagnosed with substance use disorder	43.3%	39.2%	.236	44.0%	.006
Not Diagnosed with substance use disorder	54.2%	33.3%	9.41*	32.0%	10.1*

**p<.01; *p<.05; † p<.1; [a] Chi-squares compare African-Americans to non-Hispanic Caucasians; [b] Chi-squares compare Hispanics to non-Hispanic Caucasians.

Table 9.

Logistic Regression Predicting Substance Use Service Receipt from Substance Use Disorder Diagnosis (Philadelphia only; N=306)

					95% C.I.	
	B	**S.E.**	**Wald**	**Odds Ratio**	**Lower**	**Higher**
Block 1:						
Age	-.339**	.110	9.51	.712	.574	.884
Prior Criminal Behavior	-.529**	.222	5.66	.589	.381	.911
Block 2:						
Substance Use Disorder	.448	.298	2.26	1.56	.873	2.80
African-American (vs. Non-Hispanic Caucasian)	-1.00*	.413	5.88	.367	.163	.826
Hispanic (vs. Non-Hispanic Caucasian)	-.693	.492	1.99	.500	.191	1.31
Block 3:						
Substance Use Disorder x African-American	1.62†	.862	3.53	5.05	.932	27.3
Substance Use Disorder x Hispanic	1.56	1.04	2.24	4.73	.617	36.3
Constant	7.59	2.07	13.5	1975.8		

**p<.01; *p<.05; † p<.1; Table shows results for each block as it was entered.

Table 10.

Logistic Regression Predicting Substance Use Service Receipt from Substance Use Disorder Diagnosis (Phoenix only; N=332)

					95% C.I.	
	B	**S.E.**	**Wald**	**Odds Ratio**	**Lower**	**Higher**
Block 1:						
Age	-.359**	.111	10.4	.698	.561	.869
Prior Criminal Behavior	.110	.161	.464	1.12	.814	1.53
Block 2:						
Substance Use Disorder	.476†	.265	3.23	1.61	.958	2.70
African-American (vs. Non-Hispanic Caucasian)	-.085	.415	.042	.919	.407	2.07
Hispanic (vs. Non-Hispanic Caucasian)	-.475†	.258	3.40	.622	.375	1.03
Block 3:						
Substance Use Disorder x African-American	.656	.824	.635	1.93	.384	9.69
Substance Use Disorder x Hispanic	.764	.516	2.19	2.15	.780	5.91
Constant	6.26	1.90	10.9	520.4		

**p<.01; *p<.05; † p<.1; Table shows results for each block as it was entered.

Table 11.

Percentage of Participants who Received Services (by Diagnosis – Philadelphia only).

	Non-Hispanic Caucasians	African-Americans	χ^2 [a]	Hispanics	χ^2 [b]
Diagnosed with substance use disorder	41.2%	36.5%	.124	35.3%	.125
Not diagnosed with substance use disorder	71.4%	32.5%	8.53*	41.4%	3.41†

**p<.01; *p<.05; † p<.1; [a] Chi-squares compare African-Americans to non-Hispanic Caucasians; [b] Chi-squares compare Hispanics to non-Hispanic Caucasians.

Table 12.

Percentage of Participants who Received Services (by Diagnosis – Phoenix only).

	Non-Hispanic Caucasians	African-Americans	χ^2 [a]	Hispanics	χ^2 [b]
Diagnosed with substance use disorder	44.2%	50.0%	.159	45.9%	.034
Not diagnosed with substance use disorder	50.0%	41.2%	.410	29.8%	6.95*

**p<.01; *p<.05; † p<.1; [a] Chi-squares compare African-Americans to non-Hispanic Caucasians; [b] Chi-squares compare Hispanics to non-Hispanic Caucasians.

Table 13.

Logistic Regression Predicting Substance Use Service Receipt from Substance Use Problems (African-Americans vs. non-Hispanic Caucasians).

	B	S.E.	Wald	Odds Ratio	95% C.I. Lower	95% C.I. Higher
Block 1:						
Age	-.314**	.098	10.2	.731	.603	.886
Prior criminal behavior	-.336†	.173	3.77	.715	.509	1.003
Block 2:						
Substance use problems	.028	.020	1.95	1.03	.989	1.07
African-American (vs. non-Hispanic Caucasian)	-.453*	.231	3.84	.636	.404	1.00
Block 3:						
Substance use problems x African-American	-.012	.039	.096	.988	.916	1.07
Constant	5.02**	1.67	9.06	151.0		

**p<.01; *p<.05; † p<.1; Table shows results for each block as it was entered.

Table 14.

Logistic Regression Predicting Substance Use Service Receipt from Substance Use Problems (Hispanics vs. non-Hispanic Caucasians).

	B	S.E.	Wald	Odds Ratio	95% C.I. Lower	95% C.I. Higher
Block 1:						
Age	-.374**	.103	13.1	.688	.562	.842
Prior criminal behavior	.050	.157	.100	1.05	.772	1.43
Block 2:						
Substance use problems	.034†	.018	3.64	1.03	.999	1.07
Hispanic (vs. non-Hispanic Caucasian)	-.497*	.226	4.84	.608	.390	.947
Block 3:						
Substance use problems x Hispanic	.017	.031	.310	1.02	.957	1.08
Constant	6.77	1.77	14.6	870.7		

**p<.01; *p<.05; † p<.1; Table shows results for each block as it was entered.

Table 15.

Regions of Significance for Substance Use Problems Predicting Service Receipt (African-Americans vs. non-Hispanic Caucasians)

	B	**S.E.**	**Z**	**Wald**
.000	-.413	.264	-1.56	2.45
1.85†	-.435	.238	-1.83	3.35
3.36*	-.453	.231	-1.96	3.84
3.70*	-.457	.232	-1.97	3.89
5.16*	-.475	.242	-1.96	3.84
5.55†	-.480	.427	-1.94	3.76
7.40†	-.502	.281	-1.79	3.19
9.25	-.524	.327	-1.60	2.57
11.10	-.546	.381	-1.43	2.10
12.95	-.568	.440	-1.29	1.67
14.80	-.590	.502	-1.18	1.38
16.65	-.613	.567	-1.08	1.17
18.50	-.635	.633	-1.00	1.01
20.35	-.657	.700	-.939	.882
22.20	-.679	.768	-.885	.783
24.05	-.701	.836	-.869	.703
25.90	-.723	.906	-.799	.639
27.75	-.746	.975	-.765	.585
29.60	-.768	1.04	-.735	.540
31.45	-.790	1.11	-.709	.5025
33.30	-.812	1.18	-.686	.470
35.15	-.834	1.25	-.665	.442
37.00	-.857	1.33	-.646	.418

**p<.01; *p<.05; † p<0.1

Table 16.

Regions of Significance for Substance Use Problems Predicting Service Receipt (Hispanics vs. non-Hispanic Caucasians)

	B	**S.E.**	**Z**	**Wald**
.000	-.431	.321	-1.32	2.68
1.90*	-.551	.246	-2.24	5.03
3.80*	-.519	.229	-2.26	5.12
5.70*	-.486	.227	-2.14	4.58
7.14*	-.461	.235	-1.96	3.84
7.60†	-.453	.240	-1.89	3.58
9.50	-.420	.265	-1.59	2.52
11.40	-.387	.300	-1.29	1.67
13.30	-.355	.341	-1.04	1.08
15.20	-.322	.388	-.830	.690
17.10	-.289	.437	-.662	.438
19.00	-.256	.488	-.525	.276
20.90	-.223	.541	-.413	.171
22.80	-.191	.598	-.321	.103
24.70	-.158	.650	-.243	.059
26.60	-.125	.705	-.177	.032
28.50	-.092	.761	-.121	.015
30.40	-.060	.817	-.073	.005
32.30	-.027	.874	-.031	.001
34.20	.006	.931	.007	.000
36.10	.039	.988	.039	.002
38.00	.072	1.05	.069	.005

**p<.01; *p<.05; † p<0.1

Table 17.

Percentage of Participants who Received Services for a Substance Use Disorder (by Setting).

	Jail/Prison (n=190)	**Detention Center** (n=139)	**YDC/ADJC** (n=80)	**Contracted Residential** (n=207)	**Contracted Residential Mental Health** (n=44)
Diagnosed with substance use disorder	42.2%	52.5%	57.1%	41.0%	41.0%
Not diagnosed with substance use disorder	36.5%	40.0%	31.1%	38.0%	38.0%

Table 18.

Percentage of Participants who Received Services for Substance Use Problems (by Setting).

	Jail/Prison (n=190)	**Detention Center** (n=139)	**YDC/ADJC** (n=80)	**Contracted Residential** (n=207)	**Contracted Residential Mental Health** (n=44)
High substance use problems	30.4%	54.3%	60.0%	46.3%	46.3%
Low substance use problems	26.9%	38.3%	35.0%	34.4%	34.4%
No substance use problems	21.7%	45.6%	34.0%	39.0%	39.0%

Table 19.

Percentage of Participants who Received Services for Substance Use Disorders (by Setting and by Race/Ethnicity).

	Jail/Prison			Detention Center		
	Non-Hispanic Caucasian (n=34)	**African-American (n=53)**	**Hispanic (n=103)**	**Non-Hispanic Caucasian (n=27)**	**African-American (n=53)**	**Hispanic (n=59)**
Diagnosed with substance use disorder	27.8%	47.4%	26.2%	46.7%	55.6%	53.8%
Not diagnosed with substance use disorder	56.3%	11.8%	16.4%	58.3%	34.1%	42.4%

	YDC/ADJC			Contracted Residential		
	Non-Hispanic Caucasian (n=15)	**African-American (n=24)**	**Hispanic (n=41)**	**Non-Hispanic Caucasian (n=25)**	**African-American (n=144)**	**Hispanic (n=38)**
Diagnosed with substance use disorder	71.4%	70.0%	44.4%	53.3%	34.8%	47.1%
Not diagnosed with substance use disorder	25.0%	7.1%	47.8%	80.0%	36.7%	23.8%

	Contracted Residential Mental Health		
	Non-Hispanic Caucasian (n=8)	**African-American (n=26)**	**Hispanic (n=10)**
Diagnosed with substance use disorder	12.5%	12.5%	100.0%
Not diagnosed with substance use disorder	22.2%	22.2%	0.00%

Table 20.

Percentage of Participants who Received Services for Substance use Problems (by Setting and by Race/Ethnicity).

	Jail/Prison			Detention Center		
	Non-Hispanic Caucasian (n=34)	**African-American (n=53)**	**Hispanic (n=103)**	**Non-Hispanic Caucasian (n=27)**	**African-American (n=53)**	**Hispanic (n=59)**
High substance use problems	41.7%	14.3%	27.6%	54.5%	57.1%	50.0%
Low substance use problems	55.6%	26.7%	19.2%	42.9%	31.6%	45.0%
No substance use problems	30.8%	25.8%	16.7%	55.6%	40.7%	47.6%

	YDC/ADJC			Contracted Residential		
	Non-Hispanic Caucasian (n=15)	**African-American (n=24)**	**Hispanic (n=41)**	**Non-Hispanic Caucasian (n=25)**	**African-American (n=144)**	**Hispanic (n=38)**
High substance use problems	60.0%	60.0%	60.0%	54.5%	35.0%	53.8%
Low substance use problems	50.0%	20.0%	36.4%	66.7%	34.1%	18.2%
No substance use problems	33.3%	28.6%	40.0%	75.0%	37.3%	28.6%

	Contracted Residential Mental Health		
	Non-Hispanic Caucasian (n=8)	**African-American (n=26)**	**Hispanic (n=38)**
High substance use problems	-	33.3%	30.0%
Low substance use problems	0.00%	0.00%	50.0%
No substance use problems	40.0%	26.7%	16.7%

Figure 1.

Hypothesized Model

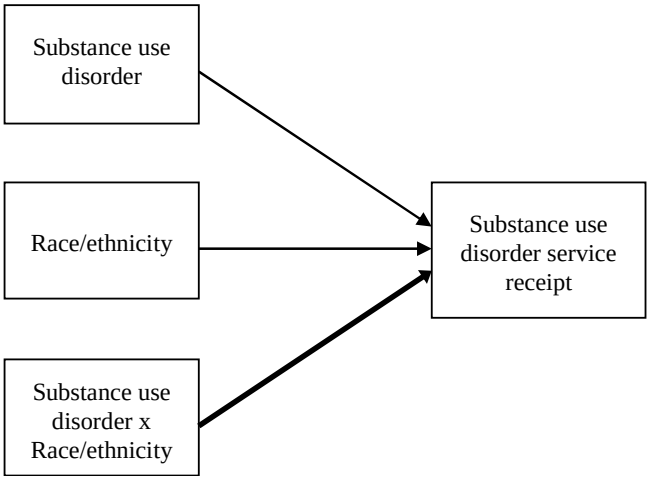


Figure 2.

Graphical Representation of Hypothesis.

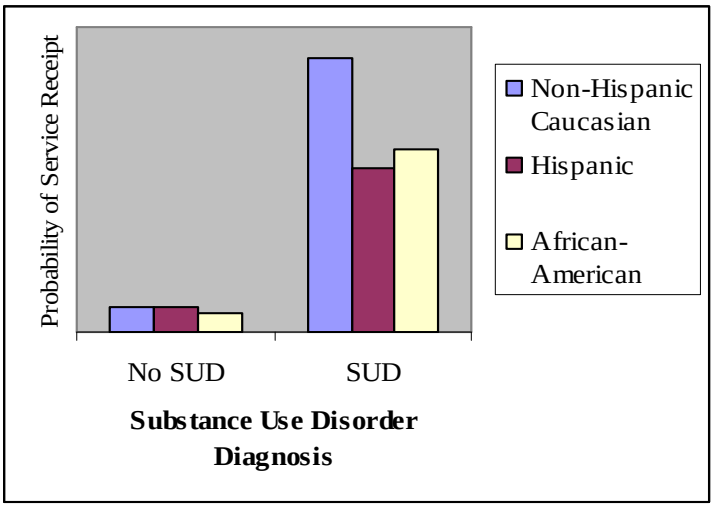
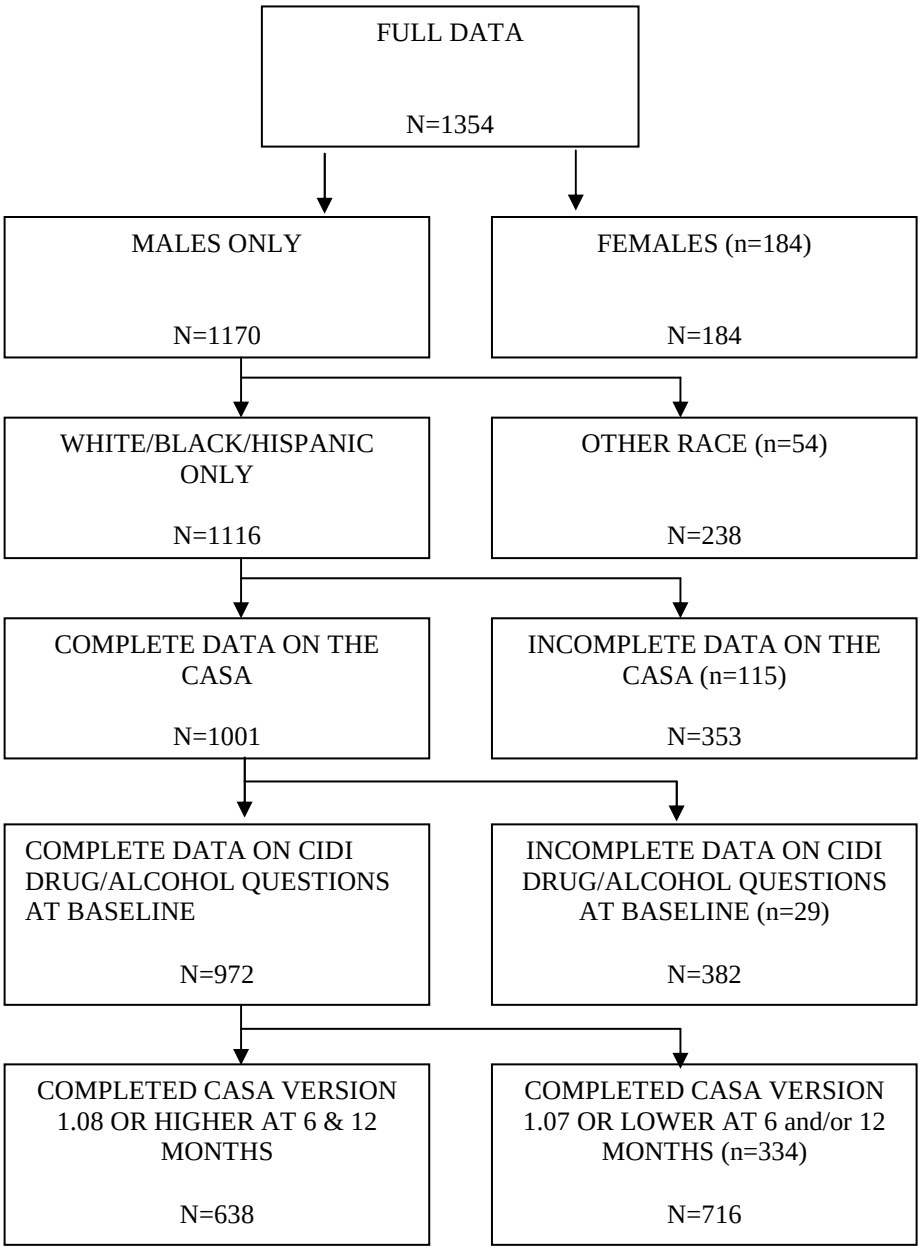


Figure 3.

Sample Size Flowchart



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