## Title

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# Perceived neighborhood safety, recovery capital, and successful outcomes among mothers 10 years after substance abuse treatment

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## Abstract

This study examines perceived neighborhood characteristics associated with successful outcome among mothers 10 years after being treated for substance use disorders. Data were obtained from 713 mothers first studied at admission to drug treatment in California in 2000-2002 and followed-up in 2009-2011. At follow-up, 53.6% of mothers had a successful outcome (i.e., no use of illicit drugs and not involved with the criminal justice system). Perceived neighborhood safety almost doubled the odds of success. Perceived neighborhood safety interacted with social involvement, decreasing the odds of success among mothers who reported more versus less neighborhood social involvement. Perceived neighborhood climate is associated with long-term outcomes among mothers with substance use disorders independent of individual-level characteristics, underscoring the need for further efforts to understand its interaction with recovery capital in ways that promote and impede health.

### Keywords

perceived neighborhood safety; recovery capital; maternal health; substance use disorders; treatment outcomes

## Introduction

Much of the research on treatment outcomes among women with substance use disorders has focused on identifying individual risk and protective factors that are associated with differential outcomes, often measured shortly after treatment exit. Few studies have examined longer-term outcomes and how neighborhood context may be associated with variations in drug use behaviors beyond what can be explained by individual level characteristics alone. A better understanding of the contextual determinants of recovery from drug abuse can help to improve existing services and interventions and thereby help to prevent or ameliorate the adverse consequences with which drug abuse is associated. In this

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The authors report no conflicts of interest

paper we focus on perceived neighborhood characteristics associated with successful outcome among mothers 10 years after treatment for substance abuse.

## Drug-dependence among mothers

Women account for more than 32% of the approximately 1.8 million admissions to treatment for substance use disorders each year (SAMHSA, 2012). Many women in substance abuse treatment are of childbearing age or have children, and are typically the primary childcare provider (Grella et al., 2000). Ongoing substance use among mothers is of particular concern because of its effects on maternal and child health during pregnancy (Covington et al., 2002; Dixon et al., 2008; Johnson and Leff, 1999; Keegan et al., 2010; Sood et al., 2001) but also because the dysfunctional home environment it creates can have detrimental effects on parenting styles (De La Rosa et al., 2010) and on child growth and development (Chatterji and Markowitz, 2001; Clark et al., 2004; Conners et al., 2004; Hanson et al., 2006; Linares et al., 2006). In addition, low-income single mothers are at risk for persistent poverty (Edin and Lein, 1997) and the physical, mental, and behavioral health problems that can accompany substance abuse are significant barriers to employability, employment, and economic self-sufficiency (Hogue et al., 2010; Jayakody et al., 2000; Laudet, 2012; Phinney et al., 2007; Pollack and Reuter, 2006; Schmidt and McCarty, 2000). Research on treatment outcomes among women with substance use disorders has mostly focused on identifying individual factors and service system interactions (e.g., drug treatment, criminal justice system involvement) that are associated with improved health and social outcomes (e.g., Evans et al., 2013; Greenfield et al., 2007; Hser et al., 2003; Messina et al., 2006). A potential limitation of this approach is that it does not acknowledge or address the many underlying forces that drive relapse risk among mothers.

## Neighborhood safety and recovery outcomes

The role of contexts in explaining health variations has been examined in relation to a variety of health behaviors (Baum et al., 2009; Diez Roux et al., 2001; Nandi et al., 2010; Silver et al., 2011; Winkleby et al., 2006). Potentially relevant for understanding substance abuse and recovery, studies have highlighted how neighborhoods that are characterized by concentrated poverty or disadvantage place individuals at greater risk for drug use initiation and persistence (Ensminger et al., 1997; Freisthler et al., 2005; Genberg et al., 2011; Jacobson et al., 2006; Nandi et al., 2010; Storr et al., 2004). Neighborhood safety has been identified as a potential determinant of physical and mental health status (Johnson et al., 2009; Roh et al., 2011) and of a variety of health-related behaviors such as physical activity (Evenson et al., 2012; Johnson et al., 2009; Tucker-Seeley et al., 2009), smoking (Johnson et al., 2009; Patterson et al., 2012), and sleep habits (Johnson et al., 2009; Singh & Kenney, 2013).

**Theoretical support for effects of neighborhood safety—**There are several theoretical explanations for why neighborhood safety may be related to variations in drug use behaviors. For example, if people feel unsafe in their neighborhoods they may refrain from interacting with others and thereby experience a heightened sense of mistrust and social isolation. Mutual trust and solidarity among neighbors contribute to social cohesion (i.e., collective efficacy), a social force that can mediate the effects of neighborhood

disadvantages on health outcomes (Kawachi et al., 1997; Sampson et al., 1997). In addition, unsafe neighborhoods are places where individuals may experience an increased fear of criminal victimization which in turn could increase psychological stress levels (Lorenc et al., 2012). Individuals may seek to escape the effects of their environment, thereby alleviating stress, by using drugs. Also, the social disorganization that characterizes unsafe neighborhoods can translate into reduced community sanctions on drug use and ambiguous local law enforcement roles (Boardman et al., 2001). In such environments, individuals are less subject to the informal social controls that work to impede drug use. Finally, unsafe neighborhoods are places where drugs are likely to be more available, a reality that could trigger or facilitate drug use behaviors (Fagan, 1992; Gorman et al., 2005; Simpson et al., 1997; Weisburd et al., 2000). The concept of neighborhood safety is consistent with several different theoretical traditions, indicating that it may be of particular salience for understanding drug use behaviors.

**Limited empirical support—**Studies on neighborhood factors, substance abuse treatment, and recovery have examined how drug treatment access and outcomes are associated with factors such as the scarcity of certain types of treatment by geography (Guerrero et al., 2013; Schmitt et al., 2003), travel distance to treatment (Beardsley et al., 2003; Guerrero et al, 2013), and exposure to potential triggers for relapse near drug treatment locations (Jacobsen, 2005). Few studies have examined neighborhood safety in relation to drug abuse or recovery. The limited existing research in this area has focused on drug injection behavior, reporting that psychological distress is higher in more socially disordered neighborhoods (as indicated by factors such as vandalism, vacant housing, crime), which leads to greater injection frequency and equipment sharing (Latkin et al., 2005). A study of young adults reported that greater fear of the neighborhood environment was related to increased drug use (Theall et al., 2009). Other research has examined depression, reporting that perception of less neighborhood safety is associated with depressive symptoms and negative perceptions of health (Ziersch et al., 2005; Roh et al., 2011). Associations between depression and neighborhood characteristics have also been documented among samples of drug users (Latkin and Curry, 2003; Zule et al., 2008).

**Recovery capital—**Recovery capital denotes personal and social resources that can be brought to bear on the initiation and maintenance of recovery from substance abuse (Cloud and Granfield, 2004; Granfield and Cloud, 2001). Drawing on social science, recovery capital is a broad term that encompasses physical, human, cultural, and social capital. This last concept has been defined and measured in different ways (Hawe and Shiell, 2000; Lochner et al., 1999). In relation to drug abuse and mental health, social capital has been operationalized as social support (e.g., Latkin and Curry, 2003; Mair et al., 2010), social involvement (Caughy et al., 2003), and neighborhood cohesion or fragmentation (Lin et al., 2011; Ivory et al., 2011). It has been theorized that recovery capital can support or impede efforts to maintain enduring drug use recovery (Cloud and Granfield, 2008). For example, studies of depression have reported that social support may counteract the effect of neighborhood stressors on depression, particularly among women (Mair et al., 2010), but other research has found that social support and social integration does not buffer the effect of neighborhood perceptions on depressive symptoms (Latkin and Curry, 2003).

Furthermore, recovery capital is conceptualized as a set of resources that can be accumulated or expended over time (Cloud and Granfield, 2008). An individual's capacity to recover from substance abuse and dependence is a function of the type and amount of recovery resources that have been developed and maintained over the course of a life (Cloud and Granfield, 2008). Taken together, these concepts suggest that the effect of neighborhood safety on drug use behaviors may vary as a function of recovery capital. Longitudinal studies provide an opportunity to better understand the positive and negative effects of recovery capital on drug use behaviors (Cloud and Granfield, 2008).

### Research questions and hypotheses

Utilizing a sample of drug-dependent mothers who were followed up 10 years after entry into drug abuse treatment, we examine the following research questions: (1) Which individual-level factors (patient demographics, type of drug treatment received) are associated with success at follow-up? (2) After accounting for individual-level factors, is perceived neighborhood safety associated with successful outcome? (3) Does the effect of perceived neighborhood safety on successful outcome vary by level of recovery capital? We hypothesized that greater perceived neighborhood safety would be positively associated with successful outcome. We did not know if the effect of neighborhood safety on outcomes would be moderated by recovery capital.

## Methods

### Data source

Data analyzed in this study were derived from the California Treatment Outcome Project (CalTOP). CalTOP aimed to develop and pilot-test an outcome monitoring system for the California statewide alcohol and other drug treatment system of care. The study recruited approximately 17,770 adults consecutively admitted to 43 drug abuse treatment programs in 13 California counties during 2000-2002. The study excluded individuals under age 18, those who participated only in short-term detoxification programs or only in mandated driving under the influence programs, and patients who did not complete the assessment for treatment planning. The CalTOP study design is described in detail elsewhere (Hser et al., 2004; Evans and Hser, 2004). In particular, CalTOP included 4,447 women who were pregnant or parenting dependent children (under age 18) at treatment admission. A survey completed for each program indicated that 3 programs served men only, 8 served women only, and 32 served men and women. Findings on associations between treatment program type and long-term treatment outcomes have been reported elsewhere (Evans et al., 2013; Hser et al., 2011).

### Study design and recruitment

As part of a prospective longitudinal research study that aimed to assess differences in outcomes between the women-only and mixed-gender programs, a sample of 1,000 pregnant or parenting women was targeted to complete a 10-year follow-up interview (Hser et al., 2011). One follow-up interview was conducted during 2009-11 by telephone with UCLA-trained interviewers. Among the 1,000 participants targeted for the 10-year follow-up study, 713 completed the interview, 46 refused, and 164 were not located. Of the remainder, 54

were deceased (for mortality findings see Hser et al., 2012) and 23 were found but unable to complete the interview (22 incarcerated, 1 too ill). Thus, the overall re-location rate was 83.6% and, excluding women who were deceased or unable to complete the interview, the interview completion rate was 77.2%. Participants received a $55 gift card for completing the interview. All study procedures were approved by the Institutional Review Boards at UCLA and at the California Health and Human Services Agency.

## Analytic sample

The present study utilizes data on 703 women who had complete baseline and 10-year follow-up data that was needed for analysis. For subjects in this sample, mean (M ± SD) age was 31.2 ± 7.3 years. The distribution of race/ethnicity was 55.9% white, 20.1% Hispanic, 17.0% African American, and 6.9% other. Regarding indicators of socioeconomic status, about 20.8% had not obtained a high school degree or equivalent, 14.6% were employed full- or part-time, and 39.3% received public assistance. About 18.4% of women were currently married and 92.6% had one or more dependent children currently living with them, with a mean of 2.4± 1.7 children per woman. Primary drug problem type included methamphetamine (43.1%), heroin (19.4%), alcohol (16.8%), cocaine (10.9%), marijuana (9.1%), and other drugs (<1.0%). More than half (56%) of participants had used their primary drug for more than ten years, and many indicated needs in other areas besides drug use as indicated by homelessness (20.2%), involvement with the criminal justice system (57.9%), chronic medical problems (24.0%), and receipt of psychiatric medication (33.7%). Treatment modality experienced at baseline included outpatient treatment (48.8%), narcotic replacement therapy (e.g., methadone maintenance) (15.4%), and residential care (35.8%).

Analysis of the baseline characteristics of women who were and were not included in the analytic sample showed no differences between groups in most of the variables that were examined, including age, race/ethnicity, education level, employment status, marital status, pregnancy status, homelessness, history of physical or sexual abuse, severity of problems in multiple domains (alcohol, drug, family, legal, medical, and psychiatric), prior system exposures (arrests, incarcerations, and mental health treatment), and length of stay in drug treatment. However, compared to the analytic sample, more women in the omitted group reported their primary drug to be alcohol (21.6% vs. 16.8%) or heroin (28.2% vs. 19.4%) and fewer reported it to be methamphetamine (33.5% vs. 43.1%) or cocaine (6.6% vs. 10.9%), omitted women had more severe employment problems, fewer received women-only treatment (42.9% vs. 52.9%), and more received narcotic replacement therapy (23.0% vs. 15.4%).

## Instruments and measures

The baseline assessment included the Addiction Severity Index (ASI), a semi-structured interview instrument that captures *individual-level demographic information* and also assesses problem severity in seven areas: alcohol and drug use, employment, family and social relationships, legal, psychological, and medical status (McLellan et al., 1980, 1992; Bovasso et al., 2001). A composite score can be computed for each scale to indicate severity in that area; scores range from 0 to 1 with higher scores indicating greater severity. Distinguished by excellent inter-rater and test–retest reliability as well as high discriminant

and concurrent validity (Bovasso et al., 2001; Kosten et al., 1983), the ASI is widely used in the addictions field (McLellan et al., 2006). Type and amount *treatment received* was also collected at baseline as part of the main study.

The primary *dependent variable* is successful outcome, constructed as a dichotomous variable and defined by the following self-reported factors as measured in the 30 days prior to the 10-year follow-up interview: (1) no use of any illicit drugs and (2) not involved with the criminal justice system (no arrests, incarcerations, or illegal activity). Recent consensus statements propose that recovery from drug use should be more broadly defined to embrace recovery as a process of change through which an individual achieves abstinence from drug use but also improved health, wellness, and quality of life (Laudet, 2007; White, 2007; The Betty Ford Institute Consensus Panel, 2007). Consistent with this conceptualization, we focus on drug abstinence and criminal involvement as the primary outcome indicator.

The primary *independent variable* is perception of neighborhood safety which was assessed at the 10-year follow-up interview by a 4-item subscale from the Neighborhood Questionnaire (Greenberg et al., 1999). The subscale encompasses three constructs. Collective efficacy was measured on a 0-3 scale (very bad-very good) in response to the question “In general, how do you feel about your neighborhood?” Informal social control was measured on a 0-3 scale (very dissatisfied-very satisfied) in response to “How satisfied are you with the police protection around there?” and on a 0-4 scale (never-very often; reversed scored) in response to “How often are there problems with muggings, burglaries, assaults, or anything else like that around there?” Drug availability was measured on a 0-3 scale (not serious-very serious; reversed scored) in response to “How much of a problem is the selling and using of drugs around there?” The neighborhood safety subscale has demonstrated acceptable reliability (Cronbach’s alpha .74 to .77; Greenberg et al., 1995, 1999) and validity (Vandell and Pierce, 1998). The range of possible scores on this subscale was from 0 to 4, with higher scores indicating greater neighborhood safety (alpha = .77). The mean score was 2.23±.71.

The *moderator* of interest was recovery capital, as indicated by two constructs – satisfaction with community resources and neighborhood social involvement - which were assessed at the 10-year follow-up interview by subscales from the Neighborhood Questionnaire (Greenberg et al., 1999). *Community resources* was measured on a 0-3 scale (very satisfied-very dissatisfied) in response to three questions: “How satisfied are you with garbage collection/schools/public transportation in your neighborhood?” (alpha=.40). This subscale was scored so that higher scores indicate greater satisfaction with neighborhood public resources. The mean score was 2.18±.81. *Social involvement* was measured by 4 items asking respondents to describe their neighborhood as ranging from one in which most people keep to themselves, or one in which most people talk or visit a lot with the other people in the neighborhood; number of neighbors the respondent knows well enough to visit or call on; how frequently the respondent gets together with any of their neighbors; and level of involvement in the neighborhood (alpha =.67). This subscale was scored so that higher scores indicate more social involvement. The mean score was 1.21±.84.

The Neighborhood Questionnaire was added to study instrumentation after data collection began and was thus administered with 491 individuals who were interviewed at follow-up. There were no significant differences between those who did and did not complete this questionnaire on almost all of the baseline variables that were examined including age, race/ethnicity, education level, employment status, marital status, homelessness, history of physical/sexual abuse, pregnancy, type of primary drug problem, years of primary drug use, history of prior events (arrests, incarcerations, mental health treatment, drug treatment), and all of the ASI problem severity scores. The one exception was that more of the women who did not complete this questionnaire were treated in a narcotic replacement setting (20.7% vs. 13.0%) and fewer received outpatient care (43.7% vs. 51.1%).

### Statistical analyses

To test differences between women who were and were not successful at follow-up, t-tests were conducted on continuous measures and Chi-square tests on categorical measures. Next, three separate logistic regression models were estimated. In Model 1, we estimated the association between successful outcome and baseline demographic and treatment factors. We added neighborhood safety to Model 2 to examine if it is associated with successful outcome independent of the individual-level variables examined in Model 1. In Model 3, we examined if the effect of neighborhood safety on successful outcome is moderated by recovery capital by creating two interaction terms: perceived neighborhood safety X community resources and perceived neighborhood safety X social involvement. We tested each interaction term separately. To address issues posed by missing values among the three perceived neighborhood factors, we conducted a sensitivity analysis for all three models by using multiple imputation methods (Rubin, 1987; Schafer, 1997). Specifically, for each logistic regression model we created five imputed replications using the SAS MI procedure. Then we combined results using the SAS MIANALYZE procedure to produce estimates and standard errors. We compared the statistical conclusions based on these estimates and standard errors with the results from the standard models. In this article, a two-tailed significance level was set on all statistical tests at $p \leq 0.05$ and all analyses were conducted using SAS 9.3.

## Results

### Characteristics of women with a successful outcome

As shown in Table 1, more than half (53.6%) of women had a successful outcome at the 10-year follow-up interview. Compared to women who did not have a successful outcome, fewer of the women with a successful outcome had a history of physical or sexual abuse (72.7% vs. 79.5%). More women with a successful outcome, compared to women without a successful outcome, reported methamphetamine as their primary drug problem at baseline (48.8% vs. 36.2%) and fewer reported it to be marijuana (6.9% vs. 12.0%). As indicated by the mean ASI composite scores, women with a successful outcome had less severe baseline problems related to medical (0.20 vs. 0.27) and psychiatric problems (0.23 vs. 0.28).

As for measures of neighborhood climate (Table 2) at the 10-year follow-up, women with successful outcomes reported greater perceived neighborhood safety (2.4 vs. 2.1) and greater

satisfaction with community resources (2.3 vs. 2.1) than women who did not have a successful outcome. There was no statistically significant difference between groups in level of social involvement.

### Factors associated with successful outcome

**Individual-level factors—**Table 3 shows information for three multivariate logistic regression models. Shown in Model 1, the odds of having a successful outcome were increased by being pregnant at baseline [odds ratio: exp(0.389)=OR 1.48, p≤0.05] and by report of methamphetamine as the primary drug problem type (versus all other drug types) [exp(0.523)=OR 1.69, p≤0.01] and it was decreased by more severe medical problems [exp(−0.620)=OR .54, p≤0.05]. Notably, treatment in a women-only versus a mixed-gender program was positively associated with successful outcomes [exp(0.327)=OR 1.39, p≤0.05].

**Neighborhood-level factors—**As shown in Model 2, each increase in perceived neighborhood safety increased the odds of success at follow-up by 78% [exp(0.578)=OR 1.78, p≤0.001], net of the other factors that were included in the model. Odds of success were also increased by being pregnant [exp(0.466)=OR 1.59, p≤0.05] and having a primary drug problem type of methamphetamine (as opposed to other drug types) [exp(0.679)=OR 1.97, p≤0.01].

**Moderators of success—**When interaction terms were included (Table 3, Model 3), moderation of perceived neighborhood safety by social involvement was significant (−0.412, p≤.01). As shown in Figure 1, as perceived neighborhood safety increased, there was a decrease in the likelihood of a successful outcome among women who reported more versus less social involvement.

Sensitivity analysis suggested that the results would not change if multiple imputation technique were used for the three models in Table 3.

## Discussion

### Summary of findings

Ten years after drug treatment, 53.6% of the mothers who were studied had achieved a successful outcome. The primary result of our analysis was that net of individual-level characteristics, perceived neighborhood safety almost doubled the odds of success. Additionally, greater perceived neighborhood safety decreased the odds of success among mothers who reported more versus less social involvement.

**Implications—**To our knowledge, this is one of the few studies to examine long-term drug treatment outcomes among a sample of drug-dependent mothers. Results showed that just over half of women had a successful outcome ten years after drug treatment. Supplemental analysis showed that among the women that did not have a successful outcome, 90.5% had used drugs in the 30 days prior to follow-up and 17.0% had been involved with the criminal justice system, suggesting that continued drug use and not criminal activity was the primary reason for their lack of success. Long-term follow-up studies generally show that there is considerable variation in drug abstinence rates (Calabria et al., 2010; Dennis et al., 2007)

and that drug use relapse occurs even after decades of no use (Hser et al., 2001). Findings indicate a need to focus attention on better addressing substance use and dependence disorders among this population.

Research has primarily considered individual-level factors in relation to drug abstinence and other treatment outcomes. Findings from this study suggest that perception of one's neighborhood is also of import, contributing to the growing number of studies that have concluded that environmental context imposes opportunities and constraints in ways that ultimately impact health (Baum et al., 2009; Diez Roux et al., 2001; Nandi et al., 2010; Silver et al., 2011; Winkleby et al., 2006). A longitudinal study of injection drug users found that relocation to relatively less deprived neighborhoods was associated with lasting injection cessation (Genberg et al., 2011). In the present study we did not examine why or how greater perceived neighborhood safety was associated with better outcomes and whether there was variation by locality or over time, constituting areas for future research.

Further, greater perceived neighborhood safety was associated with a decreased likelihood of successful outcome among mothers who reported more neighborhood social involvement. This finding contradicts a large body of research on the beneficial effects of social capital on health however it is consistent with Cloud and Granfield's concept of negative recovery capital (Cloud and Granfield, 2008). This concept captures the idea that personal circumstances and individual characteristics (attributes, behaviors, values) can impede ability to successfully terminate substance abuse. Cloud and Granfield explore how age, gender, physical and mental health, and incarceration experiences can contribute to negative recovery capital. Findings from our study suggest that neighborhood safety and social involvement also have implications for negative recovery capital. Studies of other health behaviors have found that more social involvement is not always protective of adverse health outcomes (e.g., Caughy et al., 2003). It must be remembered that our measure of social involvement mostly captured amount of social interactions and cannot be used to characterize the nature or quality of those interactions. It may be that some women in our study sought out relationships with drug-using neighbors, in effect counteracting many of the positive effects that are typically associated with greater perceived neighborhood safety and greater social involvement. Qualitative research with substance-abusing women in drug treatment indicates they are often embedded in social networks that can both help and harm recovery efforts (Padgett et al., 2008; Tracy et al., 2010). More research is needed to better understand how recovery capital interacts with neighborhood context to impact health and well-being among populations with current or former drug dependence disorders.

Finally, particular individual-level characteristics of women at baseline were associated with success ten years later. Being pregnant at treatment entry increased the odds of success. For some women pregnancy may signify a change in social role responsibilities that promotes drug use cessation and sustained recovery (Massey et al., 2012; Sword et al., 2009; Mitchell et al., 2008; Massey et al., 2011). For others, potential involvement with the social service and child welfare systems, along with child custody concerns, can exert enormous pressures on pregnant women to quit using drugs (Cloud and Granfield, 2008). Pregnancy appears to be an opportunity for relapse prevention interventions. More studies are needed to know if,

when, and how pregnancy functions as a lasting turning point in women's drug use over their life course.

A better long-term outcome was negatively associated with severe physical health problems at baseline. It is important to remember that a significant proportion of women in our sample reported a history of physical or sexual abuse, few were employed or married, and many received public assistance. Physical abuse experienced during childhood can lead to an array of midlife physical and mental health problems (Springer, 2009). Not being employed can have detrimental consequences for physical and mental well-being and overall quality of life (Falba et al., 2009; Mossakowski, 2008; Zabkiewicz, 2010; Zabkiewicz and Schmidt, 2009). This finding is consistent with the idea that persistent drug use disorders are associated with the presence of severe problems in multiple domains (Clark, 2001; Le Strat et al., 2011; McLellan et al., 2000).

Use of methamphetamine instead of other drug types, particularly marijuana, was positively associated with long-term outcomes. Life course patterns of drug use have been relatively well-documented among adult treatment samples of severe or dependent opioid users (e.g., Hser et al., 1997; Hser et al., 2001; Nosyk et al., 2013). In contrast, longitudinal studies of marijuana use mostly focus on the transition from adolescence to adulthood. These suggest that chronic marijuana use is associated with more adverse outcomes in adulthood (Juon et al., 2011) such as a reduction in work commitment (Hyggen, 2012) and antisocial behavior (Brook et al., 2011a and b). Polydrug use is common among treated drug-dependent samples such as ours but because marijuana is generally perceived to be harmless compared to other drug types, replication and further exploration of this finding is warranted.

Finally, treatment in a specialized women-only substance abuse treatment program was associated with better long-term outcomes. Greater awareness of the unique needs and experiences of many women with substance use disorders has contributed to the relatively recent development of specialized treatment programs for women (Greenfield and Grella, 2009; Greenfield et al., 2007; Greenfield et al., 2010). A few studies that have examined outcomes measured about one year after treatment have reported that women treated in women-only versus mixed-gender programs have better drug use and criminal justice outcomes (Niv and Hser, 2007; Prendergast et al., 2011). As explored in detail elsewhere (Evans et al., 2013), our finding indicates that specialized women-only substance abuse treatment has long-term benefits, lending empirical support for a modifiable health services system-level leverage point to promote relapse prevention and sustained substance abuse recovery among drug-dependent mothers.

## Limitations and strengths

Findings must be considered within the context of several study limitations. Participants were enrolled from adult drug treatment settings and thus findings may not be representative of the general substance using population. The primary dependent and independent variables are self-reported and thus vulnerable to reporting bias however such data are commonly used in treatment research and, in the absence of more objective measures, perception of neighborhood conditions has been found to be a useful alternative to characterize neighborhood conditions (Elo et al., 2009). Neighborhood climate data were collected from

a subset of the study sample which may have biased the findings. There were no significant differences in the demographic characteristics of women that did and did not provide this data. Also, sensitivity analysis suggested that the results would not change if multiple imputation technique were used for the three models in Table 3. Given the study design, including that data collection was limited to two data points, it is not possible to know if greater perceived neighborhood safety reduces drug use and criminal activity or if reduced drug use and criminal activity enhances perceptions of neighborhood safety. To address issues of causality, future longitudinal drug abuse research studies should incorporate measures of neighborhood climate at each time-point.

Strengths of this study include the longitudinal prospective study design, a relatively large and ethnically diverse sample, the use of community-based treatment seekers, a focus on mothers, and the use of both individual and contextual variables. Moreover, the study provides empirical support for the association between neighborhood context and drug treatment outcomes among a sample of drug-dependent mothers, a topic that has received very little attention previously. Future research could advance knowledge in the field by applying particular theories to elucidate further how and why neighborhood safety has an impact on drug use behaviors.

## Conclusion

In the past decade there have been significant decreases in substance use disorders among some populations but not others (Sondik et al., 2010), a trend that has been called a “failure in the 20th century” (Fielding, 1999). One possible reason for this failure is that substance abuse is often perceived as an “evil habit” or “personal choice” (Leichter, 2003) and the policies and interventions that are designed to promote recovery have paid disproportionate attention to targeting individual-level decision-making.

The impact of contextual factors on health is important to understand for all populations, but understanding its effects among drug-dependent mothers is particularly important. Mothers bear most child-rearing responsibilities and thus play a key role in exposing children to environments and values that promote or retard healthy behavior. Also, ongoing substance abuse among low-income mothers makes economic self-sufficiency difficult to achieve, a reality that has broader economic and social spillover effects. Our study found that perceived neighborhood climate is associated with long-term drug use treatment outcomes among mothers independent of individual-level characteristics, underscoring the need for further efforts to understand its interaction with recovery capital in ways that promote and impede health.

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## Highlights

We examine whether perceived neighborhood safety is associated with 10-year health outcomes.

More than half the sample of treated drug-dependent mothers had a successful outcome.

Greater perceived neighborhood safety was independently associated with better outcomes.

Perceived neighborhood safety interacted with social involvement, decreasing the odds of success.

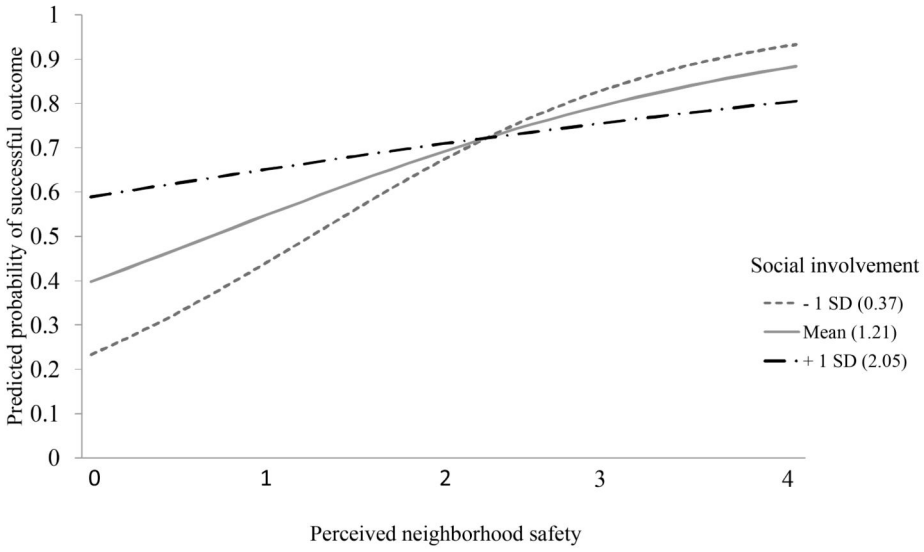


**Figure 1. Effect of neighborhood safety on successful outcome by level of social involvement**

Note: Predicted values are derived from the unstandardized regression coefficients shown in Model 3 of Table 3. We solved the equation by substituting the omitted reference category for categorical variables and the mean for other variables.

## Table 1

### Characteristics of women

| | Successful outcome | |
|---|---|---|
| | **Yes (n=377; 53.6%)** | **No (n=326; 46.4%)** |
| | % or Mean (SD) | % or Mean (SD) |
| **Individual-level characteristics at baseline** | | |
| Age | 31.0 (7.3) | 31.5 (7.3) |
| Race/ethnicity | | |
| White | 54.5 | 57.1 |
| Hispanic Non-white | 23.1 | 16.7 |
| African American | 15.4 | 19.1 |
| Other | 6.9 | 7.1 |
| Education, years | 11.5 (2.0) | 11.4 (1.8) |
| Employed (full- or part-time) | 14.1 | 15.6 |
| Married | 17.0 | 20.3 |
| Homeless | 20.4 | 19.9 |
| Physically or sexually abused in lifetime* | 72.7 | 79.5 |
| Pregnant | 42.7 | 35.9 |
| Primary drug problem type* | | |
| Methamphetamine | 48.8 | 36.2 |
| Heroin | 17.8 | 20.9 |
| Alcohol | 15.4 | 18.4 |
| Cocaine | 10.3 | 12.0 |
| Marijuana | 6.9 | 12.0 |
| Other | 0.8 | 0.6 |
| Used primary drug in lifetime, years | 12.7 (7.5) | 13.7 (7.5) |
| No. alcohol or drug treatments in lifetime | 3.0 (5.4) | 3.6 (5.8) |
| ASI Severity Scores (0-1, 1=most severe) | | |
| Alcohol | 0.15 (0.24) | 0.17 (0.25) |
| Drug | 0.16 (0.12) | 0.16 (0.13) |
| Employment | 0.78 (0.27) | 0.79 (0.26) |
| Family | 0.22 (0.23) | 0.23 (0.24) |
| Legal | 0.19 (0.21) | 0.19 (0.21) |
| Medical** | 0.20 (0.29) | 0.27 (0.35) |
| Psychiatric** | 0.23 (0.22) | 0.28 (0.26) |
| Arrested prior to enrollment | 72.9 | 75.2 |
| Incarcerated prior to enrollment | 2.9 | 3.4 |
| **Treatment experiences at baseline** | | |
| Women-only (WO) treatment | 54.1 | 50.9 |
| Treatment modality type | | |

| | Successful outcome | |
|---|---|---|
| | **Yes (n=377; 53.6%)** | **No (n=326; 46.4%)** |
| Outpatient | 51.7 | 45.7 |
| Residential | 33.7 | 38.0 |
| Narcotic replacement | 14.6 | 16.3 |
| Length of treatment stay (days) | 111.1 (140.9) | 102.4 (116.6) |

Omitted are 10 cases that were missing the information that was needed to create the outcome measure.

* $p \leq 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$

## Table 2
**Perceived neighborhood climate at 10-year follow-up**

| | Successful outcome | |
|---|---|---|
| | **Yes** | **No** |
| | % or Mean (SD) | % or Mean (SD) |
| Neighborhood safety*** (0-4; 4=safer) | 2.4 (.66) | 2.1 (.74) |
| Public service satisfaction** (0-3; 3=more satisfied) | 2.3 (.75) | 2.1 (.87) |
| Social involvement (0-4; 4=more involved) | 1.2 (.81) | 1.2 (.87) |

* $p \leq .05$

** $p \leq 0.01$

*** $p \leq 0.001$.

## Table 3

**Predicting successful outcome at 10-year follow-up (unstandardized logistic regression beta coefficients)**

| | Model 1 (n=678) | Model 2 (n=459) | Model 3 (n=459) |
|---|---|---|---|
| Individual factors | | | |
| Age (continuous) | 0.019 | 0.032 | 0.034 |
| White race/ethnicity (vs. all others) | −0.075 | −0.015 | −0.009 |
| Married (vs. not married) | −0.194 | 0.129 | 0.165 |
| Education (continuous) | 0.036 | 0.079 | 0.078 |
| Physically or sexually abused in lifetime | −0.310 | −0.356 | −0.352 |
| Pregnant (vs. not pregnant) | 0.389* | 0.466* | 0.510* |
| Drug problem is methamphetamine (vs. all others) | 0.523** | 0.679** | 0.693** |
| Years of primary drug use (continuous) | −0.014 | −0.032 | −0.034 |
| Months of incarceration (continuous) | −0.003 | 0.005 | 0.005 |
| ASI problem severity scores (continuous) | | | |
| Alcohol | 0.191 | 0.397 | 0.486 |
| Drug | 0.152 | −0.863 | −0.943 |
| Employment | −0.012 | 0.052 | 0.080 |
| Family | 0.251 | 0.366 | 0.380 |
| Legal | −0.002 | 0.154 | 0.115 |
| Medical | −0.620* | −0.431 | −0.402 |
| Psychiatric | −0.469 | −0.685 | −0.732 |
| Women only program (vs. mixed gender) | 0.327* | 0.307 | 0.282 |
| Modality is outpatient (vs. narcotic replacement) | 0.083 | −0.178 | −0.174 |
| Modality is residential (vs. narcotic replacement) | −0.105 | −0.340 | −0.367 |
| Perceived neighborhood factors | | | |
| Perceived neighborhood safety (continuous) | -- | 0.578*** | 1.110*** |
| Social involvement level (continuous) | -- | −0.004 | 0.924** |
| Community services satisfaction (continuous) | -- | 0.085 | 0.103 |
| Perceived neighborhood safety X social involvement level | -- | -- | −0.412** |

Sample sizes vary due to missing data.

* $p \leq .05$

** $p \leq 0.01$

*** $p \leq 0.001$