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Explaining long-term outcomes among drug dependent mothers treated in women-only versus mixed-gender programs

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Abstract

Specialized substance abuse treatment for parenting women is thought to improve outcomes, but long-term impacts and how they occur are poorly understood. Utilizing a sample of 789 California mothers followed for 10 years after admission to women-only (WO) or mixed-gender (MG) drug treatment, we examine the relationship between WO treatment and outcomes and whether it is mediated by post-treatment exposures to criminal justice and health services systems. At follow-up, 48% of mothers had a successful outcome (i.e., no use of illicit drugs, not involved with the criminal justice system, alive). Controlling for patient characteristics, WO (vs. MG) treatment increased the odds of successful outcome by 44%. In the structural equation model WO treatment was associated with fewer post-treatment arrests, which was associated with better outcomes. Women-only substance abuse treatment has long-term benefits for drug-dependent mothers, a relationship that may be partially explained by post-treatment exposure to the criminal justice system. Findings underscore additional leverage points for relapse prevention and recovery-supportive efforts for drug-dependent mothers.

Keywords

women-only treatment; long-term outcomes; system exposures; mediators

1. Introduction

Women account for more than 30% of the approximately 2.6 million Americans who receive treatment for substance use disorders each year (Substance Abuse and Mental Health Services Administration [SAMHSA], 2011). Of these women, two-thirds are of childbearing age and about 4% self-report pregnancy (SAMHSA, 2011). Substance use among mothers has adverse health, social, and economic impacts. Specialized treatment programs that are designed to meet the unique needs of mothers with substance use disorders are thought to improve outcomes, but research on their effectiveness is limited and factors that explain variations in outcomes are poorly understood. A better understanding of factors that promote recovery among drug-dependent mothers can help to improve existing services and interventions to prevent or ameliorate the adverse consequences of substance abuse. This study examines 10-year drug use outcomes among a cohort of mothers who received either women-only or mixed-gender substance abuse treatment. The study also examines whether

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the effects of treatment type on outcomes are mediated by post-treatment exposure to criminal justice and health services systems.

1.1 Consequences of drug-dependence among mothers

Increased risk of morbidity and premature mortality are associated with drug dependence among women. High-risk sexual behaviors (Barry, Weinstock, & Petry, 2008; Hernandez et al., 2009), intimate partner violence (Gonzalez-Guarda, Peragallo, Urrutia, Vasquez, & Mitrani, 2008), and detrimental parenting styles (De La Rosa, Dillon, Rojas, Schwartz, & Duan, 2010) are a few of the adverse impacts that have been documented. A recent study reported that substance-dependent mothers have a mortality rate 8.4 times that of US women of similar age (Hser, Kagihara, Huang, Evans, & Messina, 2012).

Serious health consequences can occur for women and their children when substances are used during and after pregnancy. The negative effects of prenatal exposure to maternal substance use, particularly alcohol, on child health are well-documented (Covington, Nordstrom-Klee, Ager, Sokol, & Delaney-Black, 2002; Dixon, Kurtz, & Chin, 2008; Johnson & Leff, 1999; Keegan, Parva, Finnegan, Gerson, & Belden, 2010; Sood et al., 2001). Pregnant women who use illicit substances may delay prenatal care and miss more healthcare visits (Funai, White, Lee, Allen, & Kuczynski, 2003; Staton, Leukefeld, & Webster, 2003; Wagner, Katikaneni, Cox, & Ryan, 1998), even though prenatal care may help to reduce the negative impact of illicit drug use on birth outcomes (El-Mohandes et al., 2003). Lower prenatal care utilization may be due to a diverse set of perceived barriers to seeking and obtaining care, including fear of child custody issues (Schempf & Strobino, 2009; Roberts & Pies, 2011).

After childbirth, mothers' ongoing drug abuse and the dysfunctional home environment it can create can have detrimental effects on children's psychological growth and development (Chatterji & Markowitz, 2001; Clark, Cornelius, Wood, & Vanyukov, 2004; Conners et al., 2004; Hanson et al., 2006; Linares et al., 2006). Furthermore, maternal well-being has been recognized as a key determinant of the health of the next generation, and also influences future public health challenges for families, communities, and the health care system (Healthy People 2020, 2012).

1.2 Specialized treatment for women

Specialized drug treatment programs for women are a relatively recent innovation that has developed in response to a greater awareness of the unique, gender-specific needs and experiences of many women who enter treatment. For example, many substance-dependent women in treatment exhibit coexisting psychiatric problems, lower self-esteem, and extensive histories of traumatic life events and experiences, including sexual and physical abuse (Greenfield et al., 2007; Hser et al., 2003b; Messina, Burdon, Hagopian, & Prendergast, 2006a; Messina, Burdon, & Prendergast, 2006b; Hodgins, el-Guebaly, & Addington, 1997). In addition, drug-dependent women are often of childbearing age, have children, and are typically the primary childcare provider (Grella, Joshi, & Hser, 2000). Most women in treatment have limited education, are unemployed, and rely on public assistance (Hser & Niv, 2006). Drug use among women is often initiated by their male partners (Hser, Anglin, & McGlothlin, 1987; Keegan et al., 2010), and it can be a mechanism for coping with abusive relationships and other life stressors (Chesney-Lind & Pasko, 2004; Covington & Surrey, 1997).

Nationwide, about 32% of all drug treatment facilities offer specialized treatment for adult women and 13% report provision of special services for pregnant and postpartum women (SAMHSA, 2011 [N-SSATS report]). These programs tend to treat only women, creating a

gender-specific "women-only" (WO) environment that contrasts with mixed gender (MG) programs, which usually treat both men and women. Some women-focused programs are embedded within mixed-gender treatment settings, where many women receive care (Tang et al., 2012). Across settings, WO programs are more likely than MG programs to offer special services such as pregnancy care, assistance with housing, transportation, job training, practical skills training, and on-site childcare and child development services (Ashley, Marsden, & Brady, 2003; Brady & Ashley, 2005; Grella, Polinsky, Hser, & Perry, 1999; Hser & Niv, 2006).

1.2.1 Effectiveness of specialized treatment for women—Empirical assessment of the effectiveness of WO programs compared to traditional or MG programs is promising, but findings are mixed and limited (Greenfield et al., 2007; Greenfield, Back, Lawson, & Brady, 2010). For example, studies restricted to completion or retention rates have reported that women in WO programs are more likely to complete treatment (Grella, 1999; Dahlgren & Willander, 1989), less likely to complete treatment (Harrison & Asche, 2001), or there is no difference in treatment completion rates (Kaskutas, Zhang, French, & Witbrodt, 2005). More recent studies that have examined outcomes measured about one year after treatment have reported that women treated in WO programs have better drug outcomes and some improved criminal justice outcomes (Niv & Hser, 2007; Prendergast, Messina, Hall, & Warda, 2011), but no apparent differences in arrests or employment status (Prendergast et al., 2011). Other studies have focused on identifying individual-level characteristics of women that moderate the effects of WO treatment. Such studies have reported that compared to MG treatment, WO treatment enhances outcomes among women with low self-efficacy (Cummings, Gallop, & Greenfield, 2010) or high psychiatric symptom severity (Greenfield et al., 2008). No study has assessed the impacts of WO treatment programming over longer periods of time, and the long-term effects of WO treatment on drug use and attendant behaviors remains unexplored.

1.3 System exposures and health

Women with substance abuse disorders come in contact with multiple service systems over their lifetime including substance abuse treatment, criminal justice, mental health, welfare, and primary health care (Hser, Evans, Huang, & Messina, 2011). Particular social contexts impose opportunities and constraints in ways that impact health-related behavior and decisions (Glass & McAtee, 2006). Some studies have reported that women treated in WO programs may be more likely than women treated in MG programs to be engaged in continuity of care just after initial treatment (Claus et al., 2007; Messina, Grella, Cartier, & Torres, 2010). However, other research has found that over a longer period of time, differences in service system exposures that have been associated with receipt of treatment in a WO versus MG program fluctuate or disappear altogether (Hser et al., 2011).

Studies on the health effects of incarceration report that incarceration exposure increases the likelihood of severe health limitations (Schnittker & John, 2007) and is associated with disparities in access to care (Kulkarni et al., 2010) and disparities in health conditions (Wang & Green, 2010). In contrast, repeated exposure to systems that treat mental health or substance use disorders can be the result of real or perceived greater need for such services (Druss et al., 2007; Fleury et al., 2012; Lindamer et al., 2012) that thus confounds relationships with subsequent health outcomes or it can represent a model of continuing care that can reduce risk and thereby yield better health outcomes (Chi et al., 2011; Grella et al., 2010; Parthasarathy et al., 2012).

In relation to women treated in WO compared to MG drug treatment settings, it is not known if differential exposures to service systems that occur after treatment may explain differences in drug use outcomes over time.

1.4 Filling knowledge gaps

The purpose of the present study is to build on our prior work (Hser et al., 2011) to examine 10-year drug use outcomes among a cohort of mothers who received WO or MG substance abuse treatment. We also examine whether the effects of WO treatment on outcomes are mediated by exposure to criminal justice and health services systems. We hypothesized that women treated in WO programs would have better drug use and related outcomes than women treated in MG programs. In addition, we expected that the effects of WO programs on outcomes would be mediated by system exposures – that is, that WO treatment would be associated with differential exposure to criminal justice and health services environments that occurred after treatment exit and that this difference in exposures would in turn be associated with differential outcomes. More specifically, we expected WO treatment to be associated with less exposure to the criminal justice system post-treatment which would lead to better outcomes whereas we did not have a priori hypotheses regarding post-treatment exposure to health services systems and its relationship to WO treatment and outcomes.

2. Materials and methods

Data analyzed in this study were derived from the California Treatment Outcome Project (CalTOP), a study that recruited approximately 17,770 adults admitted to 43 drug abuse treatment programs in 13 California counties during 2000–2002. The CalTOP study design is described in detail elsewhere (Hser, Evans, Huang, & Anglin, 2004; Evans & Hser, 2004; Hser et al., 2003a). In particular, CalTOP included 4,447 women who were pregnant or parenting dependent children (under age 18) at treatment admission. A survey was also completed for each program, which indicated that out of the 43 programs 3 served men only, 8 served women only [WO], and 32 served men and women (mixed-gender [MG]). A prior study revealed some differences in the services offered by these program types with WO programs were more likely to offer services related to children, pregnancy, and HIV testing but less likely to provide on-site psychiatric evaluation and medications, or employment-related services (Hser & Niv, 2006).

2.1 Study design and recruitment

As part of a prospective longitudinal research study that aimed to assess differences in outcomes between the WO and MG programs, we used propensity-matching procedures to select an equivalent 500 women from each type of program (500 from WO, 500 from MG). Described in detail elsewhere (Hser et al., 2011), the matching procedures involved constructing matched pairs using the nearest available Mahalanobis metric matching within calipers defined by the propensity score. We considered WO programs as the “case” group and MG programs as the “control” group. The propensity score was computed based on 47 variables at treatment intake. Before matching, the two groups were significantly different in many aspects and after matching most of these differences were no longer significant but a few remained (e.g., age, pregnant status, and prior outpatient psychiatric treatment). These measures were included in the present analyses as control variables.

The resulting matched sample of 1,000 CalTOP women was targeted to complete a 10-year follow-up interview. Follow-up interviews were conducted in 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.

2.2 Participants

The present study utilizes data on 789 women who completed the baseline interview and either completed the 10-year follow-up interview or were found to be deceased or incarcerated at follow-up. For subjects in this sample, mean (M ± SD) age was 31.5 ± 7.4 years. The distribution of race/ethnicity was 56.2% white, 20.4% Hispanic, 17.1% African American, and 6.4% other. In regards to socioeconomic indicators, about 16.2% had not obtained a high school degree or equivalent, 14.5% were employed full- or part-time, and 39.3% received public assistance. About one-fifth of women were currently married and 93.2% had one or more dependent children, with a mean of 2.3± 1.7 children per woman. Primary drug problem type included methamphetamine (40.4%), heroin (20.9%), alcohol (18.1%), cocaine (10.8%), marijuana (9.1%), and other drugs (<1.0%). More than half (57%) 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 (19.5%), involvement with the criminal justice system (58.2%), chronic medical problems (26.0%), and receipt of psychiatric medication (34.2%). Treatment modality experienced at baseline included outpatient treatment (47.0%), narcotic replacement therapy [e.g., methadone maintenance] (16.5%), and residential care (36.5%).

Analysis of the baseline characteristics of women who were (n=789) and were not (n=211) included in the analytic sample showed no differences between groups in most of the variables that were examined, including race/ethnicity, employment status, marital status, homelessness, history of physical or sexual abuse, primary drug type, most Addiction Severity Index (ASI) composite scores (drug, employment, family, legal, medical, and psychiatric), prior system exposure (arrests, incarcerations, and mental health treatment), treatment modality type, and length of stay in treatment. However, compared to the analytic sample, the omitted group was slightly younger (30.3 vs. 31.5 years old), had a little less education (11.2 vs. 11.5 years), more were pregnant (47.5% vs. 38.8%), they had more severe alcohol problems as indicated by the ASI alcohol composite score (.16 vs. .12), and fewer received WO treatment (40.3% vs. 52.5%).

2.3 Measures

The primary *dependent variable* is successful outcome, constructed as a dichotomous composite variable and defined by the following three criteria in the 30 days prior to the 10-year follow-up interview: (1) no use of any illicit drugs, (2) not involved with the criminal justice system (no arrests, incarcerations, or illegal activities), and (3) alive. Of the women who died, mean age at death was 41.6 (standard deviation 7.4), thus representing the occurrence of premature death. Average time from baseline to death was about 5 years. Most deaths were drug-related (Hser et al., 2011). For these reasons, death was conceptualized as a poor outcome and included in the operationalization of the dependent variable. Drug use and criminal justice system involvement at follow-up were self-reported whereas occurrence of death was verified by National Death Index records maintained by the Centers for Disease Control and Prevention.

The primary *independent variable* is treatment in a women-only (WO) versus mixed-gender (MG) program at baseline treatment. Prior analysis revealed that receipt of WO vs. MG

treatment was negatively associated with being pregnant, prior mental health treatment, and prior incarceration, and it was positively associated with prior drug treatment ($p \leq .05$).

The *mediators* of interest were criminal justice and health services system exposures, as indicated by the following administrative records covering 10 years of observation from baseline treatment discharge to follow-up.

Arrests—Information on women's adult arrest history for all offense types was obtained from the Automated Criminal History System of the California Department of Justice (DOJ).

Incarcerations—Women's history of incarceration in prison settings was obtained from the Offender Based Tracking System maintained by the California Department of Corrections and Rehabilitation (CDCR).

Drug treatment—Information on alcohol and drug treatment received by women from public providers, as well as from methadone treatment providers that are licensed by the state, was obtained from the California Department of Alcohol and Drug Programs. This data system tracks all admission and discharge episodes and provides data on the following: dates of admission and discharge; types of drugs used; treatment type, duration, and discharge status; and other information.

Mental health services—Information regarding mental health services utilized by women was obtained from the California Department of Mental Health (DMH). DMH maintains the Client and Service Information (CSI) database, one that tracks services and psychiatric diagnoses for patients treated in mental health facilities that received DMH funds.

Follow-up time-points differed both between and within groups and thus to account for the resulting variation in the length of the post-treatment period of observation, the measurement of each mediator was time-adjusted. Using incarceration as an example, this means that the number of months of incarceration was divided by the total number of months that were observed over the 10-year follow-up period. Similarly, the numbers of arrests, drug treatment admits, and mental health services received were each divided by the total number of months observed.

Covariates were provided by the baseline assessment at intake which included the Addiction Severity Index (ASI), a semi-structured interview instrument that captures 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, Luborsky, Woody, & O'Brien, 1980, McLellan et al., 1992; Bovasso, Alterman, Cacciola, & Cook, 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, Rounsaville, & Kleber, 1983), the ASI is widely used in the addictions field (McLellan, Cacciola, Alterman, Rikoon, & Carise, 2006).

2.4 Analysis

We divided subjects into two groups based on our primary independent variable (WO vs. MG treatment). Group differences in characteristics at baseline and in system exposures over 10 years after discharge were tested by Chi-square or ANOVA. Next, keeping in mind

that logit coefficients cannot be compared across logistic regression models (Mood, 2009) but that sequential model building techniques are still useful for examining the contribution each set of variables makes to explaining the dependent variable (Aneshensel, 2013), two separate multivariate logistic regression models were estimated. In the first model, we examined whether the composite indicator of successful outcome was associated with treatment program type (WO vs. MG), controlling for covariates. In the second model, we added the mediator variables, i.e., time-adjusted measures of post-treatment system exposures (arrests, incarceration, drug treatment, mental health treatment).

A structural equation modeling (SEM) approach was then applied to further reveal relationships between successful outcome at follow-up, treatment program type (WO vs. MG), and intervening variables. To minimize possible confounding effects, baseline characteristics (age, race/ethnicity, socioeconomic indicators, pregnancy status, past physical or sexual abuse, past drug use and treatment, past arrests and incarcerations, past mental health treatment, ASI severity scores) were also included as covariates to predict both treatment program type and outcome. Mplus 5.1 (Muthén & Muthén, 2006) was used for model fitting. Given that our outcome is a dichotomous variable, the weighted least square estimator with mean and variance adjusted chi-square was used. Missing values on the primary dependent variable and mediators were assumed to be missing at random (e.g., Yuan and Bentler, 2000). Our hypothesized model was evaluated by several fit indices, including the mean and variance adjusted χ^2, Bentler's Comparative Fit Index (CFI, Bentler, 1990), the Root Mean Square Error of Approximation (RMSEA, Steiger & Lind, 1980), and the Tucker-Lewis Index (TLI). In SEM, as a tool for evaluating the model exact fit, the mean and variance adjusted χ^2 frequently rejects acceptable models with some minor misspecification (e.g., Browne & Cudeck, 1993; Hu & Bentler, 1999). Thus, the χ^2 was used for reference only and the following criteria were used to evaluate a good fit: CFI >0.95, RMSEA <0.06, and TLI >0.90 (e.g., Hu and Bentler, 1999; Kline, 1998). We used a two-tailed significance level at $p \leq 0.05$ for all statistical tests.

3. Results

3.1 Sample characteristics

Analysis of participant characteristics at baseline showed a few differences between women treated in WO versus MG settings (see Table 1). Women treated in WO programs were older (32.2 vs. 30.8 years), more were African American (20.5% vs. 13.1%) and fewer were Hispanic (17.6% vs. 23.3%), and fewer were pregnant (26.0% vs. 52.9%). WO women had used their primary drug for more years on average at baseline (14.3 vs. 12.6 years) and had more prior treatments for alcohol or drug abuse (3.9 vs. 3.0).

3.2 System exposures over 10 years post-treatment

Exposure to criminal justice and health services systems that occurred during the 10 years after CalTOP treatment discharge is also shown in Table 1. Compared to women who received MG treatment, women who received WO treatment had fewer arrests post-treatment (.036 vs. .044 times per month). Groups were not different in the percent of time incarcerated that occurred over this time period, or in the number (per month) of drug abuse treatment admissions and mental health services utilizations.

3.3 Successful outcome

About half (48.4%) of the women who were studied had a successful outcome at the 10-year follow-up interview. More WO vs. MG women had a successful outcome (50.0%, 46.6%, χ^2 =.35) but this difference was not statistically significant. Analysis of each of the three variables that comprise the successful outcome indicator showed that almost two-thirds of

women treated in WO and MG programs had not used drugs (63.6%, 61.5%, χ^2 =.54), most women in both groups had not engaged in criminal justice activity (91.5%, 88.9%, χ^2 =.24), and most were alive (93.3%, 93.1%, χ^2 =.91).

Table 2 shows results from two multivariate logistic regression models. Results from Model 1 indicated that WO (vs. MG) treatment increased the odds of successful outcome at 10-year follow-up by 44% (b = 0.365, odds ratio [OR] = 1.44; p ≤0.05), net of covariates. In addition, successful outcome was positively associated with methamphetamine (vs. all other drug types) as the primary drug problem type (b = 0.589, OR = 1.802; p≤.01) and being pregnant at baseline (b = 0.467, OR = 1.594; p≤.01) and it was negatively associated with more severe medical problems as indicated by the ASI problem severity score (b = −.0544, OR = 0.581; p ≤0.05).

When measures of post-treatment system exposures (arrests, incarceration, drug treatment, mental health treatment) were included (Model 2), the regression coefficient for WO (vs. MG) treatment decreased, suggesting that the effect of WO (vs. MG) treatment on successful outcome may be mediated by these events. In particular, the odds of having a successful outcome was decreased by the occurrence of more post-treatment arrests (b = −4.870, OR = 0.008, p≤.001). The association between successful outcome and each of the other mediators that were examined (incarceration, drug treatment, mental health treatment) was negative but not statistically significant. As was the case in Model 1, in Model 2 successful outcome was positively associated with methamphetamine as the primary drug problem type and being pregnant at baseline and it was negatively associated with more severe medical problems.

3.4 Structural equation model

Our initial hypothesized structural equation model (SEM) of the relationships between WO treatment, system exposures, and successful outcome controlling for covariates fit the data poorly, with a mean and variance adjusted χ^2 = 147.167(p<.0000), RMSEA=.044, CFI=.442, and TLI=.102. For this initial model, the RMSEA was clearly different from all other fit statistics, perhaps because the RMSEA was somewhat biased downwards by the mean and variance adjusted χ^2 that was used (see Brosseau-Liard, Savalei & Li, in press). Model modification indices (e.g., Byrne, Shavelson, & Muthen, 1989; Sorbom & Joreskog, 1982) provided by Mplus indicated that freeing the following two paths reduced the chi-square to 42.050 and 43.727, respectively: (1) arrested (yes vs. no) before CalTOP enrollment (see Table 1) as a predictor of the number of arrests that occurred in the 10 years after treatment discharge and (2) the number of lifetime alcohol/drug treatments (see Table 1) as a predictor of the number of drug treatment admits that occurred in the 10 years after treatment discharge. After freeing these two paths, our modified model satisfied the criteria for a good model fit with a mean and variance adjusted χ^2 = 62.320(p=.3590), RMSEA=.009, CFI=.979, and TLI=.966. At the same time, model modification indices did not indicate that any other paths, variances, or covariances should be freed.

Table 3 shows the standardized SEM parameter estimates (total and individual) from our final modified model for the direct and indirect effects of WO treatment on successful outcome. The standardized coefficients allow us to compare the effect size between differently scaled explanatory variables. When compared to the amount of exposure to incarceration, drug treatment, and mental health services that occurred post-treatment discharge, number of arrests had the strongest direct association with treatment in a WO program (b = −.099 vs. −.054, −.092, −.084, respectively) and also with successful outcome (b = −.153 vs. <.000, −.118, −.109, respectively). In other words, WO treatment had a negative effect on the number of arrests that occurred over the 10 years after CalTOP discharge (b = −.099, p≤.01) and more arrests over this time period had a negative effect on

successful outcome (b = −.153, p≤.001). The indirect effect of arrests was statistically significant (b = .015, p ≤0.05).

Regarding the other mediators that were examined, WO treatment had a negative effect on incarceration exposure over the 10 years after CalTOP discharge (b = −.054, p≤.05) and more incarceration exposure had a negative, but statistically insignificant, effect on successful outcome (b < .000). The indirect effect of incarceration was not significant.

WO treatment had a significant negative effect on drug treatment received over the 10 years after CalTOP discharge (b = −.092, p≤.01) and more drug abuse treatment exposure had a negative effect on successful outcome (b = −.118, p≤.05), however the indirect effect of drug treatment was marginally significant (b = .011, p=.09).

WO treatment had a significant negative effect on mental health services received over the 10 years after CalTOP discharge (b = −.084, p≤.01) and receipt of more mental health services had a significant negative effect on successful outcome (b = −.109, p≤.05), however the indirect effect of mental health services was marginal (b = .009, p = .08).

The direct association between WO treatment and successful outcome (b = .109, p=.08) was of marginal statistical significance but stronger than its statistically significant indirect association (b = .035, p ≤0.01). The total association of direct and indirect effects with successful outcome was significant (b = .144, p≤.05).

4. Discussion

4.1 Summary of findings

As hypothesized, treatment in a woman-only (WO) vs. mixed-gender (MG) program had a positive association with successful outcome 10 years later. Furthermore, the relationship between WO treatment and successful outcome was mediated by the number of arrests that occurred during the 10 years after treatment, i.e., WO treatment was associated with fewer post-treatment arrests which was in turn associated with a better outcome.

4.2 Implications

To our knowledge, this is the first study to assess the long-term impacts of WO vs. MG treatment programming on drug use and attendant behaviors. Results showed that treatment in a women-only program had a positive association with successful outcomes 10 years later. Findings provide empirical support for the effectiveness of drug treatment facilities that offer specialized treatment for adult women.

In addition, our study revealed that the number of arrests that occurred after treatment exit mediated the relationship between WO treatment and successful outcome, i.e., WO treatment was associated with a fewer number of post-treatment arrests which was in turn associated with a better outcome. This finding is consistent with a recent relative effectiveness study that reported that over a one-year follow-up time-period, women who participated in WO treatment reported significantly less substance use and criminal activity than women who participated in MG treatment (Prendergast et al., 2011). However that same study reported no differences between treatment groups in arrests at follow-up. It may be that longer follow-up periods, like what was used by the present study, are needed for group differences in exposure to criminal justice systems to emerge. Our finding suggests that reducing exposure to criminal justice settings is one mechanism through which specialized substance abuse treatment for drug-dependent women achieves long-term benefits.

As for the other mediators that were examined, post-treatment receipt of additional drug treatment and mental health care each had a marginally significant indirect effect on the odds of successful outcome. Compared to women treated in MG settings, women treated in WO settings had fewer drug treatment admits and received fewer mental health services over the 10 years after treatment discharge, each of which increased the odds of a successful outcome however each indirect path was not statistically significant at conventional levels. Also, WO treatment had a negative effect on post-treatment incarceration exposure but the indirect effect of this exposure on successful outcome was not statistically significant. Undoubtedly, the relationships between long-term health and system interactions are complex and dynamic. A better understanding is needed regarding how the timing and accumulation of exposures to criminal justice and health services systems over the life course might impact long-term substance abuse treatment outcomes.

Finally, it is worth noting that successful outcome was associated with particular characteristics of women at baseline. Being pregnant at treatment entry increased the odds of successful outcome at the 10-year follow-up. For some women, pregnancy may create added stress and contribute to stress proliferation (Havens, Simmons, Shannon, & Hansen, 2009; Bener, Gerber, & Sheikh, 2012). For others it 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, Severtson & Latimer, 2008; Massey et al., 2011). Also, women with successful outcomes had less severe medical problems at baseline. This finding confirms and extends existing research indicating that persistent drug addiction is associated with the presence of severe problems in multiple psychosocial domains (McLellan, Lewis, O'Brien, & Kleber, 2000; Clark, 2001; Le Strat, Dubertret & Le Foll, 2011). Finally, more women with a successful outcome used methamphetamine and fewer used heroin and marijuana. Methamphetamine is recognized as a significant problem in California and evidence-based treatments are available to treat methamphetamine use (Rawson, 1999). It may be that women in the successful outcome group benefitted from such specialized care. It is also possible that their outcomes are partly explained by use of a drug that is less physically addictive than heroin (Gossop, Griffiths, Powis, & Strang, 1992) but arguably more socially stigmatized than marijuana. Supplemental analysis showed that among the women who did not have a successful outcome, 73.4% had used drugs in the 30 days prior to follow-up, 19.4% had been involved with the criminal justice system, and 13.4% were deceased (data not shown). In other words, continued drug use (and not criminal justice system activity or death) was the primary reason for an unsuccessful outcome. Drug treatment is recognized as being effective (National Institute on Drug Abuse [NIDA], 1999), but long-term follow-up studies of treated individuals generally show that severe or dependent users tend to persist in their drug use outside of treatment, often for substantial periods over their lifespan (Hser, Anglin, Grella, Longshore, & Prendergast, 1997; Hser, Hoffman, Grella, & Anglin, 2001). Findings indicate a need to focus attention on better addressing substance use and dependence disorders among this population.

4.3 Limitations and strengths

This research presents the first empirical evidence that women-only treatment is associated with successful outcomes 10 years later and that this relationship is mediated by post-treatment system exposures. Although innovative, findings must be considered within the context of several study limitations. Assignment to WO vs. MG treatment was not randomized, potentially introducing confounds that we sought to address by including covariates. Propensity-scoring matching procedures resulted in a selected sample that is more severe than the general CalTOP sample, limiting the extent to which findings can be generalized. The clustering of women within programs was not accounted for (the intra-class correlation coefficient was 0.026), and thus the precision of results may be overstated. Drug

use was self-reported, a data source that is vulnerable reporting bias, although self-reported measures of this construct is commonly used in drug treatment research. Mediators were not randomized, a topic that is the focus of ongoing research (Muthen, 2011). Also, mediators were measured with administrative data, a data source that is vulnerable to reporting biases (McCarty, McGuire, Harwood, & Field, 1998; Saunders & Heflinger, 2004) but has been found to be a valuable research resource (Hser & Evans, 2008, McCarty et al., 1998), particularly in the investigation of service system interactions and outcomes among substance abusers (Evans, Grella, Murphy, & Hser, 2010). An area for future research, we do not know whether the MG programs in the study actually mixed genders within the treatment environment, treating men and women in the same groups or sessions, or whether genders were segregated and treated in gender-specific ways. Also not examined was whether women received private treatment for mental health or substance use problems in the years between baseline and follow-up and its relationship to program type and treatment outcomes. Finally, model modification procedures were used to determine the final SEM model. Modifications were substantively meaningful however the process was still data-driven and may be susceptible to capitalization on chance (e.g., MacCallum & Austin, 2000; MacCallum, Roznowski, & Necowitz, 1992).

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, examination of direct and indirect effects on outcomes, and the use of both individual- and system-level variables. Moreover, the study provides empirical support for the long-term impact of specialized women-only treatment on long-term outcomes among a sample of drug-dependent mothers, a topic that has received very little attention previously.

4.4 Conclusion

In recent years there has been a proliferation of “gender sensitive” (Grella, 2008) or “women-focused” drug treatment programs (Greenfield & Grella, 2009). Results from this study suggest that substance abuse programs devoted to addressing women’s treatment needs has long-term benefits for drug-dependent mothers. Furthermore, this study identifies associations between specialized treatment and post-treatment system exposures that help to explain the causal mechanisms through which specialized treatment for women can impact substance abuse recovery, underscoring leverage points for future relapse prevention and recovery-supportive efforts. Information on system exposures can be used to diffuse innovations, like women-focused treatment, that more effectively prevent or alter adverse health behaviors (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004). More research is needed to further elucidate which subgroups of drug-dependent women benefit from specialized care and how those benefits are achieved.

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References

Aneshensel, CS. Theory-based data analysis for the social sciences. 2. Thousand Oaks, CA: Sage; 2013.

Ashley OS, Marsden ME, Brady TM. Effectiveness of substance abuse treatment programming for women: A review. American Journal of Drug and Alcohol Abuse. 2003; 29(1):19–53. [PubMed: 12731680]

Barry D, Weinstock J, Petry NM. Ethnic differences in HIV risk behaviors among methadone-maintained women receiving contingency management for cocaine use disorders. Drug and Alcohol Dependence. 2008; 98(1–2):144–153. [PubMed: 18684571]

Bener A, Gerber LM, Sheikh J. Prevalence of psychiatric disorders and associated risk factors in women during their postpartum period: A major public health problem and global comparison. International Journal of Women's Health. 2012; 4:191–200.

Bentler PM. Comparative fit indexes in structural models. Psychological Bulletin. 1990; 107(2):238–246. [PubMed: 2320703]

Bovasso GB, Alterman AI, Cacciola JS, Cook TG. Predictive validity of the Addiction Severity Index's composite scores in the assessment of 2-year outcomes in a methadone maintenance population. Psychology of Addictive Behaviors. 2001; 15(3):171–176. [PubMed: 11563793]

Brady, TM.; Ashley, OS., editors. DHHS Publication No SMA 04–3968, Analytic Series A-26. Rockville, MD: Substance Abuse and Mental Health Services Administration, Office of Applied Studies; 2005. Women in substance abuse treatment: Results from the Alcohol and Drug Services Study (ADSS).

Brosseau-Liard PE, Savalei V, Li L. An investigation of the sample performance of two nonnormality corrections for RMSEA. Multivariate Behavioral Research. (in press).

Browne, MW.; Cudeck, R. Alternative ways of assessing model fit. In: Bollen, K.; Long, J., editors. Testing structural equation models. Newbury Park, CA: Sage; 1993. p. 136-162.

Byrne BM, Shavelson RJ, Muthen B. Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. Psychological Bulletin. 1989; 105:456–466.

Chatterji P, Markowitz S. The impact of maternal alcohol and illicit drug use on children's behavior problems: Evidence from the Children of the National Longitudinal Survey of Youth. Journal of Health Economics. 2001; 20(5):703–731. [PubMed: 11558645]

Chesney-Lind, M.; Pasko, LJ. The Female Offender: Girls, Women, and Crime. Thousand Oaks, CA: Sage Publications; 2004.

Chi FW, Parthasarathy S, Mertens JR, Weisner CM. Continuing care and long-term substance use outcomes in managed care: early evidence for a primary care-based model. Psychiatric Services. 2011; 62(10):1194–200. [PubMed: 21969646]

Clark DB, Cornelius J, Wood DS, Vanyukov M. Psychopathology risk transmission in children of parents with substance use disorders. American Journal of Psychiatry. 2004; 161(4):685–691. [PubMed: 15056515]

Clark HW. Residential substance abuse treatment for pregnant and postpartum women and their children: Treatment and policy implications. Child Welfare. 2001; 80(2):179–198. [PubMed: 11291900]

Claus RE, Orwin RG, Kissin W, Krupski A, Campbell K, Stark K. Does gender-specific substance abuse treatment for women promote continuity of care? Journal of Substance Abuse Treatment. 2007; 32(1):27–39. [PubMed: 17175396]

Conners NA, Bradley RH, Mansell LW, Liu JY, Roberts TJ, Burgdorf K, Herrell JM. Children of mothers with serious abuse problems: An accumulation of risks. American Journal of Drug and Alcohol Abuse. 2004; 30(1):85–100. [PubMed: 15083555]

Covington CY, Nordstrom-Klee B, Ager J, Sokol R, Delaney-Black V. Birth to age 7 growth of children prenatally exposed to drugs: A prospective cohort study. Neurotoxicology and Teratology. 2002; 24(4):489–496. [PubMed: 12127894]

Covington, SS.; Surrey, JL. The relational model of women's psychological development: Implications for substance abuse. In: Wilsnack, RW.; Wilsnack, SC., editors. Gender and alcohol: Individual and social perspectives. Piscataway, NJ: Rutgers Center of Alcohol Studies; 1997. p. 335-351.

Cummings AM, Gallop RJ, Greenfield SF. Self-efficacy and substance use outcomes for women in single gender versus mixed-gender group treatment. Journal of Groups in Addiction & Recovery. 2010; 5(1):4–16. [PubMed: 21753920]

Dahlgren L, Willander A. Are special treatment facilities for female alcoholics needed? A controlled 2-year follow-up study from a specialized female unit (EWA) versus a mixed male/female treatment facility. Alcoholism, Clinical and Experimental Research. 1989; 13(4):499–504.

De La Rosa M, Dillon FR, Rojas P, Schwartz SJ, Duan R. Latina mother-daughter dyads: Relations between attachment and sexual behavior under the influence of alcohol or drugs. Archives of Sexual Behavior. 2010; 39(6):1305–1319. [PubMed: 19399605]

Dixon DR, Kurtz PF, Chin MD. A systematic review of challenging behaviors in children exposed prenatally to substances of abuse. Research in Developmental Disabilities. 2008; 29(6):483–502. [PubMed: 18037268]

Druss BG, Wang PS, Sampson NA, Olfson M, Pincus HA, Wells KB, Kessler RC. Understanding mental health treatment in persons without mental diagnoses: results from the National Comorbidity Survey Replication. Archives of Geneneral Psychiatry. 2007; 64(10):1196–1203.

El-Mohandes A, Herman AA, Nabil El-Khorazaty M, Katta PS, White D, Grylack L. Prenatal care reduces the impact of illicit drug use on perinatal outcomes. Journal of Perinatology. 2003; 23(5): 354–360. [PubMed: 12847528]

Evans E, Grella CE, Murphy DA, Hser YI. Using administrative data for longitudinal substance abuse research. Journal of Behavioral Health Services & Research. 2010; 37(2):252–271. [PubMed: 18679805]

Evans E, Hser YI. Pilot-testing a statewide outcome monitoring system: Overview of the California Treatment Outcome Project (CALTOP). Journal of Psychoactive Drugs, Suppl. 2004; 2:109–114.

Fleury MJ, Grenier G, Bamvita JM, Perreault M, Kestens Y, Caron J. Comprehensive determinants of health service utilisation for mental health reasons in a Canadian catchment area. International Journal for Equity in Health. 2012; 11:20. [PubMed: 22469459]

Funai EF, White J, Lee MJ, Allen M, Kuczynski E. Compliance with prenatal care visits in substance abusers. Journal of Maternal-Fetal and Neonatal Medicine. 2003; 14(5):329–332. [PubMed: 14986807]

Glass TA, McAtee MJ. Behavioral science at the crossroads in public health: Extending horizons, envisioning the future. Social Science & Medicine. 2006; 62(7):1650–1671. [PubMed: 16198467]

Gonzalez-Guarda RM, Peragallo N, Urrutia MT, Vasquez EP, Mitrani VB. HIV risks, substance abuse, and intimate partner violence among Hispanic women and their intimate partners. Journal of the Association of Nurses in AIDS Care. 2008; 19(4):252–266. [PubMed: 18598901]

Gossop M, Griffiths P, Powis B, Strang J. Severity of dependence and route of administration of heroin, cocaine and amphetamines. British Journal of Addiction. 1992; 87(11):1527–1536. [PubMed: 1458032]

Greenfield SF, Back SE, Lawson K, Brady KT. Substance abuse in women. Psychiatric Clinics of North America. 2010; 33(2):339–355. [PubMed: 20385341]

Greenfield SF, Brooks AJ, Gordon SM, Green CA, Kropp F, McHugh RK, Miele GM. Substance abuse treatment entry, retention, and outcome in women: A review of the literature. Drug and Alcohol Dependence. 2007; 86(1):1–21. [PubMed: 16759822]

Greenfield SF, Grella CE. What is “women-focused” treatment for substance use disorders? Psychiatric Services. 2009; 60(7):880–882. [PubMed: 19564216]

Greenfield SF, Potter JS, Lincoln MF, Popuch RE, Kuper L, Gallop RJ. High psychiatric symptom severity is a moderator of substance abuse treatment outcomes among women in single vs. mixed gender group treatment. American Journal of Drug and Alcohol Abuse. 2008; 34(5):594–602. [PubMed: 18821452]

Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: Systematic review and recommendations. Milbank Quarterly. 2004; 82(4):581–629. [PubMed: 15595944]

Grella CE. Women in residential drug treatment: Differences by program type and pregnancy. Journal of Health Care for the Poor and Underserved. 1999; 10(2):216–229. [PubMed: 10224827]

Grella CE. From generic to gender-responsive treatment: changes in social policies, treatment services, and outcomes of women in substance abuse treatment. Journal of Psychoactive Drugs. 2008; 5:327–243. [PubMed: 19256044]

Grella CE, Joshi V, Hser YI. Program variation in treatment outcomes among women in residential drug treatment. Evaluation Review. 2000; 24(4):364–383. [PubMed: 11009864]

Grella CE, Polinsky ML, Hser YI, Perry SM. Characteristics of women-only and mixed-gender drug abuse treatment programs. Journal of Substance Abuse Treatment. 1999; 17(1–2):37–44. [PubMed: 10435251]

Grella CE, Stein JA, Weisner C, Chi F, Moos R. Predictors of longitudinal substance use and mental health outcomes for patients in two integrated service delivery systems. Drug and Alcohol Dependence. 2010; 110(1–2):92–100. [PubMed: 20338696]

Hanson RF, Self-Brown S, Fricker-Elhai AE, Kilpatrick DG, Saunders BE, Resnick HS. The relations between family environment and violence exposure among youth: Findings from the National Survey of Adolescents. Child Maltreatment. 2006; 11(1):3–15. [PubMed: 16382087]

Harrison PA, Asche SE. Adolescent treatment for substance use disorders: Outcomes and outcome predictors. Journal of Child & Adolescent Substance Abuse. 2001; 11(2):1–17.

Havens JR, Simmons LA, Shannon LM, Hansen WF. Factors associated with substance use during pregnancy: Results from a national sample. Drug and Alcohol Dependence. 2009; 99(1–3):89–95. [PubMed: 18778900]

Healthy People 2020, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. 2020 Topics and Objectives: Maternal, Infant, and Child Health. 2012. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicId=26

Hernandez MT, Sanchez MA, Ayala L, Magis-Rodriguez C, Ruiz JD, Samuel MC, Lemp GH. Methamphetamine and cocaine use among Mexican migrants in California: The California-Mexico epidemiological surveillance pilot. AIDS Education and Prevention. 2009; 21(5 Suppl):34–44. [PubMed: 19824833]

Hodgins DC, el-Guebaly N, Addington J. Treatment of substance abusers: Single or mixed gender programs? Addiction. 1997; 92(7):805–812. [PubMed: 9293039]

Hser YI, Anglin MD, Grella C, Longshore D, Prendergast ML. Drug treatment careers. A conceptual framework and existing research findings. Journal of Substance Abuse Treatment. 1997; 14(6):543–558. [PubMed: 9437626]

Hser YI, Anglin MD, McGlothlin W. Sex differences in addict careers. 1. Initiation of use. American Journal of Drug and Alcohol Abuse. 1987; 13(1–2):33–57. [PubMed: 3318399]

Hser YI, Evans E. Cross-system data linkage for treatment outcome evaluation: Lessons learned from the California Treatment Outcome Project. Evaluation and Program Planning. 2008; 31(2):125–135. [PubMed: 18374980]

Hser Y-I, Evans E, Huang D, Anglin D. Relationship between drug treatment services, retention, and outcomes. Psychiatric Services. 2004; 55(7):767–774. [PubMed: 15232015]

Hser YI, Evans E, Huang D, Messina N. Long-term outcomes among drug-dependent mothers treated in women-only versus mixed-gender programs. Journal of Substance Abuse Treatment. 2011; 41(2):115–123. [PubMed: 21466942]

Hser, YI.; Evans, E.; Teruya, C.; Hardy, M.; Ettner, S.; Urada, D.; Anglin, D. The California Treatment Outcome Project (CalTOP) Final Report. Los Angeles, CA: UCLA Integrated Substance Abuse Programs; 2003a. Available at: http://www.uclaisap.org/caltop/index.htm

Hser YI, Hoffman V, Grella CE, Anglin MD. A 33-year follow-up of narcotics addicts. Archives of General Psychiatry. 2001; 58(5):503–508. [PubMed: 11343531]

Hser YI, Huang D, Teruya C, Anglin MD. Gender comparisons of drug abuse treatment outcomes and predictors. Drug and Alcohol Dependence. 2003b; 72(3):255–264. [PubMed: 14643942]

Hser YI, Kagihara J, Huang D, Evans E, Messina N. Mortality among substance-using mothers in California: A 10-year prospective study. Addiction. 2012; 107(1):215–222. [PubMed: 21831178]

Hser YI, Niv N. Pregnant women in women-only and mixed-gender substance abuse treatment programs: A comparison of client characteristics and program services. Journal of Behavioral Health Services & Research. 2006; 33(4):431–442. [PubMed: 16688389]

Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling. 1999; 6:1–55.

Johnson JL, Leff M. Children of substance abusers: Overview of research findings. Pediatrics. 1999; 103(5 Pt 2):1085–1099. [PubMed: 10224196]

Kaskutas LA, Zhang L, French MT, Witbrodt J. Women's programs versus mixed-gender day treatment: Results from a randomized study. Addiction. 2005; 100(1):60–69. [PubMed: 15598193]

Keegan J, Parva M, Finnegan M, Gerson A, Belden M. Addiction in pregnancy. Journal of Addictive Disorders. 2010; 29(2):175–191.

Kline, RB. Principles and practice of structural equation modeling. NY: Guilford Press; 1998.

Kosten TR, Rounsaville BJ, Kleber HD. Concurrent validity of the addiction severity index. Journal of Nervous and Mental Disease. 1983; 171(10):606–610. [PubMed: 6619823]

Kulkarni SP, Baldwin S, Lightstone AS, Gelberg L, Diamant AL. Is incarceration a contributor to health disparities? Access to care of formerly incarcerated adults. J Community Health. 2010; 35(3):268–74. [PubMed: 20127504]

Le Strat Y, Dubertret C, Le Foll B. Prevalence and correlates of major depressive episode in pregnant and postpartum women in the United States. Journal of Affective Disorders. 2011; 135(1–3):128–138. [PubMed: 21802737]

Linares TJ, Singer LT, Kirchner HL, Short EJ, Min MO, Hussey P, Minnes S. Mental health outcomes of cocaine-exposed children at 6 years of age. Journal of Pediatric Psychology. 2006; 31(1):85–97. [PubMed: 15802608]

Lindamer LA, Liu L, Sommerfeld DH, Folsom DP, Hawthorne W, Garcia P, Aarons GA, Jeste DV. Predisposing, enabling, and need factors associated with high service use in a public mental health system. Adm Policy Ment Health. 2012; 39(3):200–209. [PubMed: 21533848]

MacCallum RC, Austin JT. Applications of structural equation modeling in psychological research. Annual Review of Psychology. 2000; 51:201–226.

MacCallum RC, Roznowski M, Necowitz LB. Model modifications in covariance structure analysis: The problem of capitalization on chance. Psychological Bulletin. 1992; 111(3):490–504. [PubMed: 16250105]

Massey SH, Lieberman DZ, Reiss D, Leve LD, Shaw DS, Neiderhiser JM. Association of clinical characteristics and cessation of tobacco, alcohol, and illicit drug use during pregnancy. American Journal of Addiction. 2011; 20(2):143–150.

Massey SH, Neiderhiser JM, Shaw DS, Leve LD, Ganiban JM, Reiss D. Maternal self concept as a provider and cessation of substance use during pregnancy. Addictive Behaviors. 2012; 37(8):956–961. [PubMed: 22575401]

McCarty D, McGuire TG, Harwood HJ, Field T. Using state information systems for drug abuse services research. American Behavioral Scientist. 1998; 41(8):1090–1106.

McLellan AT, Cacciola JC, Alterman AI, Rikoon SH, Carise D. The Addiction Severity Index at 25: Origins, contributions and transitions. American Journal on Addictions. 2006; 15(2):113–124. [PubMed: 16595348]

McLellan AT, Kushner H, Metzger D, Peters R, Smith I, Grissom G, Argeriou M. The fifth edition of the Addiction Severity Index. Journal of Substance Abuse Treatment. 1992; 9(3):199–213. [PubMed: 1334156]

McLellan AT, Lewis DC, O'Brien CP, Kleber HD. Drug dependence, a chronic medical illness: Implications for treatment, insurance, and outcomes evaluation. Journal of the American Medical Association. 2000; 284(13):1689–1695. [PubMed: 11015800]

McLellan AT, Luborsky L, Woody GE, O'Brien CP. An improved diagnostic evaluation instrument for substance abuse patients. The Addiction Severity Index. Journal of Nervous and Mental Disease. 1980; 168(1):26–33. [PubMed: 7351540]

Messina N, Burdon W, Hagopian G, Prendergast M. Predictors of prison-based treatment outcomes: A comparison of men and women participants. American Journal of Drug and Alcohol Abuse. 2006a; 32(1):7–28. [PubMed: 16450640]

Messina N, Burdon W, Prendergast M. Prison-based treatment for drug-dependent women offenders: Treatment versus no treatment. Journal of Psychoactive Drugs, Suppl. 2006b; 3:333–343.

Messina N, Grella C, Cartier J, Torres S. A randomized experimental study of gender responsive substance abuse treatment for women in prison. Journal of Substance Abuse Treatment. 2010; 38(2):97–107. [PubMed: 20015605]

Mitchell MM, Severtson SG, Latimer WW. Pregnancy and race/ethnicity as predictors of motivation for drug treatment. American Journal of Drug and Alcohol Abuse. 2008; 34(4):397–404. [PubMed: 18584569]

Mood C. Logistic regression: Why we cannot do what we think we can do, and what we can do about it. European Sociological Review. 2009; 26(1):67–82.

Muthen, B. Applications of causally defined direct and indirect effects in mediation analysis using SEM in Mplus. 2011. Available at: http://www.statmodel.com/download/causalmediation.pdf

National Institute on Drug Abuse [NIDA]. Principles of drug addiction treatment: A research based guide. NIH Publication No 09–4180. 1999. Available at: http://www.drugabuse.gov/publications/principles-drug-addiction-treatment

Niv N, Hser YI. Women-only and mixed-gender drug abuse treatment programs: Service needs, utilization and outcomes. Drug and Alcohol Dependence. 2007; 87(2–3):194–201. [PubMed: 16996232]

Parthasarathy S, Chi FW, Mertens JR, Weisner C. The role of continuing care in 9-year cost trajectories of patients with intakes into an outpatient alcohol and drug treatment program. Medical Care. 2012; 50(6):540–6. [PubMed: 22584889]

Prendergast ML, Messina NP, Hall EA, Warda US. The relative effectiveness of women-only and mixed-gender treatment for substance-abusing women. Journal of Substance Abuse Treatment. 2011; 40(4):336–348. [PubMed: 21315540]

Rawson, R. TIP 33: Treatment for Stimulant Use Disorders (Treatment Improvement Protocol (TIP) Series 33 No 33). Rockville, MD: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Treatment; 1999.

Roberts SC, Pies C. Complex calculations: How drug use during pregnancy becomes a barrier to prenatal care. Maternal and Child Health Journal. 2011; 15(3):333–341. [PubMed: 20232126]

Saunders RC, Heflinger CA. Integrating data from multiple public sources: Opportunities and challenges for evaluators. Evaluation. 2004; 10(3):349–365.

Schempf AH, Strobino DM. Drug use and limited prenatal care: An examination of responsible barriers. American Journal of Obstetrics and Gynecology. 2009; 200(4):412.e1–412.e10. [PubMed: 19217591]

Schnittker J. Enduring stigma: the long-term effects of incarceration on health. J Health Soc Behav. 2007; 48(2):115–30. [PubMed: 17583269]

Sood B, Delaney-Black V, Covington C, Nordstrom-Klee B, Ager J, Templin T, Sokol RJ. Prenatal alcohol exposure and childhood behavior at age 6 to 7 years: I. Dose-response effect. Pediatrics. 2001; 108(2):E34. [PubMed: 11483844]

Sorbom, D.; Joreskog, KG. The use of structural equation models in evaluation research. In: Fomell, C., editor. A second generation of multivariate analysis: Vol. 2. Measurement and evaluation. New York: Praeger; 1982. p. 381-418.

Staton M, Leukefeld C, Webster JM. Substance use, health, and mental health: Problems and service utilization among incarcerated women. International Journal of Offender Therapy and Comparative Criminology. 2003; 47(2):224–239. [PubMed: 12710367]

Steiger, JH.; Lind, JC. Statistically based tests for the number of common factors. Paper presented at the annual meeting of the Psychometric Society; Iowa City, IA. 1980.

Substance Abuse and Mental Health Services Administration [SAMHSA]. DASIS Series S-59, HHS Publication No (SMA) 11–4665. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2011. National Survey of Substance Abuse Treatment Services (N-SSATS): 2010. Data on Substance Abuse Treatment Facilities.

Sword W, Jack S, Niccols A, Milligan K, Henderson J, Thabane L. Integrated programs for women with substance use issues and their children: A qualitative meta-synthesis of processes and outcomes. Harm Reduction Journal. 2009; 6:32. [PubMed: 19930575]

Tang Z, Claus RE, Orwin RG, Kissin WB, Arieira C. Measurement of gender-sensitive treatment for women in mixed-gender substance abuse treatment programs. Drug and Alcohol Dependence. 2012; 123(1–3):160–166. [PubMed: 22138537]

Wagner CL, Katikaneni LD, Cox TH, Ryan RM. The impact of prenatal drug exposure on the neonate. Obstetrics and Gynecology Clinics of North America. 1998; 25(1):169–194. [PubMed: 9547766]

Wang EA, Green J. Incarceration as a key variable in racial disparities of asthma prevalence. BMC Public Health. 2010; 10:290. [PubMed: 20509891]

Yuan KH, Bentler PM. Three likelihood-based methods for mean and covariance structure analysis with nonnormal missing data. Sociological Methodology. 2000; 30(1):165–200.

Table 1

Sample characteristics

	Women-only (WO) (n=374; 47.4%)	Mixed-gender (MG) (n=415; 52.6%)
	% or Mean (SD)	% or Mean (SD)
At CalTOP treatment enrollment		
Age **	32.2 (7.3)	30.8 (7.5)
Race/ethnicity		
White	56.0	56.5
Hispanic Non-white *	17.6	23.3
African American **	20.5	13.1
Other	5.8	7.0
Education, years	11.4 (1.9)	11.5 (1.9)
Employed (full- or part-time)	14.9	13.9
Married	18.8	17.7
Homeless	21.2	17.7
Physically or sexually abused in lifetime	76.1	74.6
Pregnant ***	26.0	52.9
Primary drug problem type		
Methamphetamine	37.1	44.1
Heroin	21.2	20.6
Alcohol	19.5	16.6
Cocaine	11.6	9.9
Marijuana	9.9	8.3
Other	0.7	0.5
Used primary drug in lifetime, years **	14.3 (7.5)	12.6 (7.9)
No. alcohol or drug treatments in lifetime *	3.9 (6.4)	3.0 (4.9)
ASI Severity Scores		
Alcohol	0.17 (0.25)	0.15 (0.25)
Drug	0.16 (0.12)	0.16 (0.13)
Employment	0.79 (0.27)	0.79 (0.25)
Family	0.22 (0.24)	0.24 (0.24)
Legal	0.20 (0.20)	0.19 (0.23)
Medical	0.24 (0.33)	0.23 (0.32)
Psychiatric	0.26 (0.24)	0.25 (0.25)
Prior to CalTOP enrollment		
Arrested	74.7	72.3
Incarcerated	2.4	4.0
Received mental health treatment	30.4	34.2
CalTOP treatment modality type		
Outpatient	48.4	45.5
Residential	34.5	38.8

	Women-only (WO) (n=374; 47.4%)	Mixed-gender (MG) (n=415; 52.6%)
	% or Mean (SD)	% or Mean (SD)
Narcotic replacement	17.1	15.8
Length of CalTOP treatment stay (days)	102.3 (126.6)	110.5 (129.7)
Over 10 years after CalTOP treatment discharge[a]		
Number of arrests *	0.036 (0.049)	0.044 (0.060)
Months of incarceration	0.007 (0.047)	0.012 (0.061)
Number of drug abuse treatment admits	0.026 (0.049)	0.029 (0.045)
Number of mental health services received	0.244 (0.921)	0.315 (1.073)

* $p \leq 0.05$;

** $p \leq 0.01$;

*** $p \leq 0.001$

[a] Time-adjusted.

Table 2

Multivariate logistic regression analyses predicting successful outcome at 10-year follow-up

	Model 1	Model 2
	Beta estimate	**Beta estimate**
Primary independent variable		
Women-only (WO) (vs. mixed-gender [MG]) treatment	0.365*	0.321*
Mediators[a]	--	
Arrests (continuous)		−4.870**
Incarceration (continuous)		−0.003
Drug treatment admits (continuous)		−3.052
Mental health services (continuous)		−0.173
Covariates		
Age (continuous)	0.018	0.011
African American race/ethnicity (vs. white)	0.091	0.162
Hispanic race/ethnicity (vs. white)	0.238	0.263
Other race/ethnicity (vs. white)	0.392	0.363
High school education or higher	0.112	0.121
Married	−0.163	−0.216
Homeless	0.285	0.324
Employed (full- or part-time)	−0.350	−0.376
Physically or sexually abused in lifetime	−0.179	−0.112
Methamphetamine (vs. other drug types) is primary drug problem	0.589**	0.634**
Pregnant	0.467**	0.515**
Years of drug use in lifetime (continuous)	−0.018	−0.019
No. alcohol or drug treatments in lifetime (continuous)	−0.001	0.006
ASI severity score (continuous)		
Drug	0.246	0.378
Alcohol	0.137	0.177
Employment	−0.519	−0.514
Family	0.086	0.112
Legal	0.040	0.088
Medical	−0.544*	−0.595*
Psychiatric	−0.291	−0.223
Arrested prior to CalTOP enrollment	−0.008	0.002
Incarcerated prior to CalTOP enrollment	0.186	0.377
Received mental health treatment prior to CalTOP enrollment	−0.306	−0.232
Methadone (vs. residential) treatment	−0.073	0.062
Outpatient (vs. residential) treatment	0.261	0.250
Average length of stay (days) (continuous)	0.0006	0.0005

* $p \leq 0.05$;

** p ≤0.01;

*** p ≤0.001

[a] Time-adjusted.

Table 3

Modeling associations between women-only treatment and successful outcome

(standardized parameter estimates from the final structural equation model [SEM])

			Indirect association calculation		
	Direct association with successful outcome	**Direct association with WO (vs. MG) treatment**	**Direct association of WO (vs. MG) treatment with each mediator**	**Indirect association of WO (vs. MG) treatment with successful outcome**	**Total association of WO (vs. MG) treatment with successful outcome**
Primary independent variable					
Women only (WO) treatment	.109#	--	--	.035**	.144*
Mediators[a]		--			--
Arrests (continuous)	−.153***		−.099*[b]	.015*	
Incarceration (continuous)	.000		−.054*	.000	
Drug treatment admits (continuous)	−.118*		−.092**[c]	.011#	
Mental health services (continuous)	−.109*		−.084**	.009#	
Covariates			--	--	--
Age (continuous)	.076	−.011			
African American (vs. white) race/ethnicity	.018	.068			
Hispanic (vs. white) race/ethnicity	.061	−.058			
Other (vs. white) race/ethnicity	.059	−.043			
High school education or higher	.034	−.051			
Married	−.037	−.007			
Homeless	.066	.043			
Employed (full- or part-time)	−.072	.022			
Physically or sexually abused in lifetime	−.045	.015			
Methamphetamine (vs. other drug types) is primary drug problem	.171**	−.031			
Pregnant	.151**	−.355***			
Years of drug use in lifetime (continuous)	−.083	.043			
No. alcohol or drug treatments in lifetime (continuous)	.024	.096*			
ASI severity score (continuous)					

			Indirect association calculation		
	Direct association with successful outcome	**Direct association with WO (vs. MG) treatment**	**Direct association of WO (vs. MG) treatment with each mediator**	**Indirect association of WO (vs. MG) treatment with successful outcome**	**Total association of WO (vs. MG) treatment with successful outcome**
Drug	.017	.016			
Alcohol	.024	−.016			
Employment	−.079	.004			
Family	.015	−.030			
Legal	.005	−.007			
Medical	−.105*	.022			
Psychiatric	−.041	−.035			
Prior to CalTOP enrollment					
Arrested	.008	−.074			
Incarcerated	.028	−.095*			
Received mental health treatment	−.075	−.096*			
Methadone (vs. residential) treatment	−.005	--			
Outpatient (vs. residential) treatment	.085	--			
Length of stay (days) (continuous)	.048	--			

p ≤0.10;

* p ≤0.05;

** p ≤0.01;

*** p ≤0.001.

Model fit indices: X^2 (df 59) =253.088, p ≤0.001; RMSEA=.009; CFI=.979; TLI=.966

[a] Time-adjusted.

[b] Arrest history prior to CalTOP enrollment was included as a predictor of this mediator (b=.313, p≤.001).

[c] History of alcohol/drug treatment prior to CalTOP enrollment was included as a predictor of this mediator (b=.281, p≤.001).