Published in final edited form as:

J Subst Abuse Treat. 2010 January ; 38(1): 90–95. doi:10.1016/j.jsat.2009.05.005.

Incentives for retention of pregnant substance users: a secondary analysis

Gregory Brigham, Ph.D.^{a,b,*}, Theresa Winhusen, Ph.D.^{b,c}, Daniel Lewis, B.A.^c, and Frankie Kropp, M.S.^c

^aMaryhaven, Columbus, OH 43207, USA

^bDepartment of Psychiatry, University of Cincinnati College of Medicine, Cincinnati, OH 45267, USA

^cCincinnati Addictions Research Center (CinARC), Cincinnati, OH 45220, USA

Abstract

Retention of pregnant substance users in treatment is challenging. In a multi-site clinical trial, 200 pregnant substance users entering outpatient treatment at 1 of 4 programs were randomized to either 3 individual sessions of Motivational Enhancement Therapy for Pregnant Substance users (MET-PS) or 3 individual sessions normally provided. Retail scrip from \$25 to \$30 was provided for attendance of research visits but not treatment visits. A post-hoc analysis of the non-methadone maintained participants (N=175) evaluated the hypotheses that monetary reinforcement for attendance would result in more consecutive, and overall, weeks of attendance of research versus non-incentivized treatment visits. Findings indicate participants were nearly three times as likely to attend 4 consecutive weeks of research visits versus treatment sessions. There was no effect for income while fewer dependents were associated with more consecutive weeks of attendance. Incentives in the \$25 to \$30 range may serve to significantly increase attendance and retention.

Introduction

Substance use during pregnancy is associated with prenatal, neonatal, and postnatal complications which represent a leading preventable cause of mental and physical problems in children (SAMHSA, 2005). Research suggests that substance abuse treatment is effective in decreasing substance use and improving birth outcomes for pregnant women who attend treatment (McMurtrie et al. 1999). Rates of drug treatment entry increase during pregnancy (Wolfe et al., 2007) but retaining pregnant women in treatment can be difficult (Haller et al., 1997) and therefore increasing treatment utilization has been identified as an important goal for programs treating pregnant substance users (Howard and Beckwith, 1996). Even small increases in compliance with drug treatment have been associated with improved maternal and infant outcomes (Jones, et al., 2002).

Contingency management, in which clients receive some form of reward contingent upon a desired behavior, such as providing “drug free” urines, attending treatment, or taking medication has been found to be effective in improving treatment retention in a range of

*Corresponding author. Maryhaven, 1791 Alum Creek Dr., Columbus, Ohio 43207, USA, Tel.: +1 614-324-5417; fax: +1 614-324-5472. E-mail address: Gbrigham@maryhaven.com.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

substance abuse disorders (Higgins and Petry, 1999; Higgins and Silverman, 1999; Petry et al., 2000). Evaluation of the effectiveness of incentives for improving treatment retention in pregnant women using alcohol or illicit drugs has been somewhat limited. There are three types of reinforcement targets common in this literature they include reinforcement for visit attendance, drug free urines, and finally consecutive drug free urines which require both consecutive visit attendance and drug free or reduced drug metabolite urine samples. The difficulty of achieving these target behaviors escalates from simple attendance to drug free urine to the most difficult consecutive attendance combined with drug free urine samples. Two small trials by Elk et al., which reinforced attendance indirectly by giving bonuses for three consecutive drug free urine samples in a one week period, found that monetary incentives totaling up to \$51 per week (N=7; Elk et al., 1995) and \$74 per week (N=12; Elk et al., 1998) could improve attendance of drug dependence treatment and prenatal care in pregnant cocaine users. Another small trial (n=14) randomized pregnant opiate users to either standard methadone treatment or enhanced treatment which included standard methadone treatment and weekly prenatal visits, weekly relapse prevention groups, and contingency rewards of \$15 per week for three consecutive drug free urines. Women in the enhanced treatment had 3 times as many prenatal visits, longer gestations and infants with higher birth weight however there were no differences between the groups in drug use (Carroll, et al., 1995). Analysis of more recent clinical trials have indicated that incentives for drug free urines are more effective in individuals who enter treatment drug free than for those who have drug positive urines at intake (Stitzer, et al., 2007). Combining reinforcement for attendance and consecutive drug free urines may set a target behavior that is too difficult to achieve initially and therefore effectively undermining the attempt to establish a reinforcement which requires that the recipient achieve a target behavior and receive reinforcement. Another early trial, with a larger sample (N=142), evaluating the efficacy of four levels of small incentives (\$0, \$1, \$5, & \$10) for increasing treatment attendance in methadone and non-methadone maintained pregnant substance users revealed that the \$5 and \$10 incentive levels significantly increased treatment attendance in non-methadone maintained but not in methadone-maintained women (Svikis et al., 1997b). However, this finding was not replicated in a follow-up study conducted by the same investigators, in which they found that \$5 incentives improved attendance in the methadone-maintained, but not the non-methadone-maintained, pregnant substance users (Jones et al., 2000). A recent study evaluating contingency management for increasing treatment retention in non-methadone maintained pregnant substance users evaluated the efficacy of escalating vouchers for improving attendance of a 7-day residential program and the first 7 days of outpatient treatment, with a total of \$525 in vouchers earned for attendance of all 14 days; the results revealed that the incentives were not effective in preventing early drop out but did increase treatment attendance in the remaining participants (Svikis et al., 2007). However, as has been noted previously, it is unlikely that such a high level incentive would be affordable for most substance abuse treatment programs (Petry et al., 2005) and, thus, this finding is likely of limited utility for substance abuse treatment programs. Given the import of increasing treatment retention in pregnant substance users (Jones, et al., 2002), information about the incentive level required to improve treatment attendance in outpatient pregnant substance users would be useful.

A recent clinical trial in which participants were randomized to Motivational Enhancement Therapy for pregnant substance users (MET-PS) or to treatment as usual (TAU; Winhusen et al., 2008) provided participants with retail scrip for completing weekly research visits whereas attendance of treatment sessions was strongly encouraged but not associated with financial incentives. A primary objective of the trial was to evaluate the efficacy of MET-PS, compared to TAU, in increasing treatment attendance; the results suggested that MET-PS was not more effective than TAU for the sample as a whole (Winhusen et al., 2008). Given the lack of effect for MET-PS, and literature to suggest that incentives might be effective in increasing attendance, we conducted a post-hoc evaluation of the possible effect of financial incentives

on visit attendance in the non-methadone-maintained pregnant substance users who participated in the trial. Specifically, we compared attendance of monetarily reinforced research visits with attendance non-incentivized treatment sessions.

In addition, since past research suggests that a given incentive can be differentially rewarding to participants (Stitzer and Bigelow, 1983; Stitzer and Bigelow, 1984; Silverman, et al., 1997) and, given the finding that \$5 increased treatment attendance in non-methadone maintained pregnant substance users in one trial (Svikis et al., 1997b) but not in another (Jones et al., 2000), we sought to evaluate factors that might influence the relative impact of incentives. The contingency management literature in substance abuse treatment suggests that higher magnitude reinforcers and less difficult target behaviors are both associated with more positive response (Kellogg, et al., 2005), however, little is known about individual predictors of response to incentives. In a secondary analysis of a large multi-site trial evaluating contingency management with stimulant abusers Stitzer et al (2007) found that being drug free at intake is associated with a more positive response to abstinence based incentives and in a separate secondary evaluation of the same multi-site clinical trial Kileen et al. (2007) reported no correlation between the extent of treatment history and response to incentives. Since the magnitude of a reinforcer and the difficulty of achieving the target behavior are considered important elements in the a contingency management intervention we were interested in the impact of the participant's income as a potential influence on the perceived value or magnitude of the incentive and the participant's number of dependents as a potential indicator of the burden that the participant must overcome to attend a session.

2. Methods

2.1 Study Design

The study was conducted by the National Institute on Drug Abuse (NIDA) Clinical Trials Network (CTN) in which clinical trials are implemented in community treatment settings to maximize the generalizability of study results. Pregnant substance users entering outpatient substance abuse treatment at one of four community substance abuse treatment centers, located in Indiana, Kentucky, New Mexico, and North Carolina, were randomly assigned to receive MET-PS or TAU in addition to other treatment provided at the clinic. This randomized, parallel, two-group trial included a one month active study phase with two follow-up assessments completed at one and three months, respectively, following the end of the active study phase. The current study is a post-hoc analysis exploring research visit attendance versus treatment session attendance in the non-methadone maintained portion of the main study sample.

2.2 Participants

Participants were recruited at intake to outpatient treatment at the four participating community-based substance abuse treatment programs. Each of these women-specific programs offered a wide range of substance abuse services for pregnant and post-partum women. All participants signed an informed consent form that was approved by the Institutional Review Boards of the participating sites.

Eligible participants were at least 18 years of age, pregnant (as confirmed by a pregnancy test), and not planning to terminate the pregnancy. To be eligible, participants were required to be identified as needing substance abuse treatment via the CTP's usual screening procedure and to have a living arrangement of sufficient stability to allow for outpatient treatment. Participants were excluded from the study if they required residential or inpatient treatment (other than detoxification), were more than 32 weeks pregnant, planned to relocate from the area within four months of signing the study consent form, had pending legal charges that might lead to incarceration (other than those requiring the participant to attend treatment), or were a

significant suicidal/homicidal risk. Of the 204 candidates signing consent, four failed screening: two for not being pregnant, one for having a legal charge that could lead to incarceration, and one for having both an unstable living situation and a condition requiring residential or inpatient treatment. For the current study, women receiving methadone maintenance were excluded from the analysis resulting in a sample of 175 women.

2.3 Procedures

Pregnant women identified by clinic staff as needing substance abuse treatment and who expressed a willingness to learn more about the study were referred to the research assistant (RA). After signing the Informed Consent Form, the screening and baseline assessments were completed. Individuals who were found to be ineligible continued into the clinic's standard intake assessment and treatment program. Eligible participants were randomized to either MET-PS or TAU. The active treatment phase was four weeks in duration. During this phase, participants in both treatment conditions were offered at least three individual counseling sessions and were also encouraged to participate in the other treatment services offered by the program (e.g., intensive outpatient, group sessions, and case management). During the active treatment phase, participants were scheduled to meet with the RA on a weekly basis.

2.4 Study Treatments

In the main study participants were randomized to one of two treatments (MET-PS or TAU). For the current analysis, the intervention of interest was the effect of the retail scrip provided as compensation for the time and effort required to participate in research visits. During the first month of treatment, participants were scheduled to meet with the RA on a weekly basis. Research visits were scheduled independently from the treatment visits. Participants received retail scrip, specifically in the form of gift certificates for use at local retail stores, in the amount of \$25 for each of three of the research visits and \$30 for the end of treatment research visit; thus, participants could earn a total of \$105 for attending weekly visits for one month. During the first month of treatment, all participants were also scheduled to attend at least one treatment session per week.

2.5 Measures

For the present paper, the primary measure of interest was the number of consecutive weeks in which at least one visit was attended. Consecutive weeks of session attendance were considered to represent a higher level of compliance than the total number of weeks of attendance. The total number of weeks in which a visit was attended was included as a less stringent measure of compliance. Clinic records were used by research staff to assess treatment visit attendance, including attendance of the individual MET-PS/TAU sessions, while research attendance was documented by the research staff responsible for completing the research visits. Participants were scored as having attended a research visit for a given week if the scheduled research visit was completed. Participants were scored as having attended a treatment visit for a given week if any treatment visit was attended during the week. The present analysis evaluated the effect of two variables that could alter the reinforcement value of the research visit retail scrip: participant total income for the prior 30 days (i.e., summing across legal, illegal, given by family income) and number of dependents for which the participant was financially responsible. These variables were taken from the Addiction Severity Index (McLellan et al., 1992) administered at baseline.

2.6 Data Analysis

Following procedures utilized in Winhusen et al. (2008), all analyses controlled for key baseline differences between the MET and TAU groups (i.e., proportion of participants with cocaine as the primary drug of abuse, proportion with marijuana as the primary drug of abuse,

proportion with pressure to attend treatment, and minority status). Preliminary analyses revealed no statistically significant effect for treatment condition (MET-PS vs TAU) on attendance. The effect of Visit Type (treatment vs. research) on continuous weeks of attendance was evaluated using a Cox proportional hazards model with treatment group (MET-PS vs TAU), and treatment group baseline differences as covariates. The effect of Visit Type (treatment vs. research) on the number of weeks in which at least one visit was attended was analyzed with a quasi-likelihood logistic regression, which included treatment group (MET-PS vs. TAU), and treatment group baseline differences. The impact of participant income and number of dependents on continuous weeks of attendance was evaluated using a Cox proportional hazards model with Visit Type (treatment vs. research), the interaction of income and Visit Type, the interaction of dependents and Visit Type, treatment group (MET-PS vs. TAU), and treatment group baseline differences as covariates; the interaction effects were the effects of interest.

3. Results

3.1 Participant Characteristics

The participants were, on average, 26 years of age and 20 weeks pregnant at the time of randomization. The majority of study participants were unmarried, were unemployed and had, on average, a high school education. The sample was fairly diverse in terms of race and ethnicity, with approximately 41% Caucasians, 39% African Americans, and 13% Hispanics. At the time of study enrollment, participants reported having used alcohol or drugs on an average of 7.3 days out the prior 28 days. Marijuana (35%) was most commonly reported as the primary substance of abuse, followed by cocaine (27%), alcohol (12%), methamphetamine (8%), opioids (4%), and the remaining 14% reported benzodiazepines or “other” as their primary drug of abuse. The average number of days each substance was used within the past 28 days was; marijuana 4.5, cocaine 1.3, alcohol 1, opiates 0.8, benzodiazepines 0.7, and methamphetamines 0.5.

3.2 Consecutive Weeks of Attendance

The analysis of continuous weeks of attendance revealed a significant Visit Type effect ($X^2=62.24$, $df=1$, $p<.0001$). As can be seen in Figure 1, this significant effect reflects greater attendance of research visits relative to treatment visits, with over 60% of the women attending four consecutive weeks of research visits compared to just over 20% attending a treatment visit for four consecutive weeks.

3.3 Weeks of Attendance

Analysis of the number of weeks in which at least one visit was attended revealed a significant Visit Type effect ($X^2=34.15$, $df=1$, $p<.0001$), which reflects greater attendance of research, compared to treatment, visits (data not shown).

3.4 Effects of Dependents and Income

Analyses of the effect of participant income and number of dependents on continuous attendance revealed no significant effects for income but did reveal a significant Visit Type $\times$ Dependent interaction effect ($X^2=4.02$, $df=1$, $p<.05$). Review of the graph (data not shown) revealed that women with fewer dependents were more likely to attend consecutive research visits than consecutive treatment visits, which might suggest that the incentives associated with research visit attendance were less reinforcing with an increasing number of dependents.

4. Discussion

The current study found more consecutive, and overall, weeks of attendance for incentive-reinforced research visits compared to treatment sessions for which no financial incentives were provided. Additional analyses indicated that greater attendance of research visits, compared to treatment visits, was associated with having fewer dependents, which might indicate that the retail scrip were more reinforcing for those for whom the burden of attendance was less. No significant relationship was found between the participant's income and research vs. treatment visit attendance.

The current findings are consistent with previous reports that incentives can be used to improve compliance in pregnant substance users. A recent Cochrane Collaborative review of 9 randomized clinical trials evaluating psychosocial substance abuse interventions, 5 of which evaluated motivational incentives, concluded that contingency management led to better study retention and a minimal effect on illicit drug use (Terplan & Lui, 2007). While prior research with pregnant women has yielded mixed findings on the efficacy of small reinforcers for substance abuse treatment attendance in non-methadone maintained outpatients (Svikis et al., 1997; Jones et al., 2000), the current study finds that retail scrip in the \$25 to \$30 range may be effective in increasing weeks of attendance and consecutive weeks of attendance. The current analysis indicates a relationship between the number of dependents and the response to incentives. This suggests that the burden of treatment compliance is another factor to be considered in determining the optimum magnitude of an incentive and desired target behavior. Establishing achievable target behaviors is necessary for optimizing the effectiveness of contingency management interventions (Stitzer, et al., 2007; Kellogg, et al., 2005).

The most cost effective size of incentives for this population is yet to be established however, even incentives in the \$25 - \$30 range or greater may be justified in view of the potential benefits and costs savings. Svikis et al. (1997a) studied a group of pregnant women who applied for prenatal care and tested positive for cocaine use in a routine drug screen. These women were provided one week of residential drug treatment followed by twice-weekly outpatient counseling in the context of their scheduled prenatal visits. The women were then compared with 46 pregnant, demographically matched women who tested positive for cocaine use and received standard prenatal care during the year before. At delivery, treated patients were less likely to test positive for cocaine use, their infants averaged higher birth weights (2934 vs. 2539 g) and longer gestational periods (39 vs. 34 weeks), and, required fewer days of neonatal intensive care resulting in a substantial cost savings when compared with untreated women (the cost of neonatal intensive care on average was \$14,500 for the treated group and \$46,700 for the comparison group).

The present study is a post hoc analysis and was not designed prospectively to test the efficacy of incentives and, thus, many potential threats to the validity of the findings were not controlled. It is possible that research visits were attended at a higher rate for reasons not related to incentives such as differing demand characteristics of the research visits, more friendly or less demanding research assistants compared to counselors, or the confidential nature of the research setting. These alternative explanations cannot be ruled out in the current analysis and therefore further research controlling for these factors is needed to make definitive conclusions about the efficacy of incentives with this population.

Despite these limitations the current study makes several contributions. First it provides analysis of a relatively large sample of pregnant substance users (N=175). This is notable since many previous studies with this population are small. Second it suggests that retail scrip in the \$25 to \$30 range may be effective in increasing weeks of attendance and consecutive weeks of attendance. Establishing the minimum effective magnitude of reinforcers is directly related

to the feasibility and effectiveness of the intervention. Finally it provides information about two factors, income and number of dependents, which might impact individual responsiveness to incentives. Income of the participant, chosen to represent a factor influencing the perceived value of an incentive, was not associated with response to incentives in the current study. The number of dependents, selected as a potential indicator of the difficulty of achieving the target behavior, was associated with response to incentives. More information is needed, on the optimum magnitude of incentives, as well as, predictors of positive response to incentives in pregnant substance users. The savings, both humanitarian and monetary, make this an important area for future research.

References

- Carroll KM, Chang G, Behr H, Clinton B, et al. Improving treatment outcome in pregnant, methadone-maintained women: Results from a randomized clinical trial. *The American Journal on Addictions* 1995;4:56–59.
- Elk R, Mangus L, Rhoades H, Andres R, Grabowski J. Cessation of cocaine use during pregnancy: Effects of contingency management interventions on maintaining abstinence and complying with prenatal care. *Addictive Behaviors* 1998;23(1):57–64. [PubMed: 9468743]
- Elk R, Schmitz J, Spiga R, Rhoades H, Andres R, Grabowski J. Behavioral treatment of cocaine-dependent pregnant women and TB-exposed patients. *Addictive Behaviors* 1995;20(4):533–542. [PubMed: 7484335]
- Haller D, Knisely J, Elswick R, Dawaon K, Schnoll S. Perinatal substance abusers: factors influencing retention. *Journal of Substance Abuse Treatment* 1997;14:513–519. [PubMed: 9437622]
- Higgins ST, Petry NM. Contingency management: Incentives for sobriety. *Alcohol Research & Health* 1999;23:122–127. [PubMed: 10890806]
- Higgins, Stephen T.; Silverman, Kenneth. Motivating behavior change among illicit-drug abusers: Research on contingency management interventions. Higgins, ST.; Silverman, K., editors; Washington, DC, US: American Psychological Association; 1999.
- Howard, J.; Beckwith, L. Issues in subject recruitment and retention with pregnant and parenting substance-abusing women. In: Rahdert, E., editor. *Treatment for drug exposed women and their children: Advances in research methodology*. 1996. p. 52-67. NIDA Research Monograph No. 165, DHHS Publication No. 96-3632
- Jones HE, Haug NA, Stitzer ML, Svikis DS. Improving treatment outcomes for pregnant drug-dependent women using low-magnitude voucher incentives. *Addictive Behaviors* 2000;25:263–267. [PubMed: 10795950]
- Jones H, Svikis DS, Tran G. Patient compliance and maternal/infant outcomes in pregnant drug-using women. *Substance Use & Misuse* 2002;37:1411–1422. [PubMed: 12371578]
- Kellogg SH, Burns M, Coleman P, Stitzer M, Wale JB, Kreek MJ. Something of value: The introduction of contingency management interventions into the New York City Health and Hospital Addiction Treatment Service. *Journal of Substance Abuse Treatment* 2005;28:57–65. [PubMed: 15723733]
- Killeen T, Carter R, Copersino M, Petry N, Stitzer M. Effectiveness of Motivational Incentives in Stimulant Abusing Outpatients with Different Treatment Histories. *American Journal of Drug and Alcohol Abuse* 2007;33:129–137. [PubMed: 17366253]
- McLellan AT, Kushner H, Metzger D, Peters R, Smith I, Grissom G, Pettinati H, Argerious M. The fifth edition of the Addiction Severity Index. *Journal of Substance Abuse Treatment* 1992;9:199–213. [PubMed: 1334156]
- McMurtrie C, Rosenberg KD, Kerker BD, Kan J, Graham EH. A unique drug treatment program for pregnant and postpartum substance-using women in New York City: Results of a pilot project, 1990-1995. *American Journal of Drug and Alcohol Abuse* 1999;25:701–713. [PubMed: 10548443]
- Petry NM, Martin B, Cooney JL, Kranzler HR. Give them prizes and they will come: Contingency management for treatment of alcohol dependence. *Journal of Consulting and Clinical Psychology* 2000;68:250–257. [PubMed: 10780125]
- Petry NM, Peirce J, Stitzer ML, Blaine J, Roll JM, Cohen A, et al. Effect of prize-based incentives on outcomes in stimulant abusers in outpatient psychosocial treatment programs: a National Drug Abuse

- Treatment Clinical Trials Network Study. *Arch Gen Psychiatry* 2005;62:1148–56. [PubMed: 16203960]
- SAMHSA (Substance Abuse Mental Health Services Administration), Office of Applied Studies. Substance Use During Pregnancy; 2002 and 2003 Update. Jun 22005 [October 7, 2008]. <http://www.oas.samhsa.gov/2k5/pregnancy/pregnancy.htm>
- Silverman, K.; Chutuape, MA.; Bigelow, GE.; Stitzer, ML. Reinforcement of cocaine abstinence in treatment-resistant patients: Effects of reinforcer magnitude. In: Harris, LS., editor. *Problems of Drug Dependence 1996, NIDA 74; Proceedings of the 58th Annual Scientific Meeting*; 1997.
- Stitzer ML, Bigelow GE. Contingent payment for carbon monoxide reduction: Effects of pay amount. *Behavior Therapy* 1983;14:647–656.
- Stitzer ML, Bigelow GE. Contingent reinforcement for carbon monoxide reduction: Within-subjects effects of pay amounts. *Journal of Applied Behavior Analysis* 1984;17:477–483. [PubMed: 6526768]
- Stitzer ML, Petry N, Peirce J, Kirby K, Killeen T, Roll J, Hamilton J, Stabile PQ, Sterling R, Brown C, Kolodner K, Li R. Effectiveness of abstinence-based incentives: Interaction with intake stimulant test results. *Journal of Consulting and Clinical Psychology* 2007;75:805–811. [PubMed: 17907862]
- Svikis DS, Golden AS, Huggins GR, Pickens RW, et al. Cost-effectiveness of treatment for drug-abusing pregnant women. *Drug and Alcohol Dependence* 1997a;45:105–113. [PubMed: 9179512]
- Svikis DS, Lee JH, Haug NA, Stitzer ML. Attendance incentives for outpatient treatment: effects in methadone- and nonmethadone-maintained pregnant drug dependent women. *Drug Alcohol Depend* 1997b Oct 25;48(1):33–41. [PubMed: 9330919]
- Terplan M, Lui S. Psychosocial interventions for pregnant women in outpatient illicit drug treatment programs compared to other interventions. *Cochrane Database of Systematic Reviews* 2007. 2007; (4)Art. No.: CD006037
- Winhusen T, Kropp F, Babcock D, Hague D, Erickson SJ, Renz C, Rau L, Lewis D, Leimberger J, Somoza E. Motivational enhancement therapy to improve treatment utilization and outcome in pregnant substance users. *Journal of Substance Abuse Treatment* 2008;35:161–173. [PubMed: 18083322]
- Wolfe EL, Guydish JR, Santos A, Delucchi KL, Gleghorn A. Drug treatment utilization before, during and after pregnancy. *Journal of Substance Use* 2007;12:27–38.
- Wolfe EL, Davis T, Guydish J, Delucchi KL. Mortality Risk Associated with Perinatal Drug and Alcohol Use in California. *Journal of Perinatology* 2005;(25):93–100.

Figure 1.