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Resets Do Not Appear to Increase the Rate of Adverse Events or Prolong Relapse in Voucher-Based Reinforcement Therapy

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Abstract

Voucher-based reinforcement therapy (VBRT) is an efficacious contingency management intervention for substance use disorders that provides escalating voucher values to reinforce continuous abstinence and typically resets escalated values to the initial low level upon detection of drug use. The objective of this study involving 130 methadone-maintained outpatients receiving VBRT was to investigate whether resets 1) increase risk for adverse events (AEs) and 2) delay return to abstinence in relation to magnitude of voucher reset. Weeks following resets were examined for increased likelihood of AEs using a Poisson regression. A Cox proportional hazards model was used to determine if higher resets increased the number of days until a negative urine specimen. Results showed that resets did not increase the likelihood of AEs nor were higher resets related to an increased delay to abstinence. Research involving larger samples is needed to produce sufficient data directly addressing safety concerns of various treatment stakeholders.

Keywords

Contingency Management; Cocaine Abuse Treatment; Adverse Event; Side-Effect; Voucher-Based Reinforcement Therapy

1. Introduction

Voucher-based reinforcement therapy (VBRT) is well-established as an efficacious contingency management (CM) intervention for drug abuse (Higgins, Alessi, & Dantona, 2002; Higgins, Heil, & Lussier, 2004; Lussier, Heil, Mongeon, Badger, & Higgins, 2006). VBRT provides vouchers exchangeable for a wide variety of goods and services after each verified drug-free urine specimen is provided and withholds this reinforcement when drug use is detected (Higgins et al., 1991; 1994). Typically, an escalating schedule of reinforcement is also employed, where voucher values begin low (e.g., \$2.50) and then increase with each consecutive drug-free specimen (e.g., by adding \$1.25). These escalating reinforcement schedules usually include a “reset” whereby provision of a drug-positive specimen or failure to submit a specimen on the scheduled day resets the subsequent earned voucher to the initial voucher value (e.g., \$2.50).

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Reset contingencies within VBRT reinforcement schedules are designed to reduce the probability of relapse to drug use by introducing a response-cost. Because voucher values increase as participants submit consecutive drug-free urine specimens, the potential loss of reinforcement is greater for individuals who have maintained abstinence for longer periods of time. Research shows that the use of an escalating schedule with reset contingencies promotes longer periods of abstinence from smoking (Roll & Higgins, 2000) and from methamphetamine use (Roll & Shoptaw, 2006) compared to an escalating voucher schedule with no resets.

Reinforcement schedules with resets have been widely examined and used without perceived negative effects both in drug abuse treatment research settings and in mental health, workplace, and educational settings (Silverman et al., 2002; Sprute, Williams, & McLaughlin, 1990; Winkler, 1970). Schroeder, Schmittner, Epstein, and Preston (2005) specifically examined the prevalence of adverse events (AEs) during VBRT for drug abstinence and found no increase in overall risk for AEs in treatment conditions that employed the use of resets compared to a baseline control condition. Petry and colleagues (2008), using a combined multicenter dataset wherein 1,687 individuals received either standardized care or standardized care plus either contingency management or motivational enhancement, found no differences in the incidence rate of SAEs between experimental and control conditions; in addition, no SAEs were determined by the safety monitoring board to be study related. While these data curtail safety concerns, they do not eliminate the possibility that resets increase the probability of AEs in VBRT to the same extent that other factors (e.g., drug use) increase them in control groups.

There also are good empirical and theoretical reasons to be concerned about potential negative side-effects related to resets. A reset contingency is a response-cost (RC) procedure (Catania, 1998; Miller, 1997; Sarafino, 2001), which is a form of punishment, and punishment procedures are known to have negative side-effects (Sidman, 1989). In a review of RC procedures within laboratory and clinical settings, Kazdin (1972) generally recognized RC as a safer alternative to more aversive punishment procedures, but warned that the risk of negative side-effects may be higher among some populations, such as soldiers diagnosed with behavioral disorders (Boren & Colman, 1970) and adolescents with antisocial or illegal behavior problems (i.e., Meichenbaum et al., 1968). He noted that further investigation was warranted. The preponderance of the behavioral literature since Kazdin's review has not demonstrated negative effects for RC contingencies, but RC has occasionally been found to be associated with negative emotional reactions such as mild anxiety and verbal or physical aggression (Schloss, 1983). In at least one study, the elimination of a response-cost procedure in an adolescent token economy appeared to reduce the frequency of negative incidence reports, use of time-out procedures, and violent episodes for clients (Hogan & Johnson, 1985). Because adult drug abusing populations include individuals with a higher than usual incidence of antisocial (Collins, Schlenger, & Jordan, 1988) and illegal (De La Rosa, Lambert & Gropper, 1990) behaviors, it is particularly important to examine the potential negative side-effects of RC in the context of substance abuse treatment.

In many VBRT studies designed to treat drug-dependence, voucher values as high as \$40 (Silverman et al., 2004) can be earned for each drug-negative urine specimen when abstinence has been achieved for prolonged durations. Therefore, a reset administered upon relapse following successful periods of abstinence might cause distress, especially when the reset occurs while the patient is receiving higher voucher values. Previous research has shown that greater distress has been associated with increases in medical and psychiatric illness (House, Wells, Landerman, McMichael, & Kaplan 1979), physical aggressive responses (Verona & Curtin, 2006), traffic accidents (Lagarde et al., 2004), and relapse to

substance use (Sinja, 2001). Given these considerations and data suggesting that community-based counselors are concerned about potential negative side-effects of incentive programs (Kirby et al., 2006), some may question whether the resets during an escalating voucher reinforcement schedule could increase distress sufficiently to contribute to AEs. Similarly, some may also question whether this distress could contribute to longer lapses of drug use following resets of higher voucher magnitudes. Although the aforementioned research showing that resets reduce relapse and that AEs occur during VBRT at rates similar to baseline may reduce concerns for scientists and VBRT advocates, a more direct examination of this relationship may better dispel concerns for other stakeholders, such as clinicians, insurers, institutional review boards (IRBs), and policy-makers. To the best of our knowledge no study has directly examined the relationship between voucher resets and AEs during VBRT.

Since a more direct examination of potential risks may better address stakeholders' concerns regarding side-effects we explored: a) whether voucher resets increase the likelihood of a subsequent AE; and b) whether the voucher value at the time of a reset is associated with the duration of relapse.

2. Methods

2.1 Participants

Participants were 130 methadone-maintained cocaine-dependent outpatients from a study comparing outcomes associated with a 12 week (standard group) versus 36 week (extended group) VBRT treatment (Kirby et al., 2009). To be considered eligible for the study, candidates had to be receiving a stable dose of 40 milligrams or more of methadone at time of intake, meet DSM-IV criteria for cocaine dependence or abuse as determined by the Psychoactive Substance Use Disorder section of the Structured Clinical Interview for DSM-IV-TR (American Psychiatric Association, 2000), and have provided evidence of recent cocaine use (as determined by a urine specimen testing positive for cocaine metabolites in the past 30 days). Participants who had a prior history of gambling problems or a spouse or significant other enrolled in the study protocol were excluded. This study was approved by both the Treatment Research Institute IRB and the Philadelphia Department of Public Health IRB.

2.2 Procedures

The schedule of reinforcement used in the study was originally described by Higgins et al. (1994) and was the same for both the standard and extended groups. The initial voucher value of \$2.50 was delivered when the first cocaine-negative specimen was submitted and the voucher value escalated by \$1.25 with each consecutive cocaine-negative specimen provided, up to a maximum value of \$40.00. In addition to escalating vouchers, bonus vouchers worth \$10.00 were provided upon delivery of three consecutive cocaine-negative specimens. If a cocaine-positive specimen was submitted or the participant failed to show up on a scheduled urine day, the participant did not earn a voucher for that day, and the value of the next earned voucher was reset to the initial voucher amount of \$2.50. In accordance with usual VBRT procedures, after five consecutive cocaine-negative specimens were provided following a reset, voucher values were restored to the highest amount earned prior to the reset. Participants provided urine specimens three times weekly during VBRT phases of the study and twice weekly during a 3-month aftercare period (where they received a \$2.00 lottery ticket - with no escalation or resets - for each cocaine negative specimen provided). Urine specimens were temperature and adulterant tested to ensure veracity, then immediately screened for the presence of the cocaine metabolite benzoylecgonine via One Step® test strips, which identify specimens with benzoylecgonine levels below 300 ng/ml as

cocaine-negative. Urinalysis results were entered into a customized web-based computer program that recorded the result, calculated and recorded the value of each voucher earned (including resets), and generated the voucher. For a complete description of the parent study procedures, see Kirby et al. (2009).

In accordance with Federal Wide Assurance requirements, research staff was trained in identification and reporting of AEs and severe adverse events (SAEs) during the parent study. Consistent with Health and Human Services (HHS) regulations (at 45 CFR part 46), AEs were defined as any unwanted physical, psychological, or behavioral change experienced by a participant during the study which may or may not have a causal relationship with the study protocol. SAEs were defined as any AE that resulted in death, was life threatening, required inpatient hospitalization or prolonged existing hospitalization, or resulted in persistent or significant disability. In cases where evidence of an AE or SAE was observed or reported by a participant, research staff probed for information including the date, nature, and severity of the event as well as a brief description. AE and SAE reports were submitted for review by the study's IRBs. AEs and SAEs were tracked and entered into a database using Microsoft Access. Because SAEs occurred infrequently, they are combined with and reported as AEs for the purposes of this study.

Resets were defined as any decrease in possible earned voucher values from \$3.75 or higher to the initial possible value of \$2.50. By schedule design, a reset could only occur once the value of a voucher was increased above \$2.50 following the submission of two or more consecutive cocaine-negative urine specimens.

2.3 Adverse Events of Focus (AEFs)

Our conceptual model for considering the relationship between resets and AEs is that resets may increase distress, which in turn may increase medical and psychiatric illnesses, accidents, physical aggression, and relapse. For analysis, AEs that could be logically related to distress produced by voucher resets were isolated. Eligible categories of AEs are referred to as AEs of focus (AEFs). They included medical illness, psychiatric illness (including suicidal or homicidal ideation), inpatient drug treatment or drug overdose, accidents, and physical altercations resulting in violence. Sixteen AEs did not fit these criteria (e.g., fires that were not caused by the participant or assaults by unknown assailants). For the purposes of this study, reset magnitude and date of occurrence were entered into a database. The AEFs that occurred during VBRT and up to 2 weeks after VBRT were also entered into the database.

2.4 Statistical Analysis

To check for the presence of confounding factors, we used a Pearson Chi Square test or a T-test of means where appropriate, examining several demographic characteristics between those participants who reported any category of AE and those who reported AEFs. In order to determine if participants who experienced AEs were systematically different from those who did not, comparisons were also made between each of the aforementioned groups and those participants who reported no AEs. Additionally, similar comparisons were made for those who experienced a reset and those participants who did not.

To address the first research question, we examined the relationship between experiencing a reset and experiencing an AEF. A Poisson regression analysis was used to compare the rates of AEs reported in a 2-week window following a reset (i.e., reset weeks) to the rates of AEs reported in other weeks (i.e., non-reset weeks). The 2-week window was selected because: 1) it seemed large enough to catch most potentially related events while still reducing unrelated variance due to too many intervening events and 2) an examination of the

distribution delays between resets and the next AE produced a distribution with a gap in AEs occurring between 11 and 20 days, producing a natural cut-off. However, we also examined windows of 1, 3, and 4 weeks and found no difference in the direction or significance of the results. Since vouchers could only be earned or reset during the intervention period, the 32 AEFs that occurred after 2 weeks following the VBRT period were excluded from our analysis.

To address the second research question, we examined the relationship between reset magnitude and delay of abstinence following a reset. A Cox proportional hazards model was used to evaluate the effect of reset magnitude on the number of days until the next negative urine specimen was obtained. The model included terms for reset magnitude, study condition, and their interaction. The sample for the survival analysis included only those cases in which a reset occurred. A survival analysis approach was chosen because the data are censored as not all individuals who were reset provided a negative urine specimen following the reset.

3. Results

3.1 Participant Characteristics

Table 1 shows the participant characteristics. No significant differences in these characteristics were found between groups of participants who reported any category of AE and those who reported AEFs, or between each of the aforementioned groups and those participants who reported no AEs. Further, there were no significant differences between participants experiencing at least one reset and those who did not.

3.2 Adverse Events of Focus

There were a total of 76 AEFs reported during the parent study, reported by 34% ($N = 44$) of the participants. Forty-four of those AEFs occurred during our window of observation, distributed across 25 individuals. Among all participants reporting an AEF, 29 reported only 1 AEF (66%), 6 reported 2 AEFs (13.5%), 4 reported 3 AEFs (9%), 2 reported 4 AEFs (4.5%), and 3 reported 5 AEFs (7%). Forty (53%) of the AEFs reported were categorized as medical illness, followed by 13 (17%) accidents, 8 (10.5%) psychiatric, 8 (10.5%) drug-related, and 7 (9%) physical altercations. There were no significant differences between the standard and extended VBRT conditions in the number of AEs reported ($\chi^2 = 2.22$, $df = 1$, $p = 0.14$).

3.3 Resets

A total of 146 resets were reported across 60 (46%) participants; 54% of all participants never experienced a reset. A participant could experience no resets only by: a) never submitting two or more consecutive cocaine-negative specimens (so the voucher value never escalated), or 2) submitting only cocaine-negative specimens throughout the voucher phase (so that a reset was never warranted). Among those who were reset, the number of resets per participant ranged from 1–9. Most participants who were reset had more than one reset; 15 (25%) were reset once, 26 (43.3%) had two resets, 8 (13.3%) had 3 resets, 5 (8.3%) had 4 resets, 4 (6.7%) had 5 resets, one person (1.7%) had 6 resets, and one person (1.7%) had 9 resets. Twenty seven (45%) participants who experienced a reset were in the standard voucher condition, while 33 (55%) were in the extended condition. There were no significant differences between the standard and extended groups in the number of resets ($\chi^2 = 0.32$, $df = 1$, $p = 0.57$).

3.4 AEFs Following Resets

Although there were 146 resets and 44 AEFs within our window of observation, there were only (1) 13 *individuals* who experienced both a reset and an AEF and (2) 18 *occasions* where one of those 13 individuals experienced both a reset and an AEF. Of these occasions, 2 out of 18 AEFs preceded their respective reset and 16 followed the reset. Only 4 (9%) of these 16 resets were followed by an AEF within 2 weeks. The 4 AEFs occurring within this 2-week window included two ER visits: one was for sinusitis seven days following a reset from \$40.00 and the other was for back pain seven days following a reset from a value of \$3.75. The other two AEFs that occurred within 2 weeks of a reset involved a psychiatric hospitalization for a diagnosis of paranoid schizophrenia occurring three days after a reset from \$5.00 and a domestic altercation 11 days following a reset from \$13.75. The Poisson regression analysis comparing the likelihood of experiencing an AEF in a reset week (i.e., during the 2 week period following a reset) and a non-reset week indicated no significant differences in AEF rates for the two time frames ($\chi^2 = 1.13$, $df = 1$, $p = 0.29$). Specifically, the AEF rates were .027 for reset weeks and .015 for non-reset weeks.

3.5 Delay to Abstinence Following Reset

Delay to abstinence could not be calculated for 10 events as the participant was discharged from the treatment center or completed the study before providing a cocaine-negative specimen following a reset. For the remaining reset events, the number of days until the delivery of the next cocaine-negative specimen ranged from 1 to 177 ($N = 136$; $M = 17.29$; $SD = 29.3$). The majority of resets were followed by a cocaine-negative specimen within 1 week ($N = 82$; 60.3%). The magnitude of reset values ranged from \$3.75 – \$40.00 ($M = \$13.12$; $SD = \$12.80$). Results from the Cox proportional hazards model using all reset events indicated that reset magnitude was not a significant predictor of delay to abstinence ($\chi^2 = 0.98$, $df = 1$, $p = 0.32$).

4. Discussion

This study did not support concerns that contingent resets, presented as part of a standard VBRT intervention, pose potential negative side effects for participants, either by increasing the risk for experiencing an AE or by increasing the delay to submitting a cocaine-negative urine specimen following the reset. Given previous research on response cost in behavior therapy in general and in addictions treatment in particular, it is unlikely that behaviorally-trained clinicians and researchers familiar with response-cost procedures would find this surprising. However, until recently, systematic reporting of AE data was not common in behavioral trials for substance abuse. The aforementioned studies that compared rates of AEs between non treatment and VBRT treatment conditions do so within the context of larger RCTs, which may obscure a more specific relationship between resets and AEs. For example, higher rates of drug use in non treatment groups may contribute to higher rates of AEs for these groups in relation to VBRT groups. With this considered, findings of no significant differences in rates of AEs in VBRT treatment groups would not eliminate the possibility of a reset effect on AEs rates.

Closer examination of the events where AEFs followed the reset within 2 weeks provides some face validity to the statistical findings. The AEF for sinusitis, although followed by a large magnitude reset, was reported previously by the same participant and described by that participant as a recurring condition that existed prior to entry to the study. The ER visit for back pain occurred 1 week following a relatively small magnitude reset. The domestic violence AEF did not occur until 11 days following the reset and according to the participant was due to ongoing conflict and not directly related to voucher earnings. In the case of the AEF for psychiatric hospitalization, the participant was observed exhibiting dissociative

behavior earlier in the day and prior to being reset. While this suggests that the dissociative behavior was not initiated by the reset, one could make the case that these symptoms resulted from the anticipation of being reset. Although these qualitative accounts do not discount the possibility that any of these AEFs were related to distress induced by voucher resets, none exhibit clear relatedness. Indeed, the study's IRBs ultimately determined these four aforementioned AEFs to be unrelated to the study protocol. Given these overall findings, we feel fairly confident that although resets may be perceived as potentially distressing for an individual, perceived distress due to voucher reset alone is not likely to increase risk for an AEF.

The finding that resets did not appear to increase the delay to abstinence indicates that any perceived individual distress from higher magnitudes of resets does not seem to increase drug use following a reset. It is important to remember that in this study, after a reset occurred, voucher values were restored to the highest prior amount earned following five consecutive cocaine-negative urine specimens. This was designed to encourage a participant who was at a large voucher value prior to the reset to return to abstinence quickly following use and to reduce potential distress caused by a reset. Note also that the larger the voucher reset, the greater the incentive to resume abstinence. It seems possible that this procedural caveat may have mitigated the effect of larger-magnitude resets and a delay to return to abstinence. To the best of our knowledge this is an unanswered empirical question worthy of future research.

This is the first study that has directly examined the relationship between AEs and resets during substance abuse treatment. While one study cannot provide a definitive answer to the broad and important question of the safety of resets, this study begins directly addressing concerns related to two potential negative side-effects of resets; increases in AEs and the potential to delay a return to abstinence. Failure to find evidence for either relationship may better dispel concerns for other stakeholders in the field of substance abuse treatment (e.g., addictions treatment providers, patients, insurers, IRBs, policy makers, and families). In this way, this study provides a unique contribution to the literature regarding the safety of VBRT; an efficacious treatment for substance use disorders. It is our hope that it may stimulate other researchers to examine the issue of negative side-effects more directly.

It also is important to note that the relationship between resets and AEs may be confounded to the extent that drug use, the very behavior that would cause an individual to be reset, is the same behavior that could logically cause an AEF. For example, drug use itself has been associated with medical and mental health problems (Adrian & Barry, 2003) as well as elevated rates of traffic accidents (Movig, et al., 2004). Thus, even if the association between AEFs and resets had been found to be significant, potential inter-correlation between the AEF, the preceding reset itself, and the drug use that caused the reset would prove difficult to disentangle. Given our findings, however, this may provide further confidence that resets alone do not seem to increase the risk for AEFs.

The study did have several limitations that must be considered when viewing the results. First, AEFs relevant to our analysis were relatively infrequent in our population. We observed only 44 AEFs during the active intervention period, and only 13 of the AEFs occurred in individuals who also experienced a reset during that period. A larger number of events would have allowed us to use more sophisticated analyses to examine the research hypotheses. For example, it seems reasonable to speculate that the larger the voucher reset, the more distress it might cause and that higher levels of distress may be more likely to create conditions leading to AEs. It was not possible to examine the relationship between AEFs and reset magnitude in this study because of the limited number of AEFs that occurred. As such, while the results of this study fail to support a relationship between resets

and AEs, they do not rule them out. Additional research utilizing larger datasets is very much needed.

Second, methods of AE identification and reporting within the present study, while keeping with federal-wide standards, were reliant upon voluntary participant self-report, except in instances where research staff could visually determine the occurrence of an AE. As such, various factors such as participant's rapport with staff, socio-cultural barriers, and participant's willingness to spend time to allow AEFs to be properly documented, could lead to instances of underreporting of AEFs.

The limits of our findings suggest that further assurances may be needed to confirm that VBRT with resets is an effective and safe method for initiating drug abstinence within substance abusing populations. Conducting a similar analysis within the context of a large study examining VBRT with and without resets could provide additional valuable information in this regard. Alternately, an investigation within a multi-site collaborative study employing regimented AE reporting procedures would provide a sufficient sample for an adequately powered Incidence Density Ratio analysis.

As research has shown, voucher resets play an integral role in maintaining abstinence within VBRT. While VBRT provides one, if not the most efficacious treatment for initiating cocaine abstinence, we are also obligated to demonstrate that our interventions are not associated with any potential negative side-effects that might promote risk to participants. Unless the use of voucher resets in VBRT is shown to be safe as well as efficacious, legitimate concerns of treatment stakeholders could pose an obstacle to further acceptance and administration of these types of interventions. This investigation lends support to the claim that the resets administered during VBRT do not present a safety hazard and may help to alleviate ethical concerns of stakeholders regarding beneficial and effective VBRT treatments.

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References

- Adrian M, Barry SJ. Physical and mental health problems associated with the use of alcohol and drugs. *Substance Use & Misuse*. 2003; 38:1575–1614. [PubMed: 14582571]
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders, text revision (DSM-IV-TR). 4th Ed.. Arlington, VA: American Psychiatric Publishing, Inc; 2000.
- Boren JJ, Colman AD. Some experiments on reinforcement principles within a psychiatric ward for delinquent soldiers. *Journal of Applied Behavior Analysis*. 1970; 3:29–37. [PubMed: 16795235]
- Catania, AC. *Learning*. 4th Ed.. Upper Saddle River, NJ: Prentice Hall; 1998.
- Collins JJ, Schlenger WE, Jordan BK. Antisocial personality and substance abuse disorders. *Bulletin of the American Academy of Psychiatry & the Law*. 1988; 16(2):187–198. [PubMed: 3395703]
- De La Rosa, M.; Lambert, EY.; Gropper, B., editors. National Institute on Drug Abuse Research Monograph. Vol. 103. 1990. Drugs and violence: Causes, correlates, and consequences.
- Highsmith ST, Alessi SM, Dantona RL. Voucher-based incentives: A substance abuse treatment innovation. *Addictive Behaviors*. 2002; 27:887–910. [PubMed: 12369474]
- Higgins ST, Budney AJ, Bickel WK, Foerg FE, Donham R, Badger GJ. Incentives improve outcome in outpatient behavioral treatment of cocaine dependence. *Archives of General Psychiatry*. 1994; 51:568–576. [PubMed: 8031230]

- Higgins ST, Delaney DD, Budney AJ, Bickel WK, Hughes JR, Foerg F, Fenwick JW. A behavioral approach to achieving initial cocaine abstinence. *American Journal of Psychiatry*. 1991; 148:1218–1224. [PubMed: 1883001]
- Higgins ST, Heil SH, Lussier JP. Clinical implications of reinforcement as a determinant of substance use disorders. *Annual Review of Psychology*. 2004; 55:431–461.
- Hogan WA, Johnson DP. Elimination of response cost in a token economy program and improvement in behavior of emotionally disturbed youth. *Behavior Therapy*. 1985; 16:87–98.
- House JS, Wells JA, Landerman LR, McMichael AJ, Kaplan BH. Occupational stress and health among factory workers. *Journal of Health & Social Behavior*. 1979; 20:139–160. [PubMed: 479526]
- Kazdin AE. Response cost: The removal of conditioned reinforcers for therapeutic change. *Behavior Therapy*. 1979; 3:553–546.
- Kirby, KC.; Carpenedo, CM. A behavioral model for maintenance of drug abstinence; Poster session presented at the Health Maintenance Consortium Conference at NIDA; Rockville, MD. 2009 March. Poster retrieved from http://hmcrc.srph.tamhsc.edu/Meetings/10th%20Meeting/Final%20Products/2009_HMC_Meeting_PowerPoints/Kirby_HMC_Presentation%203%202%2009.pdf
- Lagarde E, Chastang J, Gueguen A, Coeuret-Pellicer M, Chiron M, Lafont S. Emotional stress and traffic accidents: The impact of separation and divorce. *Epidemiology*. 2004; 15:762–766. [PubMed: 15475727]
- Lussier JP, Heil SH, Mongeon J, Badger GJ, Higgins ST. A meta-analysis of voucher-based reinforcement therapy for substance use disorders. *Addiction*. 2006; 101:192–203. [PubMed: 16445548]
- Meichenbaum DH, Bowers K, Ross RR. Modification of classroom behavior of institutionalized female adolescent offenders. *Behaviour Research and Therapy*. 1968; 6:343–353. [PubMed: 5734552]
- Miller, K. *Principles of Everyday Behavior Analysis*. 3rd Ed.. Pacific Grove, CA: Brooks/Cole; 1997.
- Movig KL, Mathijssen MP, Nagel PH, van Egmond T, de Gier JJ, Leufkens HG, Egberts AC. Psychoactive substance use and the risk of motor vehicle accidents. *Accident Analysis and Prevention*. 2004; 36:631–636. [PubMed: 15094417]
- Petry NM, Roll JM, Rounsaville BJ, Ball SA, Stitzer M, Peirce JM, Blaine J, Kirby KC, McCarty D, Carroll KM. Serious adverse events in randomized psychosocial treatment studies: Safety or arbitrary edicts? *Journal of Consulting and Clinical Psychology*. 2008; 76(6):1076–1082. [PubMed: 19045975]
- Roll JM, Higgins ST. A within-subject comparison of three different schedules of reinforcement of drug abstinence using cigarette smoking as an exemplar. *Drug and Alcohol Dependence*. 2000; 58:103–109. [PubMed: 10669060]
- Roll JM, Shoptaw S. Contingency management: Schedule effects. *Psychiatry Research*. 2006; 144(1): 91–93. [PubMed: 16905197]
- Sarafino, EP. *Behavior modification: Principles of behavior change*. 2nd Ed.. Mayfield, CA: Mountain View; 2001.
- Schloss PJ. The prosocial response formation technique. *The Elementary School Journal*. 1983; 83(3): 220–229.
- Schroeder JR, Schmitter JP, Epstein DH, Preston KL. Adverse events among patients in a behavioral treatment trial for heroin and cocaine dependence: Effects of age, race, and gender. *Drug and Alcohol Dependence*. 2005; 80(1):45–51. [PubMed: 16157230]
- Sidman, M. *Coercion and its fallout*. Boston, MA, US: Authors Cooperative; 1989.
- Silverman K, Robles E, Mudric T, Bigelow G, Stitzer M. A randomized trial of long-term reinforcement of cocaine abstinence in methadone-maintained patients who inject drugs. *Journal of Consulting and Clinical Psychology*. 2004; 72(5):839–854. [PubMed: 15482042]
- Silverman K, Svikis D, Wong CJ, Hampton J, Stitzer ML, Bigelow GE. A reinforcement-based therapeutic workplace for the treatment of drug abuse: Three-year abstinence outcomes. *Experimental and Clinical Psychopharmacology*. 2002; 10:228–240. [PubMed: 12233983]

- Sinja R. How does stress increase risk of drug abuse and relapse? *Psychopharmacology*. 2001; 158(4): 343–359. [PubMed: 11797055]
- Sprute KA, Williams RL, McLaughlin TF. Effects of a group response cost contingency procedure on the rate of classroom interruptions with emotionally disturbed secondary students. *Child & Family Behavior Therapy*. 1990; 12(2):1–12.
- Verona E, Curtin JJ. Gender differences in the negative affective priming of aggressive behavior. *Emotion*. 2006; 6:115–124. [PubMed: 16637755]
- Winkler RC. Management of chronic psychiatric patients by a token reinforcement system. *Journal of Applied Behavior Analysis*. 1970; 3:47–55. [PubMed: 16795237]

Table 1

Variable	AE of Focus (n = 44)	No AE of focus (n = 87)	Reset (N = 60)	No Reset (n = 71)
Female % (n)	31.8 (14)	36.8 (32)	33.3 (20)	36.6 (26)
Age (mean)	41.6 (SD = 10.3)	44.7 (SD = 10.8)	43.6 (SD =10.5)	41.6 (SD = 10.6)
Education				
<HS	31.8 (14)	36.0 (31)	39.0 (23)	31.0 (22)
HS/GED	40.9 (18)	38.4 (33)	35.6 (21)	42.3 (30)
>HS	27.3 (12)	25.6 (22)	25.4 (15)	26.8 (19)
Health Status % (n)				
Good-Excellent	59.1 (26)	66.7 (58)	71.7 (43)	57.7 (41)
Fair-Poor	40.9 (18)	33.3 (29)	28.3 (17)	42.3 (30)
Marital Status % (n)				
Married/Living with Partner	20.5 (9)	18.6 (16)	15.0 (9)	22.9 (16)
Divorced/Widowed/Separated	29.5 (13)	29.1 (25)	25.0 (15)	32.9 (23)
Never Married	50.0 (22)	52.3 (45)	60.0 (36)	44.3 (31)
Race % (n)				
White	33.3 (14)	35.7 (30)	39.7 (23)	30.9 (21)
Black	64.3 (27)	64.3 (54)	58.6 (34)	69.1 (47)
Other	2.4 (1)	0.0	1.7 (1)	0.0
Employed % (n)	13.6 (6)	12.8 (11)	15.0 (9)	11.4 (8)
Income				
<\$10,000	65.9 (29)	63.2 (55)	60.0 (36)	67.6 (48)
≥\$10,000	34.1 (15)	36.8 (32)	40.0 (24)	32.4 (23)