AIDS Behav (2015) 19:S156–S162
DOI 10.1007/s10461-014-0990-x

ORIGINAL PAPER

A Remotely-Delivered CBT and Contingency Management Therapy for Substance Using People with HIV

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Published online: 3 February 2015

Abstract Substance using HIV patients are at risk for non-adherence, and most prior interventions in this population have had only modest effects on adherence. Contingency management (CM) is a promising intervention. The Centralized Off-site Adherence Enhancement (CARE) program involved 12 telephone-delivered substance and adherence-targeted cognitive behavior therapy sessions coupled with CM for adherence to antiretroviral therapy (ART) and counseling participation. CM involved 6 weeks of escalating reinforcement for taking prescribed doses followed by 6 weeks of tapering variable rate reinforcement, and separate reinforcement for counseling ($806 possible). Participants' adherence was measured by devices which wirelessly provided real-time notification of device-opening. HIV infected patients on ART ($N = 10$) with recent stimulant or alcohol use completed 10.2 of 12 possible telephone sessions, spent 42.8 min/call, and rated the counseling 6.2 on a 1–7 scale. Medication adherence improved from 81 to 93 % ($p = 0.04$). CARE appears to be acceptable and engaging.

Keywords AIDS · HIV · Adherence · Compliance · Contingency management

Resumen Los pacientes con VIH que utilizan substancias o alcohol están en riesgo de no adherirse al tratamiento, y la mayoría de las intervenciones anteriores de este grupo han demostrado efectos modestos en la adherencia. El Manejo de Contingencias (CM) es una intervención prometedora. El programa central para incrementar la adherencia a tratamiento (CARE por sus siglas en Inglés) se compone de 12 sesiones de asesoramiento vía telefónica que incluyen Terapia de Comportamiento Cognitivo (CBT por sus siglas en Inglés) teniendo como objetivo la adherencia y uso de sustancias, asi como el CM para mejorar la adherencia al tratamiento antirretroviral (ART). El CM involucra 6 semanas de sesiones de reforzamiento gradual para tomar las dosis prescritas, seguido por 6 semanas de sesiones de reforzamiento variable, proveyendo un estímulo por participación en las sesiones (de hasta $806). La adherencia de los participantes se midió mediante dispositivos inalámbricos que proporcionaron la notificación en tiempo real de apertura de estos dispositivos. Los pacientes infectados con VIH que tomaban tratamiento antirretroviral ($N = 10$) y que habían usado recientemente algún estimulante o alcohol completaron 10.2 sesiones telefónicas de 12 posibles, duraron 42.8 minutos en cada llamada, y

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calificaron las sesiones de asesoramiento de 6.2 en una escala de 1–7. La adherencia al tratamiento mejoró de un 81 % a un 93 % ($p = 0.04$). El programa CARE parece ser un método aceptable y prometedor.

Introduction

The successful use of antiretroviral therapy (ART) has transformed HIV into a complex, chronic disease with improvements in patient quality of life and decreased mortality [1–4]. Despite substantial recent improvements in medication and need for less demanding adherence schedules, viral suppression is still contingent upon ART adherence, with suboptimal adherence associated with resistant infection, disease progression, and increased risk of HIV transmission [5, 6]. HIV-infected individuals with a history of substance abuse have worse HIV outcomes, in part mediated through decreased medication adherence [7]. Studies have found lower adherence among HIV-infected individuals who use injection and non-injection drugs [8–10]. Importantly, patients dependent on illicit drugs with continued substance use show reduced adherence and worse HIV outcomes [11–16]. Thus, interventions that address both ART adherence and substance use are needed to help improve clinical outcomes [17].

Perhaps the most promising intervention to date is contingency management (CM). CM has been shown to improve ART adherence and reduce viral load among illicit drug-using populations [18–20]. However, CM has not been shown to sustain such effects following discontinuation, and requires substantial resources to implement—direct costs of the contingencies, increased staff hours, and staff training [19].

We developed Centralized Off-site Adherence Enhancement (CARE), to address barriers to on-site CM and lack of sustained benefits. CARE provides remote automated delivery of reinforcement in real-time, using a theory-based variable-ratio, tapered reinforcement schedule, and includes remotely-delivered, telephone-based cognitive behavioral therapy (CBT). Remote and automated delivery reduces the delay between the target behavior and reinforcement, and reduces or eliminates the need for additional specially trained staff for implementation. A few studies have evaluated remote delivery of reinforcement, and have shown high acceptability and feasibility, and significant improvement in a range of health behaviors compared to control conditions [21–25].

However, prior CM studies have not demonstrated improvements following discontinuation of contingencies, suggesting that other approaches or additional interventions are needed. Using an alternative schedule of reinforcement, such as variable ratio reinforcement, which maintains higher levels of responding when reinforcement is discontinued [26], may increase the likelihood that patients will maintain medication adherence after the end of the study. Benefits from CBT targeting a range of disorders have been shown to remain or even increase after the end of treatment [27, 28]. CBT delivered via telephone has been shown to be effective for a range of disorders [29], and in some cases more effective than face-to-face treatment [30]. In addition to being convenient and efficient, telephone-based counseling has been effective in people with HIV. A 14-session telephone-based intervention was associated with significantly improved adherence and a trend towards a lower viral load [31], although other telephone-based interventions have not been effective [32]. The current study evaluated the feasibility, acceptability and initial efficacy of CARE in 10 people prescribed ART with recent substance use.

Methods

Participants

Participants were recruited from a local HIV clinic through brochures and discussion with clinical staff. Inclusion criteria for this pilot trial were (1) current treatment with ARV medications, (2) either (a) self-reported risky alcohol use defined as >14 drinks/week or >4 drinks/occasion for men 65 or younger; >7 drinks/week or >3 drinks/occasion for women, OR (b) ≥2 days of either cocaine or amphetamine use, in the past 60 days, (3) able to provide voluntary informed consent, and (4) able and willing to use a Wisepill device to store at least one antiretroviral medication. Exclusion criteria were (1) physiological dependence on alcohol, illicit opioids or sedatives as assessed by the history and symptom review, (2) dispensed medications in a monitored setting, (3) unable to speak English, and (4) unable to complete the study because of anticipated incarceration or move. Participants with physiological dependence on substances in which reducing or abstaining could lead to withdrawal symptoms (e.g., seizures, hallucinations, psychosis and suicidality) were excluded because this small pilot study was not equipped to treat these symptoms. Poor medication adherence was not an inclusion criterion because the study was primarily focused on acceptability and feasibility.

CARE

Materials

Each participant was provided with a rechargeable electronic pill dispenser (Wisepill Technologies, Sumerset, South Africa) that transmits a wireless message to a secure

server each time the device is opened. Participants were given a detailed introduction and orientation to the device, and instructed to use it to store at least 1 of their ART medications. The battery allowed continuous wireless function for 2–3 weeks before needing to be recharged.

Participants also received a study debit card to allow for electronically loaded reinforcements. The cards were similar to other credit based debit cards, did not identify research or clinic, and could be used at any establishment that accepted debit cards.

Contingency Management for Medication Adherence

Daily medication adherence was defined as receipt of an electronic record of all scheduled doses within a 6 h time window (±3 h of each target dose time). For example, if the dosing schedule was once-daily at 9:00 am, and the electronic record for the given day indicated the device was opened at 11:00 am, the record met criteria and indicated medication adherence. Upon transmission of the record, the reinforcement value was automatically calculated for each participant based on the dose schedule (once or twice daily), dose time, and their reinforcement schedule. An automated, positively-framed text message was then sent to the participant's phone including the amount earned for that day, thus providing reinforcement almost immediately.

The reinforcement schedule used escalating, continuous reinforcement for weeks 1–6 of treatment, followed by tapering, variable interval reinforcement for weeks 7–12. Reinforcement value started at $2.00/day and increased daily by $1.00 for each consecutive day of adherence to a maximum of $10. The value was reset to $2.00/day if all doses were not taken within the specified window. For weeks 1–6, participants received payment for every day of documented adherence ($384 possible). For weeks 6–12 ($150 possible), the scheduled value of each payment remained the same, however, the probability of reinforcement reduced progressively, from every other day (weeks 7–8), to every third day (weeks 9–10), to every fourth day (weeks 11–12). The total possible earnings for medication adherence were $544. Payments were loaded electronically onto the participant's study debit card twice weekly (Tuesday and Friday) and included all medication adherence reinforcements to that date.

Cognitive Behavioral Therapy

Therapy consisted of 12 CBT sessions for both substance use and medication adherence provided over 12 weeks. Sessions were delivered via telephone by two Masters and one Ph.D level therapists. Participants were assigned to the same therapist for all sessions. Participants generally received one session per week, but therapists accommodated up to two sessions per week if a prior session was missed so that sessions were provided within the 12 week period. Sessions were designed to be approximately 1–1.5 h for the first 2 sessions, and approximately 45–50 min for all subsequent sessions. Participants received reinforcement for session attendance of $30 for the first 2 sessions and $20 for all subsequent sessions ($260 possible). Reinforcement values were loaded onto the patient debit card after each session. In addition to reinforcement messages, the participant's counselor scheduled daily medication reminders, and weekly CBT related messages that were sent via text message based on participant preference for frequency and time (e.g., waking hours etc.).

The manual was an integration of the twelve weekly sessions of manual-based CBT for cocaine users [33] and alcohol users [34] with the addition of adherence counseling adapted from our prior published description [35]. Other sources include a CBT-based adherence training manual [36] and materials from a workshop on how to provide CBT for depression and adherence [37].

Assessments

Feasibility and acceptability measures included retention, number of telephone sessions attended and minutes of sessions, treatment satisfaction, and dollar amount of contingent reinforcement. Initial efficacy outcome measures included adherence, substance use, and self-reported coping skills. Participants completed assessments at screening, baseline (4 weeks prior to treatment initiation), treatment initiation, and at weeks 4, 8, and 12 (end of treatment). Participants were paid $50 for the screening and baseline assessment visits and $25 for each subsequent assessment.

Patient satisfaction consisted of 19 Likert-scaled items [1–7] rating overall satisfaction, and ratings of specific telephone-based aspects of the therapy. Medication adherence, based on the Wisepill data described above, was calculated as the percentage of days that the device was opened at least once. We chose this outcome because it is more consistent with other research that does not focus on dose time or multiple doses [14, 19, 38, 39]. Urine samples for toxicology analyses were performed using ToxCup Drug Screen Cup (Branan Medical Corporation, Irving, CA) that included morphine/opiates (>300 ng/ml cutoff), cocaine metabolite (benzoylecgonine >300 ng/ml cutoff), methamphetamine (>500 ng/ml cutoff), and tetrahydrocannabinol (>50 ng/ml cutoff). Urine screens were evaluated for any drug of abuse and for stimulants (cocaine or methamphetamine). No toxicology test was conducted for alcohol. Self-reported drug use and use of medical and psychiatric services were assessed using time line follow back methodology [40]. Coping skill effectiveness was

evaluated with the Effectiveness of Coping Behaviors Inventory (ECBI) [41].

Data Analysis

For measures of feasibility and acceptability, descriptive statistics were computed. For outcomes over time we conducted linear mixed model (LMM) analyses for the continuous outcome (days of medication adherence, self-reported substance use, and the ECBI score), and general estimating equations (GEE) for the categorical outcome of urine screens.

Results

Baseline Characteristics

Two potential participants who signed consent did not participate. One did not have alcohol or drug use in the past 60 days and one withdrew consent. Table 1 presents demographic characteristics of the sample. Of note, patients lived approximately 10 miles from the clinic but 90 % did not have their own transportation. Two participants took a twice-a-day ART regimens and eight were prescribed a once-daily dose.

Seven participants most recent viral load was less than 50 copies/ml, one was less than 400 copies/ml, and two had greater than 20,000 copies/ml. Mean CD4 was 451 (SD 218, range 128–795) cells/μl. Eight participants reported two or more days of cocaine or methamphetamine use in the 60 days prior to baseline. Four reported use of only cocaine, three only methamphetamine, and one both. Eight participants reported use of alcohol in the prior 60 days.

Table 1 Demographic and clinical characteristics of HIV infected patients in CARE

Characteristic	$N = 10$
Age, years, mean (SD)	45.5 (10.3)
Gender, % male, (*n*)	80 % (8)
Race	
White, % (*n*)	40 % (4)
Black, % (*n*)	60 % (6)
Ethnicity	
Hispanic, % (*n*)	20 % (2)
Non-hispanic, % (*n*)	80 % (8)
Income, median (range)	$847 ($60–$1147)
Miles from clinic, mean (SD)	9.5 (3.0)
Have own transportation, % (*n*)	10 % (1)

Feasibility and Acceptability

All ten participants completed the 12 week study. Participants completed a mean of 10.2 (SD 1.8, median 11) of 12 possible CBT telephone sessions, and averaged 42.8 min per call (SD 14.0), despite having no stipulation concerning the duration of calls. During the treatment period, no participants initiated substance abuse treatment, although one participant reported attending a self-help group on one occasion. Participants earned a mean total of $595.30 in contingent reinforcement (range $327–$806, $371.30 for medication adherence, and $224 for session attendance). Overall patient satisfaction of the treatment was high (mean 6.2, SD 0.8), as were items focused on the telephone counseling (mean 6.4, SD 0.6), and the text messages (mean 5.8, SD 1.3).

Outcomes

Figure 1 presents the weekly percent of days of ART medication adherence and values for each participant and the regression line and confidence interval for the whole group. As can be seen in the figure, medication adherence improved from 80.7 % at the start of treatment to 93.2 % at the end of treatment ($p = 0.04$).

Urine screens for all drugs did not significantly change over the course of treatment ($p = 0.10$). However, for stimulants there was a significant decrease over time from baseline through 12 weeks (50–20 %, $p = 0.04$).

From baseline to the week 12 end of treatment assessment, days of self-reported drug and alcohol use in the previous 30 days showed significant reduction in mean days of alcohol use (8.4–4.4, $p = 0.04$), and marginally significant reductions in mean days of marijuana use (8.1–4.2, $p = 0.08$), but did not differ for cocaine or amphetamine use.

Participants reported significantly increased use of coping skills ($p = 0.01$) on the ECBI. Mean scores improved from 0.72 (SD 0.42) to 1.18 (SD 0.43).

Discussion

Despite the small sample size, CARE appears to be engaging and feasible, and all participants completed treatment. Importantly, patients used the wireless medication device consistently, not only during treatment when they were receiving compensation, but prior to treatment, providing a 4-week period of baseline adherence. That patients were willing and able to use the device during this period without direct compensation is encouraging, particularly for comparison to a non-compensated comparison condition in a future clinical trial. Patients were also

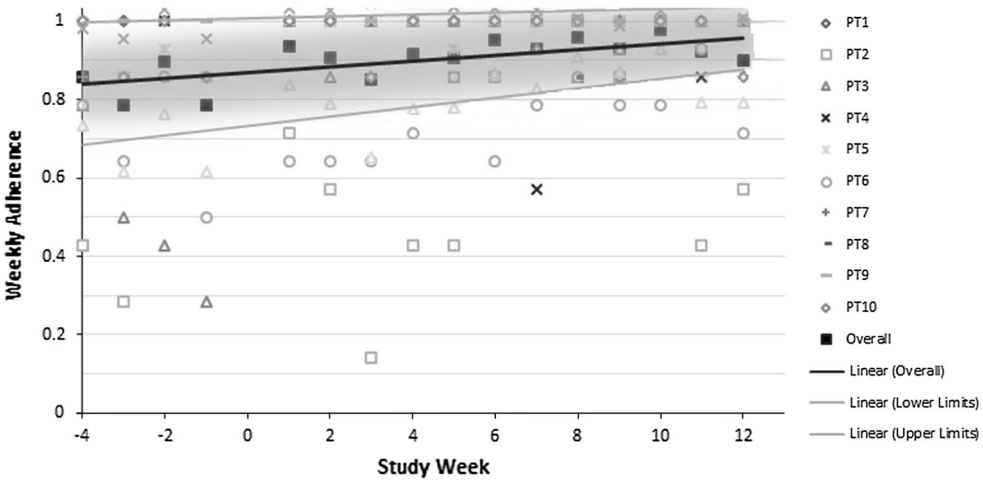

Fig. 1 Individual patient and overall ART medication adherence by week

engaged in the CM for adherence, earning approximately 68 % of the total possible earnings. Since most patients took their medication the majority of days, all patients had repeated contact with the reinforcement, an important component of behavioral shaping [42]. In addition, the telephone counseling worked well. Patients completed almost all available sessions and rated the treatment highly. Patients appeared to appreciate the flexibility of the telephone as compared to an in-person session. Because most patients did not have their own vehicles but tended to use mass transit or friends for clinic and study visits, having in person sessions would have placed a greater burden on patients' time, money, and commitment. Despite no requirements to remain on the call for a given amount of time, mean session length was over 40 min per call. The telephone sessions were also convenient for therapists who were able to coordinate schedules and accommodate session times outside regular clinic hours.

Although preliminary findings on adherence outcomes and substance abuse showed improvement, the study was not able to evaluate efficacy. First, there was no control group and the sample size was very small, In addition, lower medication adherence was not an inclusion criterion, and a number of the patients had greater than 90 % medication adherence at baseline which limits ability to generalize to people with lower baseline adherence. Thus, a clinical trial including patients with less than 90 % adherence is warranted [5, 6].

Although there was a reduction in urine screens positive for stimulants and self-reported alcohol use, therapists reported that motivation for substance abstinence was inconsistent, and substance use was more difficult to address with several patients. This is not surprising since patients who were enrolled had recent substance use, regardless of whether they were seeking treatment for substance use. Providing increased justification for evaluating substance use in the earlier sessions, including how use affects adherence and ART effectiveness, was helpful, but other approaches may be equally or more effective, such as CM for substance abstinence.

There were several technical and logistic issues that need to be addressed. First, since the therapy was provided to patients in California from another state, therapists were not licensed substance abuse counselors in California. Thus, implementation would need to address cross-state licensing [43]. Second, some logistical issues could not be negotiated by phone (i.e. problems using the Wisepill devices) and it was important to define therapist, patient, and site clinician roles so patients knew who to ask for. Third, despite offering a study phone and compensation for use of minutes for the therapy sessions, patients who used their own phone had concerns with using minutes, and all patients had issues with cell coverage, dropped calls, and sound quality. Problem solving around these issues on a case-by-case basis should be incorporated in the therapy manual. Fourth, patients called the therapists between sessions, at times during off-hours, or texted the therapist frequently. In addition, some patients made calls when they were traveling, when they were in settings with friends, when they were intoxicated, or when they were distracted. Without face-to-face contact, therapists had limited cues to evaluate whether therapy was appropriate at that time. Thus, therapists need to clarify early in treatment that because of the distance, issues requiring immediate on-site attention had to be deflected to local clinicians. Finally, some patients tracked their reinforcement closely, and greatly appreciated the added financial support. However, this led to discrepancies between self-reported adherence and verification from the WisePill server that required substantial contact, coordination, and resolution by local and remote staff. At this stage of development of this novel

treatment delivery method it is important to closely monitor the automated system for delays or server problems and for the therapist to review the contingency schedule and participant payments on a weekly basis, and to address perceived discrepancies openly and flexibly.

This study had several limitations in addition to the small sample size. First, there was no external validation of medication adherence or biological outcomes measures (e.g., viral load, CD4). However, recent findings indicate high correspondence between electronic event monitoring systems and HIV biologic outcomes [44, 45]. Second, it is not possible to disentangle whether it was the financial incentives, the counseling, or the regular self-monitoring by use of the Wisepill device that improved adherence in this study. Further evaluation in a controlled trial would be needed to more precisely identify the mechanism of CARE's action. Third, the results only evaluated the effects during treatment, with no follow-up. Since the reinforcement schedule and CBT are intended to maintain effects following treatment, additional evaluation with a follow-up period is needed. Finally, although patients received messages for the amount they earned after each device opening event, contingent reinforcement payments were made to participants' cards twice a week rather than immediately. While this schedule is still relatively quick, is more frequent than in-person CM, and allowed for individual case evaluation prior to reinforcement, the delay could be shortened. Semi-automated daily reinforcement would seem practical, and may improve the strength of the reinforcer.

Acknowledgments We would like to thank the patients who have participated in the CARE study. This work was supported by Grant R34DA031643 from the National Institute on Drug Abuse (NIDA)/ National Institute of Health (NIH). Portions of the paper were presented in June, 2013, at the 8th International Conference on HIV Treatment and Prevention Adherence, Miami, FL.

References

1. Crum NF, Riffenburgh RH, Wegner S, Agan BK, Tasker SA, Spooner KM, et al. Comparisons of causes of death and mortality rates among HIV-infected persons: analysis of the pre-, early, and late HAART (highly active antiretroviral therapy) eras. J Acquir Immune Defic Syndr. 2006;41(2):194–200.
2. Buchacz K, Baker RK, Palella FJ Jr, Chmiel JS, Lichtenstein KA, Novak RM, et al. AIDS-defining opportunistic illnesses in US patients, 1994–2007: a cohort study. Aids. 2010;24(10):1549–59.
3. Puhan MA, Van Natta ML, Palella FJ, Addessi A, Meinert C. Ocular Complications of ARG. Excess mortality in patients with AIDS in the era of highly active antiretroviral therapy: temporal changes and risk factors. Clin Infect Dis. 2010;51(8):947–56.
4. Palella FJ Jr, Baker RK, Moorman AC, Chmiel JS, Wood KC, Brooks JT, et al. Mortality in the highly active antiretroviral therapy era: changing causes of death and disease in the HIV outpatient study. J Acquir Immune Defic Syndr. 2006;43(1):27–34.
5. Bangsberg DR. Less than 95 % adherence to nonnucleoside reverse-transcriptase inhibitor therapy can lead to viral suppression. Clin Infect Dis. 2006;43(7):939–41.
6. Bangsberg DR, Kroetz DL, Deeks SG. Adherence-resistance relationships to combination HIV antiretroviral therapy. Curr HIV/AIDS Rep. 2007;4(2):65–72.
7. Shuper PA, Neuman M, Kanteres F, Baliunas D, Joharchi N, Rehm J. Causal considerations on alcohol and HIV/AIDS–a systematic review. Alcohol Alcohol. 2010;45(2):159–66.
8. Aloisi MS, Arici C, Balzano R, Noto P, Piscopo R, Filice G, et al. Behavioral correlates of adherence to antiretroviral therapy. J Acquir Immune Defic Syndr. 2002;31(Suppl 3):S145–8.
9. Ortego C, Huedo-Medina T, Llorca J, Sevilla L, Santos P, Rodríguez E, et al. Adherence to highly active antiretroviral therapy (HAART): a meta-analysis. AIDS Behav. 2011;15(7):1381–1396.
10. Rosen MI, Black AC, Arnsten JH, Goggin K, Remien RH, Simoni JM, et al. Association between use of specific drugs and antiretroviral adherence: findings from MACH 14. AIDS Behav. 2013;17(1):142–7.
11. Baum MK, Rafie C, Lai S, Sales S, Page JB, Campa A. Alcohol use accelerates HIV disease progression. AIDS Res Hum Retrovir. 2010;26(5):511–8.
12. Baum MK, Rafie C, Lai S, Sales S, Page B, Campa A. Crack-cocaine use accelerates HIV disease progression in a cohort of HIV-positive drug users. JAIDS J Acquir Immune Defic Syndr. 2009;50(1):93–9. doi:10.1097/QAI.0b013e3181900129.
13. Cook JA, Burke-Miller JK, Cohen MH, Cook RL, Vlahov D, Wilson TE, et al. Crack cocaine, disease progression, and mortality in a multicenter cohort of HIV-1 positive women. AIDS. 2008;22(11):1355–63 (London, England).
14. Sullivan LE, Botsko M, Cunningham CO, O'Connor PG, Hersh D, Mitty J, et al. The impact of cocaine use on outcomes in HIV-infected patients receiving buprenorphine/naloxone. JAIDS J Acquir Immune Defic Syndr. 2011;56:S54–61. doi:10.1097/QAI.0b013e3182097576.
15. Cofrancesco J Jr, Scherzer R, Tien PC, Gibert CL, Southwell H, Sidney S, et al. Illicit drug use and HIV treatment outcomes in a US cohort. Aids. 2008;22(3):357–65.
16. Hicks PL, Mulvey KP, Chander G, Fleishman JA, Josephs JS, Korthuis PT, et al. The impact of illicit drug use and substance abuse treatment on adherence to HAART. AIDS Care. 2007;19(9):1134–40.
17. Haynes RB, Ackloo E, Sahota N, McDonald HP, Yao X. Interventions for enhancing medication adherence. Cochrane Database Syst Rev. 2008. doi:10.1002/14651858.CD000011.pub3.
18. Rigsby MO, Rosen MI, Beauvais JE, Cramer JA, Rainey PM, O'Malley SS, et al. Cue-dose training with monetary reinforcement: pilot study of an antiretroviral adherence intervention. J Gen Intern Med. 2000;15(12):841–7.
19. Rosen MI, Dieckhaus K, McMahon TJ, Valdes B, Petry NM, Cramer J, et al. Improved adherence with contingency management. AIDS Patient Care STDS. 2007;21(1):30–40.
20. Sorensen JL, Haug NA, Delucchi KL, Gruber V, Kletter E, Batki SL, et al. Voucher reinforcement improves medication adherence in HIV-positive methadone patients: a randomized trial. Drug Alcohol Depend. 2007;88(1):54–63.
21. Dallery J, Raiff BR, Grabinski MJ. Internet-based contingency management to promote smoking cessation: a randomized controlled study. J Appl Behav Anal. 2013;46(4):750–64.
22. Dallery J, Glenn IM, Raiff BR. An Internet-based abstinence reinforcement treatment for cigarette smoking. Drug Alcohol Depend. 2007;86(2–3):230–8.
23. Stoops WW, Dallery J, Fields NM, Nuzzo PA, Schoenberg NE, Martin CA, et al. An internet-based abstinence reinforcement smoking cessation intervention in rural smokers. Drug Alcohol Depend. 2009;105(1–2):56–62.

24. Alessi SM, Petry NM. A randomized study of cellphone technology to reinforce alcohol abstinence in the natural environment. Addiction. 2013;108(5):900–9 (Abingdon, England).
25. Raiff BR, Dallery J. Internet-based contingency management to improve adherence with blood glucose testing recommendations for teens with type 1 diabetes. J Appl Behav Anal. 2010;43(3):487–91.
26. Ferster CB, Skinner BF. Schedules of reinforcement. New York: Appleton-Century-Crofts; 1957.
27. Butler AC, Chapman JE, Forman EM, Beck AT. The empirical status of cognitive-behavioral therapy: a review of meta-analyses. Clin Psychol Rev. 2006;26(1):17–31.
28. McHugh RK, Hearon BA, Otto MW. Cognitive behavioral therapy for substance use disorders. Psychiatr Clin N Am. 2010;33(3):511–25.
29. Muller I, Yardley L. Telephone-delivered cognitive behavioural therapy: a systematic review and meta-analysis. J Telemed Telecare. 2011;17(4):177–84.
30. Mohr DC, Ho J, Duffecy J, Reifler D, Sokol L, Burns MN, et al. Effect of telephone-administered vs face-to-face cognitive behavioral therapy on adherence to therapy and depression outcomes among primary care patients: a randomized trial. JAMA. 2012;307(21):2278–85.
31. Himelhoch S, Medoff D, Maxfield J, Dihmes S, Dixon L, Robinson C, et al. Telephone based cognitive behavioral therapy targeting major depression among urban dwelling, low income people living with HIV/AIDS: results of a randomized controlled trial. AIDS Behav. 2013;17(8):2756–64.
32. Collier AC, Ribaudo H, Mukherjee AL, Feinberg J, Fischl MA, Chesney M. A randomized study of serial telephone call support to increase adherence and thereby improve virologic outcome in persons initiating antiretroviral therapy. J Infect Dis. 2005; 192(8):1398–406.
33. Carroll KM. A cognitive-behavioral approach: treating cocaine addiction. Rockville: NIDA; 1998.
34. Anton RF, O'Malley SS, Ciraulo DA, Cisler RA, Couper D, Donovan DM, et al. Combined pharmacotherapies and behavioral interventions for alcohol dependence: the COMBINE study: a randomized controlled trial. JAMA. 2006;295(17):2003–17.
35. Rosen MI, Ryan C, Rigsby M. Motivational Enhancement and MEMS review to improve medication adherence. Behav Chang. 2002;19:183–90.
36. Wagner GJ, Kanouse DE, Golinelli D, Miller LG, Daar ES, Witt MD, et al. Cognitive-behavioral intervention to enhance adherence to antiretroviral therapy: a randomized controlled trial (CCTG 578). Aids. 2006;20(9):1295–302.
37. Safren S, O'Cleirigh C, Bullis J, Otto M, Stein M, Pollack M. An introduction to delivering cognitive behavioral therapy for adherence and depression (CBT-AD) for individuals living with HIV infection. 5th International conference on HIV treatment adherence. Miami; 2010.
38. Safren SA, O'Cleirigh CM, Bullis JR, Otto MW, Stein MD, Pollack MH. Cognitive behavioral therapy for adherence and depression (CBT-AD) in HIV-infected injection drug users: a randomized controlled trial. J Consult Clin Psychol. 2012;80(3):404–15.
39. Tetrault JM, Kozal MJ, Chiarella J, Sullivan LE, Dinh AT, Fiellin DA. Association between risk behaviors and antiretroviral resistance in HIV-infected patients receiving opioid agonist treatment. J Addict Med. 2013;7(2):102–7.
40. Sobel LC, Sobel MB. Timeline follow-back: a technique for assessing self-reported alcohol consumption. In: Allen JP, Litten RZ, editors. Measuring alcohol consumption: psychosocial and biochemical methods. Totowa: Human Press; 1992. p. 41–72.
41. Litman GK, Stapleton J, Oppenheim AN, Peleg M, Jackson P. Relationship between coping behaviors, their effectiveness and alcoholism relapse and survival. Br J Addict. 1984;79:283–91.
42. Lamb RJ, Kirby KC, Morral AR, Galbicka G, Iguchi MY. Improving contingency management programs for addiction. Addict Behav. 2004;29(3):507–23.
43. Herbert JD, Goetter EM, Forman EM, Yuen EK, Erford BM, Milillo JJ, et al. Crossing the line: interstate delivery of remote psychological services. Behav Ther. 2012;35:145–52.
44. Liu H, Miller LG, Golin CE, Hays RD, Wu T, Wenger NS, et al. Repeated measures analyses of dose timing of antiretroviral medication and its relationship to HIV virologic outcomes. Stat Med. 2007;26(5):991–1007.
45. Liu H, Miller LG, Hays RD, Golin CE, Wu T, Wenger NS, et al. Repeated measures longitudinal analyses of HIV virologic response as a function of percent adherence, dose timing, genotypic sensitivity, and other factors. J Acquir Immune Defic Syndr. 2006;41(3):315–22.