



Considerations for Implementing Contingency Management in Substance Abuse Treatment Clinics: The Veterans Affairs Initiative as a Model

Carla J. Rash¹ · Dominick DePhilippis²

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Abstract

Contingency management (CM) is an efficacious intervention for the treatment of substance use disorders that is widely applicable across a range of client populations and characteristics. Despite its strong evidence base, CM remains underutilized in real world practice. This article introduces CM for clinicians interested in adopting CM and briefly reviews this research evidence. In addition, CM protocols are described, with emphasis on the specific design considerations important to CM's efficacy. The recent Department of Veterans Affairs (VA) initiative, which represents the first successful large-scale implementation effort, is presented. It provides a model for the training and supervision components that may be critical to implementation with fidelity. Continued research in this area, as well as further demonstrations of successful dissemination and implementation, will be critical for improving the adoption of this intervention in clinical, nonresearch settings.

Keywords Motivational incentives · Rewards · Reward-based interventions · Fishbowl · Vouchers · Implementation

Substance use and related disorders can be conceptualized using the operant conditioning principle of reinforcement (Fischman & Schuster, 1978). Reinforcement refers to a consequence or outcome that increases the likelihood of a behavior occurring again, and reinforcers are the stimuli serving as the consequence. The two principle mechanisms of reinforcement are positive (i.e., when the behavior is followed by the

✉ Carla J. Rash
carlarash@gmail.com

¹ Calhoun Cardiology Center, University of Connecticut Health School of Medicine, 263 Farmington, Avenue (MC 3944), Farmington, CT 06030-3944, USA

² Center of Excellence in Substance Addiction Treatment and Education, Corporal Michael J. Crescenz Veterans Administration Medical Center, Perelman School of Medicine, Department of Veterans Affairs, Pennsylvania, PA, USA

provision [addition] of an appealing stimulus) and negative (i.e., escape from or avoidance [negation] of an unappealing stimulus). The pharmacological effects (i.e., the “high”) from initial use can be viewed as a positive reinforcer, increasing the likelihood of subsequent use, and relief from withdrawal (negative reinforcement), plays a role in the maintenance of use over time for many drugs. Recognizing that continued drug use is being reinforced via these processes, we might consider how to arrange alternate contingencies to compete with drug use. That is, can we make abstinence more appealing than continued drug use? Contingency management (CM) is a behavioral intervention based on these same operant conditioning principles that attempts to directly address this issue (Bigelow, Stitzer, Griffiths, & Liebson, 1981; Bigelow, Stitzer, & Liebson, 1984).

CM offers clients opportunities to earn tangible reinforcers (positive reinforcement) for achieving target behaviors such as providing drug-negative urine samples or attending treatment sessions, with the goal of increasing these behaviors (e.g., submission of drug-negative samples, treatment engagement) in the future. With CM, target behaviors also are subject to negative reinforcement because clients avoid a diminution in the magnitude of positive reinforcement (i.e., a reset in the size of the available positive reinforcement) that would otherwise occur when the target behavior is not performed. Lastly, CM includes an extinction procedure (i.e., withholding positive reinforcement) when the target behavior is not performed. In other words, using CM clinicians reinforce the behavior they want to increase, whether that is abstinence, attendance, or other behaviors, and put the competing behavior (e.g., drug use, absence from treatment) through extinction. It is typically delivered as an adjunct to standard services, and it blends well with nearly any platform therapy with which it is paired, including intensive outpatient services, 12-step, cognitive-behavioral therapies, community reinforcement approach, motivational enhancement or motivational interviewing, and pharmacotherapies.

CM has demonstrated robust efficacy for the treatment of substance-use disorders in research trials, but uptake in clinical settings has been slow. This article provides a brief overview of CM’s evidence base, focusing on its generalizability to client subpopulations and settings. We then discuss implementation efforts, including the large and successful roll-out of CM in the Department of Veterans Affairs (VA), which provides a model for future large-scale projects. Last, we identify core issues related to the progress and success of CM’s adoption in the VA and other settings. CM has additional costs, yet it is cost-effective (Olmstead, Sindelar, & Petry, 2007a, 2007b; Olmstead & Petry, 2009; Sindelar, Elbel, & Petry, 2007). It is important to note that these benefits are only realized when CM is implemented with fidelity. This latter section focuses on the decision points critical to the efficacy of CM.

Evidence of Efficacy

Multiple meta-analyses (Ainscough, McNeill, Strang, Calder, & Brose, 2017; Benishek et al., 2014; Dutra et al., 2008; Griffith, Rowan-Szal, Roark, & Simpson, 2000; Lussier, Heil, Mongeon, Badger, & Higgins, 2006; Prendergast, Podus, Finney, Greenwell, & Roll, 2006; Sayegh, Huey, Zara, & Jhaveri, 2017) have examined the impact of CM on substance use treatment outcomes, finding consistent medium size effects ($d_s = 0.41-$

0.68). In comparison to other established behavioral approaches to substance use treatment, CM generates larger effects ($d = 0.58$) than cognitive-behavioral therapy ($d = 0.28$) or relapse prevention ($d = 0.32$; Dutra et al., 2008). CM has been applied widely and with success to many types of substance use disorders, with stimulants and opioid abstinence among the most frequently targeted. CM targeting these substances generates moderate effect sizes (cocaine $ds = 0.62$ – 0.75 ; opioids $ds = 0.65$ – 0.85 ; Lussier et al., 2006; Prendergast et al., 2006; Sayegh et al., 2017). Reflecting a pattern identified across behavioral interventions (Dutra et al., 2008), CM targeting polysubstance use generates smaller effects ($ds = 0.15$ – 0.62 ; Ainscough et al., 2017; Lussier et al., 2006; Prendergast et al., 2006; Sayegh et al., 2017). CM has also been applied to promote alcohol, nicotine, and marijuana abstinence with success.

Two major systems have been developed for CM delivery, voucher CM and prize-based or “fishbowl” CM. In a voucher protocol, a client earns vouchers representing monetary amounts that can be exchanged for goods and services of their choice. In Higgins et al.’s (1994) seminal study of voucher CM for cocaine abstinence, 40 participants with cocaine dependence were randomized to 24 weeks of community reinforcement approach (CRA) therapy with frequent urine testing or the same plus vouchers earned for cocaine-negative urine samples in the first 12 weeks. For the first negative sample, clients earned \$2.50 in vouchers, and this amount increased by \$1.25 for each subsequent consecutive cocaine-negative sample submission. In addition, clients earned a \$10 bonus weekly if all samples tested negative for that week. If clients submitted all negative samples across the 12 weeks of CM, they earned \$997.50 in vouchers. Missed appointments, failure to submit samples, and positive samples did not earn vouchers, and the amount to be earned at the next negative sample was reset to the initial value.

CM improved retention in treatment (75% versus 40% in CRA only group), and 55% of the CM group achieved 10 weeks or more of continuous cocaine abstinence versus 15% in the CRA only group. It is important to note that the design of this study with CM offered in the first 12 weeks, but no vouchers in weeks 13–24, allowed the investigators to assess the impact on abstinence following removal of the contingencies. Declines in durations of abstinence in the latter half of treatment were evident in both treatment groups, but withdrawal of the contingencies did not adversely affect abstinence relative to the CRA-only group. In weeks 1–12, the voucher group achieved 7.2 weeks of continuous cocaine abstinence versus 3.9 weeks in the CRA-only group. In weeks 13–24, there were 6.1 and 2.7 weeks of continuous cocaine abstinence, respectively. Since the promising results of the Higgins et al. (1994) study, voucher CM has been applied to a wide spectrum of substances other than cocaine, as well as other target behaviors such as treatment attendance and medication adherence (Lussier et al., 2006).

Although voucher CM is efficacious, it is also costly (e.g., ~\$1000/patient for 12 weeks of treatment in the Higgins et al. [1994] study). Magnitude of reinforcement is one of the basic principles of effective CM (Petry, 2000). Simply reducing the available earnings, for example, by setting lower voucher amounts for each negative sample, decreases efficacy (e.g., Higgins et al., 2007; Silverman, Chutuape, Bigelow, & Stitzer, 1999). Other avenues of decreasing cost, such as decreasing the frequency of drug testing and reinforcement are also problematic. Nancy Petry’s innovative prize-based CM tackled the cost issue directly in a way that preserved frequent testing and

reinforcement. She introduced probability in earnings and variability of magnitude into the CM protocol. The combination of chance earnings (i.e., sometimes winning, sometimes not) and manipulating the size of prize earnings resulted in a protocol that reduced overall costs without reducing efficacy (Olmstead & Petry, 2009; Petry, Alessi, Marx, Austin, & Tardif, 2005; Petry, Alessi, Hanson, & Sierra, 2007).

In prize CM, clients earn draws from a fishbowl for demonstrating target behaviors rather than earning a set voucher amount. A typical fishbowl contains 500 slips, of which 50% are winning (i.e., client earns a prize) and the remaining 50% are nonwinning (i.e., positive statements such as “Good job!” or “Keep up the good work!”). The winning slips note prizes of variable magnitude—small, large, or jumbo. Smaller, lower-cost items are most prevalent and larger magnitude prizes less so. The most common prizes are small prizes worth about \$1 (e.g., toiletries, food items). A smaller proportion are large prizes worth about \$20 (e.g., clothing items, gift cards), and 1 slip represents the jumbo prize worth about \$100 (e.g., electronics, gift cards). Upon drawing winning slips, clients select their desired prize within that category from a stocked prize cabinet that offers multiple choices in each prize category. For the first negative sample submission, clients earn a draw from the fishbowl and the number of draws earned increases for each consecutive negative sample (1 draw for the first negative sample, 2 draws for the second consecutive negative sample, 3 draws for the third consecutive negative sample, and so on). Bonus draws for achieving consistent abstinence (i.e., consecutive negative samples) over prescribed periods of time can also be offered. Similar to voucher schedules, prize CM includes extinction and negative reinforcement procedures (i.e., clients do not earn draws for missed, refused, or positive samples), and these events result in a reset in the number of draws to the initial value. Due to the introduction of the probabilistic element and gradient magnitudes, overall maximum expected earnings can be arranged to be about one-third that of voucher schedules.

The first examination of prize CM (Petry, Martin, Cooney, & Kranzler, 2000) targeted alcohol-negative breath samples in clients with alcohol dependence recruited from a VA intensive outpatient program. Participants ($N = 42$) were randomized to one of two treatments: standard clinic services with frequent breath alcohol monitoring and 15 minutes of alcohol abuse education weekly, or the same standard clinic services and monitoring plus the opportunity to earn draws for alcohol negative breath samples. Results suggested that prize CM significantly improved treatment retention (84% versus 22% in standard care). CM also increased time until the first drinking and first heavy drinking episodes relative to the standard clinic services.

In subsequent studies (Petry, Alessi et al., 2005, 2007), Dr. Petry compared prize CM directly to voucher CM. In Petry, Alessi et al. (2007), 74 methadone maintained individuals with cocaine dependence were randomized to standard clinic services, standard clinic services plus up to \$585 in vouchers for cocaine negative samples, or standard clinic services plus up to about \$300 average maximum expected earnings in prizes. Median weeks of consecutive abstinence were 0, 6, and 6 weeks for the standard services, voucher CM, and prize CM, respectively. These findings suggest that prize CM is a viable option for reducing costs while preserving efficacy. It is worth highlighting that prize CM also demonstrates a connection between magnitude and efficacy similar to that noted above for voucher CM (Higgins et al., 2007; Silverman et al., 1999). Petry et al. (2004) tested this effect by comparing a “standard” prize CM

of about \$240 in average maximum expected earnings over 12 weeks to a “mini” prize CM condition of \$80 in average maximum expected earnings over the same timeframe. The Results in the “mini” condition did not differ from standard care, suggesting that when the overall expected average maximum of prize earnings is arranged to be too low (as in the \$80 condition), it does not produce benefits beyond standard care (Petry et al., 2004).

Given that both voucher and prize CM are efficacious (Lussier et al., 2006; Benishek et al., 2014), the choice of which system to use is often dependent on contextual factors, of which cost is only one consideration. Voucher CM may be preferred by clients (Hartzler & Garrett, 2016), possibly because it offers predictable earnings. This predictability may also ease the burden on staff, because they know how much a client will be earning before appointments. In contrast, prize CM’s element of chance increases effort on the part of staff. Though the number of draws is known prior to each visit, the actual prize earnings are variable and must be carefully tracked. The drawing of slips and selection of prizes by the clients in prize CM also add time to the appointment, which may be a consideration for busy clinics. On the other hand, prize CM presents each patient an opportunity to earn high-magnitude prizes at every visit, which increases excitement for the program.

We have focused on voucher and prize CM delivery systems above given that the bulk of research to date has employed these models. The choice between the two is often a matter of preference and fit. Beyond these options, however, several other adaptations are available including cash-based, name-in-the-hat, therapeutic work-places, contingent housing, deposit models, and others. Readers are referred to further descriptions of these approaches in Petry (2000, 2012).

Generalizability

Although CM’s early research findings were promising, an important aspect of moving this intervention from research to clinical practice involved large-scale examinations of efficacy in community clinics. Such investigations were important for establishing that CM is efficacious outside the original developers’ research laboratories. In addition, recruitment of participants from multiple community clinics using the least restrictive eligibility criteria would build support of CM’s generalizability to real-world clients. Two separate multisite studies, one focused on intensive outpatient substance use disorder treatment clinics (Petry, Peirce et al., 2005b) and another focused on methadone maintenance clinics (Peirce et al., 2006), evaluated prize CM in these settings using the National Drug Abuse Treatment Clinical Trials Network. The Petry, Peirce et al. (2005b) study recruited 415 participants from eight intensive outpatient clinics. The Peirce et al. (2006) study involved 388 participants recruited from six methadone programs. Participants with stimulant use disorders were randomized to standard clinic services with or without incentives for the primary drug targets (stimulant and alcohol). Alcohol was included as a primary drug target because of its association with stimulant use (Peirce et al., 2006). Prize draws were earned contingent on abstinence from all primary drug targets, and positive samples for one or more primary targets earned no draws and reset the schedule for the next negative sample to the initial value. Additional draws could be earned for opioid-negative samples in the Peirce et al. (2006) study and

opioid- and marijuana-negative samples in Petry, Peirce et al. (2005b) if the samples tested negative for all primary targets. Positive samples for these secondary drugs did not affect reinforcement for the primary targets.

Results of these studies (Peirce et al., 2006; Petry, Peirce et al., 2005b) provided additional support of CM's beneficial impact on abstinence outcomes, and in the intensive outpatient setting, it also improved treatment retention. CM participants in the intensive outpatient settings achieved longer durations of continuous abstinence from stimulants and alcohol (4.4 versus 2.2 weeks) and were more likely to complete treatment (49% versus 35%). Rates of achieving ≥ 4 , 8, or 12 weeks of stimulant and alcohol abstinence were significantly higher for CM participants (40%, 26%, and 19%, respectively) compared to those receiving standard clinic services without CM (21%, 12%, and 5%, respectively), odds ratios = 2.5–4.5. In the methadone study (Peirce et al., 2006), 54% of samples submitted tested negative for stimulants in the CM group compared to 39% in the standard services condition. Likewise, rates of achieving ≥ 4 , 8, or 12 weeks of continuous abstinence from stimulants and alcohol were significantly higher for CM participants (24%, 17%, and 6%, respectively) than those receiving standard services alone (9%, 2%, and 1%, respectively), odds ratios = 3.1–11.1.

The Clinical Trials Network studies (Peirce et al., 2006; Petry, Peirce et al., 2005b) were a critical foundational step related to establishing CM's generalizability. Subsequent studies have investigated whether CM is effective for specific client subpopulations. CM appears to be robust in its generalizability. It improves outcomes regardless of demographic characteristics, including race (Barry, Sullivan, & Petry, 2009), gender (Burch, Rash, & Petry, 2015; Rash & Petry, 2015), age (Weiss & Petry, 2011, 2013), income (Rash, Olmstead, & Petry, 2009; Rash, Andrade, & Petry, 2013; Secades-Villa et al., 2013), and housing status (Rash, Alessi, & Petry, 2017). Likewise, investigations of comorbid substance use disorders (Rash, Alessi, & Petry, 2008a) or cooccurring substance use (Alessi, Rash, & Petry, 2011), psychopathology or psychiatric symptoms (García-Fernández, Secades-Villa, García-Rodríguez, Peña-Suárez, & Sánchez-Hervás, 2013; Weinstock, Alessi, & Petry, 2007), history of prior substance-abuse treatment (Killeen, Carter, Copersino, Petry, & Stitzer, 2007; Rash, Alessi, & Petry, 2008b), history of prostitution (Rash, Burki, Montezuma-Rusca, & Petry, 2016), criminal justice involvement (Ginley, Rash, Olmstead, & Petry, 2017; Petry, Rash, & Easton, 2011), and medical comorbidities (Burch, Rash, & Petry, 2017; Walter & Petry, 2015) find that CM is efficacious and generalizable across a wide range of background characteristics.

One clinical characteristic that does warrant consideration is substance use severity at treatment initiation. In other psychosocial treatments for addictions, active versus remitted substance use at the time of treatment entry is predictive of treatment response (Alterman et al., 1997; Kampman et al., 2001; Sánchez-Hervás et al., 2010). This finding is evident in CM trials as well (Petry et al., 2004; Petry, Barry, Alessi, Rounsaville, & Carroll, 2012; Stitzer et al., 2007a, 2007b), though not consistently in the same direction across studies. Results from Campbell et al. (2014) suggest benefits of CM may be attenuated for those individuals presenting drug-negative at the start of treatment. In other words, individuals presenting drug-negative are more likely to stay drug-negative throughout treatment, with or without CM. Thus, the benefits of CM may be more pronounced among individuals presenting drug-positive. Other studies find benefits in both drug-positive and drug-negative groups (Stitzer, Peirce et al., 2007a) or benefits only in those testing negative at baseline (Stitzer, Petry et al., 2007b).

Petry, Barry et al. (2012a) directly examined this issue by randomizing clients based on positive or negative drug use status at intake. Among those presenting drug-negative, CM significantly improved attendance and abstinence outcomes relative to usual intensive outpatient services, a finding consistent with Stitzer, Petry et al. (2007b) and Stitzer, Peirce et al. (2007a) but in contrast to the Campbell et al. (2014) study, which found no benefit of CM in this subgroup. In the Petry, Barry et al. (2012a) drug-positive arm, participants were randomized to usual intensive outpatient services or one of two CM conditions: standard CM (\$250) or a higher magnitude condition (\$560). For drug-positive clients, both CM conditions resulted in significant improvements relative to usual services; however, the higher magnitude produced more robust outcomes. The overall findings of this study suggest that CM benefits clients regardless of initial status, but that enhanced CM may be warranted for those testing drug-positive at treatment entry. Additional research will be needed given the mixed results for drug-negative individuals, and such studies may shed light on specific groups or settings where drug use at treatment entry is more or less important (e.g., methadone versus intensive outpatient settings).

Based on this research, some clinics may decide to offer CM to all clients, guided by an equal opportunity principle. The Petry, Barry et al. (2012a) study suggests benefits for both drug-positive and drug-negative individuals, supporting this decision. As an alternative, clinics may opt to direct limited CM resources to those least likely to respond to usual care services or adopt a stepped care model that introduces CM for nonresponders. A third possibility raised by Cunningham et al. (2017) might involve offering higher magnitude CM for those testing drug-positive at treatment entry and developing a lower cost CM that could target alternate behaviors (e.g., attendance, completion of treatment-related goals) for those testing drug-negative at intake. An important consideration of these latter approaches is the potential for inadvertent shaping of clients toward submitting drug-positive samples at treatment entry if, for example, it became known at the clinic that testing drug-positive results in access to CM or higher magnitude CM.

The decision of whether and how to offer CM and to whom is challenging. The above studies largely suggest that CM is widely generalizable and that most clients will benefit from CM. Thus, the question of which clients should be offered CM is often controlled by cost considerations. The reinforcers used in CM have upfront costs that as of yet are not reimbursable. Clinics implementing CM often direct CM to subgroups that do not seem to respond to standard services. In the next sections, we discuss the successful implementation of CM throughout the Department of Veterans Affairs (VA) specialty care settings for substance use disorders. This effort directed CM to a subset of clients, providing one example of this decision process.

The Department of Veterans Affairs CM Effort

In 2011, an independent review of VA services indicated that less than 1% of veterans with substance use disorders had documented receipt of CM as part of their treatment (Watkins et al., 2011). Given that CM is an evidence-based treatment with strong support, the VA initiated a nationwide clinical effort to increase CM's use. This initiative was directed primarily to veterans with stimulant use disorders, given the

lack of evidence-based pharmacotherapy options for this patient subgroup (Petry, DePhilippis, Rash, Drapkin, & McKay, 2014). As part of this effort, the VA committed seed funds for CM costs and provided regional training for VA providers. At the initial four regional training sessions conducted in 2011, 187 providers from 113 substance use programs participated in a 1.5 day training workshop. The workshops were designed to provide background knowledge about CM, address barriers to CM, provide education about how to design CM protocols that adhere to efficacious parameters, and role play CM delivery (Petry et al., 2014; Rash, DePhilippis, et al. 2013). Abstinence-based CM targeting a single drug (cocaine or methamphetamine, depending on regional prevalence) or single drug class (e.g., all stimulants) was emphasized, though attendance and other behavioral targets were discussed. A “standard” protocol was offered, which reinforced stimulant abstinence using prize CM, was 12 weeks in duration with twice-weekly testing, used escalating draws with a cap of 8, and offered a maximum of 164 draws with an average expected maximum earnings of \$364 in prizes.

By late 2012, 78 (69%) of programs participating in these initial trainings had begun delivering CM to patients, and in this same year, the VA committed additional clinical dollars to the initiative (Petry et al., 2014). Subsequent to the initial training sessions, an additional 16 programs were trained in CM. By 2015, 116 (90%) of the 129 programs had implemented CM (DePhilippis, Petry, Bonn-Miller, Rosenbach, & McKay, 2018), and by the end of 2018, 126 (98%) have implemented CM. By the end of 2015, the majority of programs ($N = 94$) adopted abstinence-based CM, though 22 (17%) of the programs opted for attendance-based CM based on low prevalence of stimulant use in their clinic populations (DePhilippis et al., 2018). However, by the end of 2018, 107 programs targeted abstinence whereas 19 targeted attendance (because 3 of the 22 programs that targeted attendance switched to targeting abstinence). About 70% used the standard prize CM protocol presented in the training, and the remaining sites adapted the protocol to their individual clinic needs or structure. An average of two clinicians (range = 1 to 9) per program were delivering CM to a median of 17 clients (range = 1 to 136 patients). These clients attended a median 14 sessions and submitted 95% negative samples (DePhilippis et al., 2018). Overall, these data suggest a robust response to the CM initiative in terms of program and patient engagement with outcomes on par with randomized clinical trials.

An important aspect of the success of the VA initiative has been the availability of coaching calls led by a CM expert. Programs could use these calls both for the planning stage prior to implementation and ongoing after implementation (Petry et al., 2014). Prior to each call, programs were asked to complete an implementation form (available as an appendix in DePhilippis et al., 2018) that collected data on the CM setting, structure, outcomes, and aspects of fidelity to CM principles. Since the initial trainings, over 600 calls have occurred through 2015 (DePhilippis et al., 2018) and since 2015, 75% or more programs have engaged in at least one call per year. Initial planning calls aimed at preventing protocol deviations from research-based parameters that might undermine CM’s efficacy. These planning stage calls may be particularly important for programs attempting to adjust a standard protocol to their clinic needs. Such issues are usually addressable early in planning (e.g., scheduling appropriately spaced urine tests Monday and Thursday or Tuesday and Friday rather than Monday and Wednesday). If unaddressed, however, poorly implemented CM may leave long-lasting and erroneous impressions that CM is ineffective among staff.

Postimplementation coaching calls also focused on design issues and reviews of the empirical basis for protocol features when needed. The ongoing provision of support seems to be a critical component in the success of the VA initiative. Newer programs learned from the efforts of programs that were further along their implementation timeline, and the calls also provided a mechanism for involving newcomers (due to staff turnover; DePhilippis et al., 2018). Even among the more experienced programs, participation in the coaching calls may serve to maintain quality control and prevent protocol drift over time. The implementation forms completed prior to calls provided valuable information for coaches about where adjustments may be needed in addition to eliciting provider concerns. Not only were coaching calls used as an opportunity to identify and correct deviations from the protocol, they also served as an opportunity to recognize effective implementation. Indeed, the milieu established in the coaching calls is consistent with the positive reinforcement focus of CM (i.e., praise was used to reinforce fidelity to the prize CM protocol), and corrective actions were framed as opportunities for the implementers to increase the benefits of their efforts in making CM available to their patients.

In wide-scale implementation efforts, the provision of regular coaching may be the most difficult to arrange given its ongoing nature and requirement of expert input, but it appears to be an essential element for the implementation of CM programs that maintain fidelity and in turn produce effects similar to those observed in clinical trials. Whenever possible, clinics implementing CM should seek input from experts for training, planning, and postimplementation support. This guidance is critical when deviations from standard protocols are considered.

Implementation Considerations

The VA initiative provides a model for successful implementation that included expert input, training workshops, provision of a standard protocol with flexibility to adjust, and ongoing consultation pre- and postimplementation. One reason underlying the success of this effort may lie in CM's flexibility. It can be adjusted in many different ways to fit the needs of individual programs and client populations. This strength can also be a liability. DePhilippis et al. (2018) noted that many clinics participating in coaching calls were planning or implementing protocols that deviated from acceptable practices, and these deviations would likely have persisted without expert involvement. Despite training, access to resources, and good intentions, it is easy for novice implementers to go astray and unknowingly weaken the CM intervention. Below, we discuss design features that must be carefully and deliberately considered. To help guide the readers, we start with a generic model, similar to that used in the VA effort. This model protocol could use either voucher or prize-based systems, targets illicit drug abstinence, objectively monitors and reinforces the target behavior twice weekly, and is 12 weeks in duration. Though many other variations exist, here we focused on the most common adaptations to a "generic" voucher or prize CM protocol.

Target behaviors Primary among the decisions to be made is the selection of the target behavior. CM is efficacious in reducing stimulant, opioid, alcohol, tobacco, and marijuana use (e.g., Lussier et al., 2006; Prendergast et al., 2006). Targeting abstinence is popular, in part, because it is readily and objectively verifiable via drug testing.

Moreover, it includes *de facto* reinforcement of treatment retention, i.e., the client must remain in treatment to receive reinforcement that is contingent on abstinence. Single drug targets are usually preferred given that CM protocols targeting single-drug abstinence generate larger effect sizes (Griffith et al., 2000). In addition, multiple drug abstinence may be unattainable for some clients, whereas abstinence from a single drug or single drug class (i.e., must test negative for all stimulants) may be much more accessible. Consider a CM program directed toward clients with cocaine use disorders who may have other drug use occurring in addition to the cocaine use. A protocol that requires these clients to achieve abstinence from all drugs is a much more difficult bar to achieve compared to a protocol that only requires abstinence from cocaine in order to earn reinforcers. Far more clients in the latter program will access reinforcers. Reinforcement increases the likelihood of the targeted behavior occurring in the future, but only when clients are exposed to the reinforcers. Single drug targets increase that exposure.

Among possible drug targets, a clinic might consider which substance is of most concern at their clinic, and, when possible, use data on clinical outcomes to guide their selection. Prevalence alone may not be sufficient if it does not appear related to client outcomes. Marijuana use, for example, is often highly prevalent, but do these patients have worse outcomes or problems with retention? In contrast, clinic data might indicate that those with stimulant or opioid disorders, though less prevalent, are more likely to drop out of treatment prematurely, have difficulty attaining any duration of abstinence, and/or are more likely to relapse.

In the VA effort, another consideration was the availability of effective treatments for a particular substance use disorder. Their program largely targeted stimulants either singly when one stimulant (e.g., cocaine or methamphetamine) was predominant in the region or by substance class (e.g., requiring abstinence from all tested stimulants) in regions where stimulant use was mixed. The rationale behind the selection of this target was guided by the lack of an efficacious pharmacotherapy option to complement behavioral therapy for individuals with stimulant disorders. This rationale remains relevant.

Beyond abstinence, CM can be beneficial to a host of other behaviors that are aspects of substance use disorder treatment. CM is efficacious in increasing attendance to treatment sessions (Kelly, Daley, & Douaihy, 2014; Ledgerwood, Alessi, Hanson, Godley, & Petry, 2008; Petry, Martin, & Finocche, 2001; Petry, Barry et al., 2012b), medication adherence (Petry, Rash, Byrne, Ashraf, & White, 2012b; Petry, Alessi, Byrne, & White, 2015; Raiff, Jarvis, & Dallery, 2016a; Rosen et al., 2007), and adherence to complex medical regimens (Raiff & Dallery, 2010; Raiff, Barry, Ridenour, & Jitnarin, 2016b; Stanger et al., 2013). It can also be used to promote completion of treatment goal-related activities (Petry et al., 2001, 2006) that extend beyond the treatment clinic, such as completion of employment-related activities (e.g., attending job skills training) or medically related activities (e.g., attending a medical appointment). Last, CM can target therapy compliance (e.g., completion of verifiable exercises or worksheets) as well as completion of therapeutic behaviors (e.g., chore completion).

Regardless of the behavior selected, it is imperative that the behavior 1) be clearly defined for the benefit of clinician and client alike, and 2) that the behavior be objectively verifiable. Objective verification is such an integral aspect of CM that the ability to verify often limits what behaviors we target for CM protocols. For example,

medication adherence would require the ability to verify each dose was taken as prescribed using methods such as observation (in-person or remotely via video) or via medication event monitoring systems (MEMs caps). If a clinic does not have the means to verify dosing, then medication adherence would not be a good candidate for a CM protocol and another behavior that can be objectively verified should be selected.

Objective verification for nonabstinence targets can be challenging. CM targeting goal-related activities, for example, requires careful thought about what forms of verification will be sufficient, and verification may differ across activities (e.g., AA attendance documented via a signed and dated card, a dated and filled prescription, a dated patient note verifying a medical appointment). In contrast, CM targeting abstinence verified objectively via negative drug samples is more straightforward.

Consider behaviors that occur at a high frequency and can be objectively monitored readily, as discussed below. In addition, it is important to select a behavior with room for improvement. If the clinic already has low rates of stimulant use or high group attendance, then the addition of CM targeting these behaviors would add cost without much benefit. In contrast, CM targeting attendance to a group with historically low attendance would be more likely to generate effects.

Patient Population Clinics will also need to consider who among their population will be eligible. This selection is often decided in concert with the target behavior and with an eye toward resources. CM programs are often extended to a subset of clients in order to both pilot test the program and to direct limited resources to those who can best benefit. If a decision has been reached to focus on reducing cocaine use, who among the client population will be eligible? Will the CM program apply to all patients with cocaine use disorder or only new admissions with cocaine use disorders? Select eligibility criteria with an eye toward avoiding unintended incentives for the client to engage in the problem behavior in order to gain access to the program. As an example, it could be relatively easy for a client to test positive for a single point-in-time test in order to gain access to the reinforcers, but an eligibility requirement based on prior medical records (e.g., prior history of cocaine use disorder) is much more difficult to manufacture. Planning ahead in terms of who will be eligible and by what criteria can also mitigate complaints among staff or clients about access and equity.

For clinics interested in reinforcing increased attendance, clinic data might shed light on which sessions (group, individual, or 12-step) have historically poor attendance. In this situation, all clients in a given treatment stage might be eligible or further eligibility criteria might be employed (e.g., substance use disorder type or presence of a dual diagnosis) if the clinic data suggests that subgroups of clients tend to have worse attendance and retention. Piloting the CM program with a small selection of clients (1–3) is encouraged, because this process allows clinicians to test the eligibility criteria, learn the protocol, and practice explaining the program to clients. Most important, piloting a CM protocol allows time to address problem areas before a wide-scale effort is attempted.

Schedule parameters In addition to the selection of the population, target behavior, and delivery method (i.e., vouchers or prizes), several parameters of the reinforcement schedule itself offer flexibility. However, in all cases, deviations from the optimal should be considered with a high degree of caution and recognition that changes in

more than one parameter could quickly result in a protocol that is not effective. Again, we recommend a standard protocol that includes the following elements: uses either voucher or prize-based systems, targets illicit drug abstinence, objectively monitors and reinforces the target behavior twice weekly, and is 12 weeks in duration. We also recommend providing reinforcers immediately following the demonstration of the target behavior, using similar magnitudes of reinforcement as demonstrated efficacious in research trials, and including escalating reinforcement with sustained achievement. Explanation for these recommendations and guidance on possible modifications follows.

Immediacy Two meta-analyses (Griffith et al., 2000; Lussier et al., 2006) have identified immediacy of reinforcement as significant moderators of outcomes. Immediacy refers to delivering the reinforcer as close in time to the behavior as possible, which promotes the connection between a behavior and its consequence. For CM abstinence protocols, we use on-site rapid urine tests, read and relay the test results to the client within minutes after the client provides the urine sample (per instructions of the test), and provide vouchers or prize draws at that time if the sample was negative. Whenever possible, we recommend adhering to this structure.

The most common barrier to the immediacy principle is found in clinics who wish to send urine samples to an external laboratory for testing. This process can result in a delay of 1 to 3 days between submission of the urine sample and reinforcement, which is not optimal for maximizing the impact of a CM program. The VA programs, which often had onsite laboratories, were encouraged to negotiate rapid turn-around (i.e., same day) results, and if this was not possible, to use qualitative testing kits at the point-of-care. On-site, point-of-care testing kits (i.e., dipsticks, rapid screening cups) are available at low cost, and they provide results within 3 to 5 minutes. Use of these tests permits availability of reinforcement close in time with sample submission consistent with best practices.

Another common deviation from the immediacy principle is requiring the client to achieve multiple steps in order to access reinforcement. Hinging reinforcement on too high a goal, such as attending a month of groups, would be an example of this pattern. Because the availability of reinforcement is delayed following each individual instance in which the client attends therapy sessions, connections between the behavior and consequence are weakened. Most important, however, is that because the reinforcement is so delayed in this example, its value to the client is discounted and has less of an effect on behavior (Lattal, 2010). Clients must be exposed to the intervention, reinforcers in this case, in order for it to have any potential for impact. A better approach that is more consistent with CM principles would be to reinforce the client each time they attend sessions so that clients have early and frequent opportunities to be exposed to reinforcers. It would be optimal if attendance is reinforced during or immediately following a session or group.

Similar to abstinence in CM, other behaviors should also be reinforced as immediately as possible following their occurrence. Technology is playing a role in easing some of the challenges related to immediacy of reinforcement. Recent studies (Mitchell et al., 2018; Petry et al., 2015) reinforcing medication adherence used cell phones with video capability to remotely monitor and reinforce adherence in real time. Remote monitoring has also been applied to smoking cessation (e.g., Dallery, Glenn, & Raiff,

2007; Dallery, Raiff, & Grabinski, 2013; Dallery, Meredith, Jarvis, & Nuzzo, 2015; Dallery et al., 2017; Meredith, Grabinski, & Dallery, 2011), alcohol detection (e.g., Alessi & Petry, 2013; Barnett, Tidey, Murphy, Swift, & Colby, 2011; Barnett et al., 2017; Dougherty et al., 2014; Dougherty, Karns et al., 2015; Dougherty, Lake et al., 2015; Mathias et al., 2018), and blood glucose testing among those with diabetes (Raiff & Dallery, 2010).

Frequency of assessment/reinforcement Frequent assessment and reinforcement opportunities are desirable in CM protocols. In abstinence-based CM, the frequency of visits is often dependent on the technology used to test samples. Stimulant and opioid on-site urine tests typically provide a 2 to 3 day detection window, and in order to detect most instances of use, a Monday/Wednesday/Friday schedule optimizes toxicology surveillance and maximizes availability of incentives. Decreasing to twice weekly visits is likely to increase the probability that some substance use may occur without detection, but this schedule can be acceptable with appropriate spacing (i.e., Monday and Thursday or Tuesday and Friday, but not Monday and Wednesday) as in the Clinical Trials Network studies (Peirce et al., 2006; Petry, Peirce et al., 2005a) and the recommended standard protocol for the VA effort (DePhilippis et al., 2018; Petry et al., 2014). Thus, both twice or thrice-weekly CM are acceptable schedules with trade-offs. Thrice-weekly CM offers more reinforcement opportunities than twice-weekly CM, but increases the burden on both the patient and provider and typically increases costs per patient. For these reasons, we recommend a twice-weekly schedule for abstinence-based CM protocols. Less frequent schedules in abstinence protocols, such as those involving only one visit per week, are problematic because this arrangement allows too many opportunities for continued substance use without detection, and they are associated with smaller effect sizes (Griffith et al., 2000).

Other detection technologies, such as alcohol and tobacco breathalyzers, have short detection windows. When relying on these technologies, daily or twice daily assessment and reinforcement visits may be needed to be reasonably sure that most substance use is detected. Other behaviors occurring in a high-frequency pattern (e.g., medication adherence) would also suggest increased frequency of monitoring and reinforcement that best matches the natural behavior.

Another method used to reduce costs and burden involves the use of tapered monitoring schedules. These approaches systematically and gradually reduce the frequency of testing over the treatment period. In one application of this approach, the schedule is set a priori and applied to all clients regardless of testing results. In Petry et al. (2000), alcohol use was monitored daily for the first 4 weeks and then weekly for 4 weeks. During this latter stage, the specific day of testing was randomly selected from among the days the client was scheduled to attend the clinic. In another example (DeFulio, Donlin, Wong, & Silverman, 2009), an adaptive approach was used in which the schedule tapers over time, but is tied to the client's performance. Clients submit thrice-weekly samples for a minimum of 4 weeks. Those consistently submitting samples meeting criteria transition to an intermittent, random schedule for the remainder of the 6-month treatment period. However, if a required sample tested positive or was missed, the frequency reset to thrice-weekly until sustained abstinence was again demonstrated. These tapered monitoring approaches may be particularly useful in

settings where other aspects of care start at high frequency and then taper (e.g., intensive outpatient treatment transitioning to aftercare).

Attendance is not tied to testing technology timelines, but attendance-based CM should still adhere to this principle. As above, reinforcement for attendance to two to three groups or sessions per week would be ideal. A minimum frequency for CM-attendance would be no less than weekly opportunities (Petry, 2012).

Magnitude of reinforcement Magnitude of CM is directly tied to its efficacy (Businelle, Rash, Burke, & Parker, 2009; Higgins et al., 2007; Lussier et al., 2006; Packer, Howell, McPherson, & Roll, 2012; Petry et al., 2004; Silverman et al., 1999), and higher magnitudes may be particularly important with more severe substance use at treatment entry (Petry et al., 2012). In general, a guiding principle for incentive magnitude is that it should be sufficiently large to compete with the behavior targeted for change. If the behavior change is complex and difficult, as drug abstinence is, then sufficient magnitude should be offered to both initiate and sustain this change in the face of triggers and cravings.

Though the magnitude of reinforcement poses one of the biggest and consistently endorsed barriers to implementation (Rash et al., 2012), the monetary amount available per client over the course of the designated treatment period should be on par with magnitudes used in clinical trials if similar outcomes are expected. Voucher-based abstinence CM protocols are typically about \$1,000 per client over 12 weeks of treatment (e.g., Festinger, Dugosh, Kirby, & Seymour, 2014; Higgins et al., 1994; Higgins, Wong, Badger, Ogden, & Dantona, 2000; Schottenfeld, Moore, & Pantalon, 2011; Sigmon & Higgins, 2006). Typical prize-based protocols range about \$250–\$400 per client over the same interval (e.g., Peirce et al., 2006; Petry et al., 2004; Petry, Peirce et al., 2005b). The VA initiative recommended a “standard” prize-based CM protocol with average maximum expected per client of \$364 (Petry et al., 2014). Yet, typical magnitude per client in practice may not adhere to these standards. In a survey of substance use treatment providers indicating they had used reinforcers with clients, more than 75% reported magnitudes of \$50 or less per client over the course of treatment (Rash et al., 2012). This discrepancy is concerning as it may yield little or no consistent effects on client outcomes and contribute to negative perceptions of CM in general. As CM implementation moves forward, a concerted effort to adhere to evidence-based CM protocols, as well as the tools and financial support to do so, is needed.

Escalation The CM protocols described above (e.g., Higgins et al., 1994; Petry et al., 2000) included escalation in monetary amounts or draws with each consecutive demonstration of the target behavior. Most escalating schedules include a reset feature. A reset results from failure to demonstrate the target behavior (e.g., an unexcused missed visit, a positive sample). When these circumstances occur, the client does not earn any incentives that day, and at the next successful demonstration of the target behavior, the amount of reinforcement is reset to the initial value and escalates from there. The inclusion of resets in escalating schedules results in increased negative sample submissions and longer durations of continuous abstinence compared to an escalating schedule without a reset feature (Roll & Shoptaw, 2006). Protocols that include both escalation and resets appear to be optimal both for initiating and sustaining abstinence (Roll et al., 2006).

In summary, clinics should aim for protocols that as closely as possible adhere to those proven efficacious. Any deviations must be considered carefully and consultation with CM experts is encouraged. Continued research on schedule parameters may refine our knowledge about critical and required components of effective designs versus those that can be adapted (Damschroder & Hagedorn, 2011).

Conclusion

CM has generated a large amount of research supporting its efficacy. Despite this evidence base, it remains underutilized in clinical practice (Herbeck, Hser, & Teruya, 2008; McGovern, Fox, Xie, & Drake, 2004; Willenbring et al., 2004; Benishek, Kirby, Dugosh, & Padovano, 2010). It can be widely applied to clients with substance use disorders, regardless of specific drug, and it is suitable across a large number of client demographic and clinical characteristics. We now have an example of a large-scale successful implementation effort through the VA initiative, which provides a model for training, consultation, and coaching. Outside of the VA, looming questions remain about the viability of CM without a reimbursement mechanism (Petry, Alessi, Olmstead, Rash, & Zajac, 2017), and this issue poses a major barrier to its routine use. This dilemma of an efficacious intervention with wide applicability and an inability to provide it will be difficult to resolve without payer and policy changes. Progress in these areas is unlikely without providers, clients, and family members of clients calling on policy makers for change. The VA initiative started with a question: Why are we not providing an efficacious intervention to our veterans? The same question can be asked by the scores of individuals suffering from substance use disorders in treatment across our nation. Why should they be denied access to an intervention that works?

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