Substance use disorders: Principles, components, and monitoring during treatment with contingency management

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INTRODUCTION

Contingency management is a powerful tool in the treatment of patients with substance use disorders (SUD), particularly those for which pharmacotherapy is unavailable or only partially effective. Contingency management is typically delivered as an augmentation to psychosocial treatment such as group addiction counseling and/or cognitive-behavioral therapy delivered in the context of an addiction treatment program.

Contingency management provides incentives to SUD patients contingent upon treatment attendance and/or verified drug abstinence in order to increase the likelihood of these behaviors, which are essential components and outcomes of effective treatment. Contingency management interventions can be customized to address patient preferences or program needs, such as the resources available for the intervention.

This topic describes the theory, principles, assessment, and components of contingency management for use in SUD treatment. Efficacy, implementation, and training for contingency management are discussed separately. Other SUD treatments, including for specific substances and continuing care models, are discussed separately.

- (See "Substance use disorders: Training, implementation, and efficacy of treatment with contingency management".)
- (See "Alcohol use disorder: Pharmacologic management".)
- (See "Alcohol use disorder: Psychosocial management".)
- (See "Cannabis use disorder: Clinical features, screening, diagnosis, and treatment".)
- (See "Stimulant use disorder: Treatment overview".)
- (See "Stimulant use disorder: Psychosocial management".)
- (See "Pharmacotherapy for smoking cessation in adults".)
- (See "Behavioral approaches to smoking cessation".)
- (See "Continuing care for addiction: Components and efficacy".)
- (See "Continuing care for addiction: Implementation".)

THEORETICAL FOUNDATION

Contingency management is based on the principles of operant conditioning, a type of learning in which positive consequences (also called reinforcers) sustain and increase frequency of the behavior that produces them. From this perspective, drug use is conceptualized as operant behavior motivated and maintained by the biological reinforcing effects of drugs, which include their euphoric subjective effects and/or relief from withdrawal symptoms. In this conceptual model, contingency management works by enhancing the positive consequences of drug abstinence through alternative sources of reinforcement that compete with continued substance use.

In the natural environment, positive consequences of drug abstinence may be remote and uncertain (eg, better health, repaired relationships, social productivity) relative to the immediate psychological and physiological effects of using drugs. Contingency management interventions motivate and maintain drug abstinence by providing the drug user with earlier, more salient, and more predictable positive consequences for abstaining from drugs. As examples, monetary-based reinforcers such as tangible prizes or vouchers exchangeable for retail goods have been offered to patients with substance use disorders based on their achievement of objectively measured, agreed-upon goals, particularly drug abstinence, as demonstrated by drug-negative biological tests.

PRINCIPLES

For contingency management to be effective, the connection between performance of the desired behavior and delivery of the reinforcer must be:

- Based on objective evidence of the target behavior (eg, urinalysis evidence of recent drug use versus abstinence)
- Delivered soon after the occurrence of a target behavior
- Delivered frequently
- Of sufficient magnitude
- Reliably and consistently maintained over time

Consistency fosters patient trust in the clinic and its staff. It can counter expectations that some may bring to treatment from a chaotic and unpredictable lifestyle.

INITIAL ASSESSMENT

A psychiatric/substance use evaluation, medical history, physical examination, and laboratory tests, which are generally indicated at the start of an episode of substance use disorder (SUD) treatment, are described in detail separately. (See "Substance use disorders: Clinical assessment".)

An American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) diagnosis of an SUD (or substance abuse/dependence in earlier DSM versions) is typically required for entry into SUD treatment that includes contingency management. Less rigorous criteria (eg, self-reported substance-related problems) may also be appropriate and acceptable in some clinical settings.

Information about severity of the SUD at treatment entry is useful for conceptualizing and potentially tailoring contingency management interventions. The simplest and most objective way to determine current severity is to examine biological (eg, urine) test results during the first few weeks of treatment. Individuals who test negative can be considered low severity (and currently in remission) while those testing positive for one or more drugs can be considered higher severity. Encouraging regular attendance early in treatment including provision of attendance-contingent reinforcers, can provide clinicians the opportunity to obtain a baseline assessment that clarifies the nature and extent of current drug use.

COMPONENTS

Contingency management is not typically delivered as an isolated intervention but as an augmentation of another psychosocial treatment, such as drug counseling, multimodal substance use disorder (SUD) treatment, or a structured behavioral therapy. Two commonly used therapies, cognitive-behavioral therapy (CBT) and the community reinforcement approach

(CRA), are especially compatible with contingency management. CBT teaches skills that should be helpful in remaining drug abstinent. CRA is complimentary in that it introduces and supports alternative behaviors that may compete with drug use. In theory, combined treatment (contingency management plus CBT or CRA) should produce better long-term outcomes than contingency management alone, although evidence on this point is mixed. CBT and CRA are described in detail separately. (See "Substance use disorders: Training, implementation, and efficacy of treatment with contingency management", section on 'Efficacy' and "Substance use disorders: Psychosocial management".)

Target behaviors — The target behavior selected for contingency management must be one that can be objectively observed and measured, minimizing clinician and patient bias from its ongoing assessment. The most common target behaviors for SUDs are treatment attendance and abstinence, as described here.

Treatment session attendance — Measured by staff observation. SUD treatments have traditionally relied on face-to-face meetings for delivery of psychosocial interventions. Attendance at scheduled meetings, however, can be irregular, leading to engagement failure and early drop-out.

Early treatment attendance incentives will ideally promote regular treatment contact and engagement and may forestall early treatment drop-out. As an example of contingency management at the beginning of treatment:

- A noncontingent “priming” reinforcer at intake can introduce patients to the procedure, accompanied by an explanation of the role of tangible incentives in the program.
- A more substantial bonus is provided upon attending the first post-intake session.
- Rewards with escalating values that can encourage frequent, regular attendance are provided thereafter.

Drug abstinence — Established through quantitative or qualitative measurement of the substance and/or its metabolites in breath, saliva, or urine (see 'Drug testing' below), abstinence incentives have been the most widely used evidence-based contingency management intervention in SUD treatment.

Drug testing

Stimulants, opiates, cannabis — Urine tests are most commonly used in contingency management to detect recent use versus nonuse of stimulants, opiates, and cannabis. Urine is the best means of testing for these drugs because there are well-validated testing methods

available that can detect drugs for two to four days after ingestion (sometimes longer in the case of cannabis). Validated saliva testing is also now available.

Urine or saliva tests should be conducted at least twice weekly in the beginning of an abstinence incentive program. Frequency can often be decreased to weekly or less if and when stable abstinence is achieved [1,2]. When testing is infrequent, samples should be collected under an unpredictable schedule so that patients cannot prepare in advance for the upcoming test. Immediate reinforcement can be provided by using validated rapid testing systems on site rather than off-site clinical laboratories, which may require days for results to be obtained.

Urine or saliva samples will, ideally, be collected under direct observation of treatment staff in order to discourage sample falsification or adulteration. Temperature sensitive urine cups and adulterant detection strips may also be used to prevent sample falsification. The cost of onsite urine drug panels for clinical use ranges from approximately 1 to 2 dollars per drug to 5 to 10 dollars for more comprehensive drug panels. Because cannabis may be detected in urine for several weeks after abstinence is initiated, depending on frequency and amount of recent use, it is advisable to give patients a two-week grace period during which attendance incentives are offered before switching the target to cannabis abstinence.

Alcohol — Alcohol's rapid clearance from the body limits the value of urine drug testing and presents challenges to implementing effective contingency management based on testing for alcohol use. Breath alcohol level (BAL) is the current testing method of choice for alcohol consumption as it can at least preclude the awarding of abstinence incentives during a period of acute intoxication.

New measurement methodologies have become available that are making contingency management for alcohol use disorder more feasible and effective, including:

- SCRAM bracelets that detect alcohol consumption from sweat on the skin [3-5]
- Ethyl-glucuronide, a longer-lasting biological marker [6,7]
- Remote breath alcohol monitoring [8,9]

Tobacco smoking — Several biological markers are available to detect recent tobacco smoking. Breath carbon monoxide, a byproduct of combustion, permits convenient, objective measurement, provided that the abstinence criterion cut-off is set sufficiently low (eg, 6 ppm or lower), and testing can be conducted within the window for detection (a few hours since last use). More frequent testing may be possible using internet-based abstinence reinforcement, with breath carbon monoxide readings monitored remotely using a home-based video camera [10] or smart phone [11,12]. Once initial smoking abstinence has been established, cotinine in urine or saliva can be used as the basis for contingency management. This primary metabolite

of nicotine provides a highly specific marker of nicotine exposure over a several-day window. A caveat is that cotinine will not provide a measure of smoking exposure if nicotine replacement medication is part of the treatment.

Reinforcers — A reinforcer is a positive consequence that, when delivered reliably following a particular behavior, increases the subsequent likelihood of that behavior. What will serve as a reinforcer may differ from one individual to another. If tangible prizes are used, these should be salient and desirable to the patient(s), and of sufficient magnitude to effectively motivate behavior change. Because money is a universal conditioned reinforcer in our society, money or monetary value has generally been the basis for contingency management programs.

Cash payments are a convenient way to deliver monetary reinforcers. Although there is no evidence to suggest cash payments increase drug use or likelihood of relapse [13,14], many clinical settings prefer to avoid cash payments to patients out of concern that cash may be too easily used to purchase drugs. Reloadable debit cards are now available that can have added benefits by enabling remote and instantaneous transfer of money [9] while placing restrictions on the amount and/or frequency of cash withdrawal from automated teller machines. Purchase restrictions can also be placed on undesirable establishments such as liquor stores.

Alternative rewards include gift cards and retail goods. Gift cards retain the motivational effects and flexibility of money, and can be readily varied in magnitude while addressing individual patient preferences. Because individuals differ in how they value different incentives, it is advisable to ask patients what they would like to work for, including specific retail gift cards, before selecting a reinforcer for contingency management (table 1).

Several studies have demonstrated that magnitude (eg, the total dollar value) of reinforcer is generally positively associated with a higher likelihood of behavior change [1,15-18]. As an example, a six-month study of contingency management in treatment of cocaine use, published in 2007, found that twice as many subjects were abstinent at the end of treatment when the incentives were valued at $2000 compared with $500 (about 50 versus 25 percent) [15]. A 2006 review of research on voucher reinforcement concluded that effect size of the intervention increased systematically as average reinforcer values ranged from less than $5 to more than $16 per day [16]. When a contingency management intervention is ineffective, the type and magnitude of reinforcers should be reviewed, and changed if indicated.

Reinforcement methods — Two widely employed methods for delivering reinforcers in contingency management are described below.

Voucher reinforcement — Upon achieving target behaviors, participants earn vouchers with point value designations that can be traded for retail goods of the patients' choosing. As an

example, in a 12-week trial of 40 patients with stimulant use disorder randomized to contingency management or a control condition, patients received vouchers for each stimulant-negative urine sample submitted in tests conducted three times weekly [19]. The monetary value of points awarded started at $2.50 and increased steadily over time (at $1.25 per urine sample). A $10 bonus was awarded each time the patient achieved three consecutive negative urine tests in a row. A reset penalty was used for relapse prevention by returning the value of the vouchers to its original low value if a urine test was missed or positive. Escalation of points with reset as a penalty is designed to promote sustained (rather than sporadic) abstinence by making drug users increasingly "invested" in their own abstinence.

The total amount of money available to each participant during the first 12 weeks in the standard voucher method was about $1000. This value was meant to be highly attractive and sufficient to motivate the difficult task of achieving and sustaining drug abstinence. Patients could accumulate points and request exchange for tangible items at any time; staff would then purchase the desired items.

Intermittent prize-based reinforcement — Intermittent prize-based reinforcement was developed to provide a potentially lower-cost but still effective alternative to voucher programs [1,20,21]. The method relies on intermittent reinforcement in which only occasional instances of the behavior are reinforced. It is called the "fishbowl method" because patients who achieve target behaviors earn draws from a bowl filled with chips, rather than vouchers of a fixed amount. To promote sustained durations of behavior change, the number of draws escalates over successive instances of the target behavior (eg, submission of drug-negative urine) and resets to the original low number of draws with missing or positive urines.

The chips have different values that can be exchanged for prizes: Typically half indicate "good job" while the other half have values ranging from 1 to 100 dollars. A much higher frequency of low than of high value chips is generally included in the bowl (eg, there may be only a single $100 chip) and the number and value of chips, as well as the total number of draws, can be altered in a specific application to control the total value of available prizes. In initial application, clients were asked what they want to work for and prizes were kept on site and visible to enhance saliency. A "standard" fishbowl in initial studies (conducted in 2006 and 2014) offered $250 in prizes over a 12-week intervention; in other studies, prize earnings totaling $400 have been used [22,23]. A lower total earning amount of $80 (2004) was not efficacious [1].

Monitoring — The delivery of contingency management is consistent with a scientist-practitioner model of therapy [24]. The systematic collection of data to track each patient's participation and outcomes can help clinicians formulate individualized treatment goals,

understand what interventions are helpful, and provide individualized feedback, done most effectively in a graphical representation of outcomes over time (figure 1 and figure 2) [25].

Technological innovations — Contingency management is incorporated into two smartphone apps:

- A software application that uses client self-administered saliva and breath testing as the basis for contingency management incentives with testing verified by video monitoring and rewards delivered remotely by company staff.
- A software application that relies on clinicians to administer and verify sample testing for contingency management; it also offers a bank of CBT modules that patients self-administer. The application has been approved by the US Food and Drug Administration for SUD treatment.

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Opioid use disorder and withdrawal" and "Society guideline links: Benzodiazepine use disorder and withdrawal" and "Society guideline links: Alcohol use disorders and withdrawal" and "Society guideline links: Stimulant use disorder and withdrawal" and "Society guideline links: Cannabis use disorder and withdrawal".)

SUMMARY

- Contingency management in the treatment of patients with substance use disorders (SUDs) uses incentives to encourage attendance and/or abstinence from alcohol/drug use. Contingency management is typically delivered as an augmentation to other psychosocial and medication-based treatment. (See 'Introduction' above and 'Target behaviors' above.)
- A psychiatric and substance use evaluation, medical history, physical examination, laboratory tests, and direct observation of urinalysis results should be performed at the start of an episode of SUD treatment to establish current drug use status (active versus remitted) and reinforcer preferences. (See 'Initial assessment' above and "Substance use disorders: Clinical assessment".)

- Incentives used as contingent reinforcers are generally discrete tangible items that can be delivered repeatedly following the occurrence of the target behavior. Reinforcers should be of sufficient magnitude and salience to the patient to effectively motivate behavior change. Typical examples include gift cards, retail goods, or cash transferred to a reloadable card. (See 'Reinforcers' above.)

- Urine or saliva testing is the most common and convenient method for determining abstinence in contingency management for SUD including stimulants, opioids, and cannabis. Observed sample testing should be conducted at least twice weekly in order to detect short-acting drugs. Frequency can be decreased to once weekly or less after stable abstinence is achieved. (See 'Drug testing' above.)

- Two methods are available to deliver contingent incentives. In the voucher method, participants earn points with monetary value for each instance of the target behavior and points can be traded for retail goods of the patients' choosing. Prize bowl reinforcement uses the principle of intermittent reinforcement with draws from a bowl that provide probabilistic rather than certain reinforcement following each instance of the behavior. Both methods have been tested and found to be effective. (See 'Reinforcement methods' above.)

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