CONTINGENCY MANAGEMENT FOR THE TREATMENT OF OPIOID USE DISORDERS

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OHIO SUBSTANCE USE DISORDER

CENTER OF EXCELLENCE

Department of Mental Health & Addiction Services

Substance Use Disorder Center of Excellence

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Executive Summary

Background

Opioid use disorder (OUD) is a significant public health challenge in the United States, with opioids linked to the highest rates of overdose deaths. Contingency management (CM) is an intervention based on operant conditioning principles that has shown promise in treating substance use disorders, including OUD. This report outlines findings from a literature review conducted to examine the effectiveness of CM in addressing OUD.

Methods

A comprehensive literature review was conducted using multiple databases, including APA PsycInfo, CINAHL, MEDLINE, Psychology and Behavioral Sciences Collection, SocINDEX, and the Cochrane Library. The search focused on experimental studies examining CM interventions for OUD. A total of 41 articles met the inclusion criteria and were reviewed in depth.

Findings

All studies examined opioid use outcomes with most of them also reporting on other types of drugs and alcohol. Seventeen studies reported positive findings for opioid use outcomes, 13 had mixed results, and 11 reported no statistically significant effect. Treatment retention outcomes were examined by 33 studies. Of those, seven studies found positive effects of CM on treatment retention, five showed mixed results, and 21 found no statistically significant effect. Seven studies examined mortality and morbidity related outcomes, with none finding statistically significant differences between CM and comparison groups. Only two studies reported on craving, with no evidence of CM's effectiveness on this outcome.

Conclusion

Contingency Management shows promise in treating OUD, particularly in reducing drug use and improving treatment retention. However, results are mixed, exacerbated by the variability of the CM approach and study designs. The long-term effectiveness of CM also remains unclear since only a handful of studies included follow-up outcomes. More research is needed to determine the optimal implementation of CM for OUD treatment.

Opioid Use Disorder Trends in the U.S. and Ohio

Substance misuse poses a significant challenge in the United States, with opioids being linked with the highest rates of overdose deaths (Ahmad et al., 2024). The term "opioids" refers to a class of drugs including prescription pain medications with addiction potential, such as oxycodone and morphine, as well as pharmaceutical fentanyl, illegally made fentanyl, and the illegal drug heroin (Centers for Disease Control and Prevention [CDC], 2024a). As a strong synthetic opioid, pharmaceutical fentanyl is usually prescribed for advanced stage cancer patients and severe pain (CDC, 2024b). Illegally made fentanyl is attained through the drug market and has been a major contributor to overdose death rates in recent years (CDC, 2024b; Ahmad et al., 2024). While prescription opioids can help manage pain effectively, it is important for patients to take them only as prescribed by a doctor to minimize the risk of developing serious side effects or an addiction (American Association of Anesthesiologists, 2024). Opioid use disorder (OUD) is a condition characterized by compulsive and prolonged misuse of illicit or prescription opioids, diagnosed when an individual exhibits at least two of several diagnostic criteria within a 12-month period, including loss of control over use, cravings, persistent social or occupational problems, and continued use despite negative physical or psychological consequences (American Psychiatric Association, 2022).

The Centers for Disease Control and Prevention's National Vital Statistics System provides reported and provisional drug overdose death estimates for every month from January 2015 through the present (Ahmad et al., 2024). Estimates represent the count of deaths that occurred over the last 12 months since the month of the estimate. Data is available at the national and state levels for several drug classes. Figures 1 and 2 show trends in drug overdose deaths connected to opioid use in the US and Ohio between 2015 and 2023 where data are available.

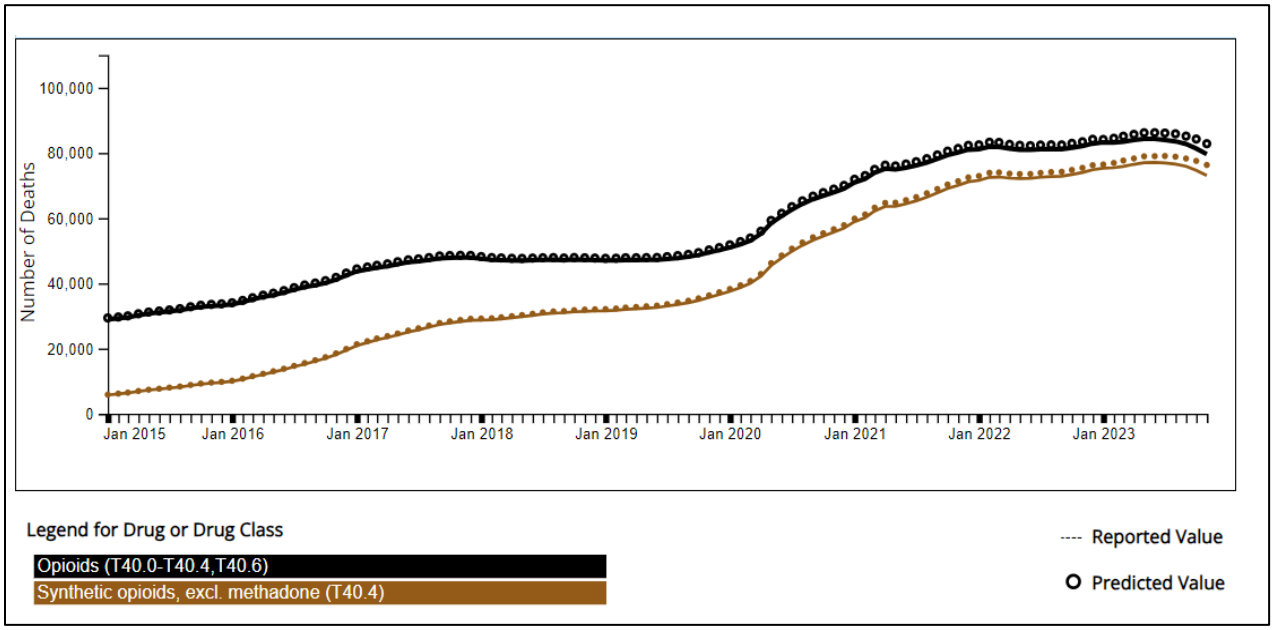
The reported number of deaths from opioids increased between January 2015 and November 2023 in the U.S and Ohio. The reported number of deaths from opioids[1] in the U.S. increased nearly threefold, from 28,986 in January 2015 to 79,642 in November 2023. For Ohio, overdose deaths due to opioids increased from 2,335 in April 2015 to 3,898 in November 2023, representing about a 1.67-fold increase (Ahmad et al., 2024). According to the Ohio Department of Health, in 2022, fentanyl or its analogs were involved in 81% of unintentional drug overdose deaths and 96% of opioid-related overdose deaths in the state.[2]

[1] "Opioid overdose deaths are identified by the presence of any of the following multiple cause-of-death codes: opium (T40.0); heroin (T40.1); natural opioid analgesics (T40.2); methadone (T40.3); synthetic opioid analgesics other than methadone (T40.4); or other and unspecified narcotics (T40.6)" (Ahmad et al., 2024).

[2] For more detailed information on drug overdose deaths for the state of Ohio, see the Ohio Department of Health's 2022 Unintentional Drug Overdose Report: https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/violence-injury-prevention-program/media/2022-ohio-drug-overdose-report.

Figure 1

Provisional Number of Drug Overdose Deaths by Drug or Drug Class: United States[3]

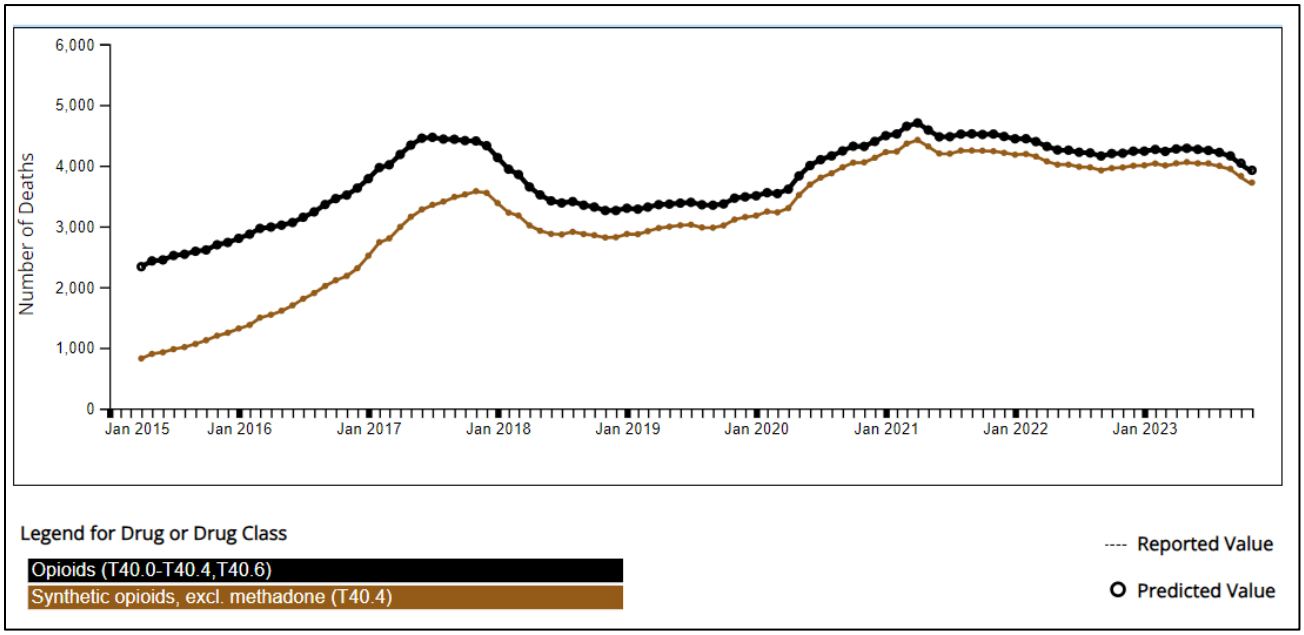


Source: Ahmad, F. B., Cisewski, J. A., Rossen, L. M., and Sutton, P. (2024). *Provisional drug overdose death counts.* National Center for Health Statistics.

[3] Ahmad et al. (2024) noted: "Reported provisional counts for 12-month ending periods are the number of deaths received and processed for the 12-month period ending in the month indicated. Provisional counts may not include all deaths that occurred during a given time period. Therefore, they should not be considered comparable with final data and are subject to change. Predicted provisional counts represent estimates of the number of deaths adjusted for incomplete reporting…Drug overdose deaths involving selected drug categories are identified by the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD–10) multiple cause-of-death codes." See https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm for more information.

Figure 2

Provisional Number of Drug Overdose Deaths by Drug or Drug Class: Ohio[1]



Source: Ahmad, F. B., Cisewski, J. A., Rossen, L. M., and Sutton, P. (2024). *Provisional drug overdose death counts.* National Center for Health Statistics.

This report describes the use of contingency management (CM) for addressing OUD and preventing overdose deaths. The following sections define and describe CM and summarize the results of a literature review that was conducted to understand the effectiveness of CM in treating OUD. The literature review focused on answering the following questions:

1. What are the substance use outcomes associated with the use of CM to address OUD?
2. What are the treatment retention outcomes associated with the use of CM to address OUD?
3. What are the mortality and morbidity related outcomes associated with the use of CM to address OUDs?

Contingency Management

According to the Department of Health and Human Services (HHS), there are several effective FDA-approved medications for opioid use disorder (MOUD), including buprenorphine, methadone, and extended-release naltrexone (U.S. Food and Drug Administration [FDA], 2024; HHS, 2023). Although effective in reducing opioid use, these medications (often referred to as first-line treatments) can be combined with other interventions to generate better clinical outcomes, especially among individuals exhibiting poor treatment adherence and continued use (Holtyn, Toegel, & Novak, 2023). One such intervention that has been used in conjunction with medication-assisted treatment (MAT) for OUD is contingency management (CM).

Contingency management is grounded in operant conditioning, which is a learning process focused on behavioral modification through the association of stimuli with positive reinforcement or punishment (Higgins & Petry, 1999). Historically, the primary focus of CM has been the cessation of drug use, usually conceptualized as the longest period of continued abstinence, with treatment retention, attendance, and medication compliance introduced in more recent studies. Typically, urine drug tests (UDTs) are administered multiple times each week (to detect brief periods of abstinence) and abstinence is positively reinforced each time a negative UDT is submitted. The reinforcers can be monetary-based and consist of vouchers that are exchangeable for goods, analogous to a clinic-managed bank account or a clinic-managed store. Some programs allow participants to earn a certain number of entries to a raffle or lottery-style draw for each instance of meeting a behavioral goal, with prizes usually ranging from US $1 to $100 in value. Some CM programs include a negative reinforcement component, where missed or positive UDTs might result in a reset of the voucher magnitude or number of draws. Importantly, in effective CM interventions, the magnitude of reinforcement provided (voucher

amounts or draws for prizes) increases with sustained periods of abstinence and resets upon non-compliance (Budney & Higgins, 1998; Petry, 2000; Petry & Stitzer, 2002).

In practice, the core of CM lies in providing immediate rewards for target treatment goals (i.e., abstinence, treatment attendance, meditation compliance) that support and reinforce a drug-free lifestyle (Michigan Department of Health and Human Services [MDHHS], 2024). Research has found that incorporating CM into OUD treatment can lead to improved medication adherence, longer periods of abstinence (especially for individuals with polysubstance use), longer treatment engagement, and better social functioning (Carroll et al., 2001a; HHS, 2023; Jarvis et al., 2019; Oliveto et al., 2005; Proctor, 2022).

Voucher-Based Reinforcement Therapy

Voucher-based CM is commonly used in trials that reinforce abstinence from both stimulants and opioids. In the early 1990's, Higgins and colleagues were among the first to apply the principles of operant behavioral learning to the understanding and modification of drug use behavior (Higgins et al., 1994; Higgins & Silverman, 1999). They manualized a 24-week intervention that included a combination of counseling based on the Community Reinforcement Approach (CRA) and 12 weeks of voucher-based-CM contingent on cocaine abstinence. During the initial 12 weeks, participants were expected to attend counseling sessions twice a week and undergo urine toxicology testing for cocaine three times a week. During weeks 13-24, the schedule was reduced to one weekly counseling session and urinalysis twice a week. In their later work, Higgins and his colleagues (2019) explained that allowing participants to earn vouchers for submitting negative cocaine urine drug samples during the initial 12 weeks of the intervention served as a crucial first step. This approach was intended to establish naturalistic sources of reinforcement for a healthy lifestyle. Specifically, they provided vouchers

exchangeable for retail items “to bridge that temporal gap between entering treatment and initiating cocaine abstinence and establishing natural sources of nondrug reinforcement in one’s community that would be necessary to sustain longer-term abstinence” (Higgins et al., 2019, p. 504).

The key characteristics of the voucher system manualized by Budney & Higgins (1998) included an escalating schedule, a bonus, and a reset contingency. According to a recommended reinforcement schedule, participants could earn points for submitting negative UDTs, each worth approximately $0.25. During the initial 12 weeks of the intervention, the first negative UDT was worth 10 points ($2.50), with points per sample increasing by five points with each consecutive negative UDT, e.g., second negative UDT = 15 points (10 + 5) or $3.75 ($2.50 + $1.25). A $10 bonus was given for every three consecutive negative UDTs. Positive UDTs earned zero points and resulted in a reset. A reset implies that the subsequent negative UDT would revert to the starting value, which, in this instance, would be 10 points ($2.50). However, five consecutive negative UDTs following a reset would restore the voucher back to its value prior to the reset. During weeks 13-24, participants were eligible to receive one state lottery ticket for each cocaine-negative UDT (Budney & Higgins, 1998). In total, each patient could earn up to $997.50 in vouchers throughout the initial 12 weeks of treatment (Budney & Higgins, 1998; Higgins et al., 1994). Although quantified as cash values, the vouchers were only redeemable for retail items, previously approved and in support of a cocaine-free lifestyle (Budney & Higgins, 1998). Several more recent adaptations of the CRA-plus-voucher system have used the original design proposed by Higgins and colleagues (1994) to promote continuous abstinence, while others have explored the effectiveness of varying reinforcement schedules (Roll et al., 2006).

Prize-Based Contingency Management

Another widely used technique, also known as the "fishbowl", or simply prize-based CM, was developed and later manualized by Petry and Stitzer (2002) as part of the National Institute on Drug Abuse (NIDA) funding. The manual draws from earlier CM research, focused on individuals with cocaine and opioid use disorders (Petry et al., 2000, 2001, 2002), to propose low-cost clinical management strategies for a range of treatment settings (Petry & Stitzer, 2002).

As compared to voucher-based CM, which rewarded abstinence with a predictable monetary value exchangeable for goods or services, the "fishbowl" technique is a probabilistic approach that reinforces abstinence with a chance of winning a prize. For every drug-negative UDT, submitted twice a week, an individual would get one draw from the fishbowl and select a prize from the appropriate category if they drew a winning slip. The prizes usually range from small ($1) to jumbo ($100), but about half of the draws typically result in "non wins." Each consecutive negative UDT allows the participant to draw more prizes, including bonus rounds. Missed or positive samples typically result in the reset in the number of draws. Despite a relatively low probability of an individual winning a large or jumbo prize during the course of the intervention, Petry & Stitzer (2002) argued for allowing participants to select and suggest desired future prizes. Allowing feedback from participants can both motivate the patient to maintain their abstinence and help reduce the overall cost of running a CM program. The authors estimated that even with a $5000 budget for prizes and 50 participants, the cost would be an average of $100 per patient. Figure 3 below is a sample fishbowl schedule that would allow the patients to earn 20 draws per week.

Figure 3

Sample Fishbowl Schedule

	Number of Slips	Probabilities of Winning	Average Price/Prize	Cost per Draw
Non-winners	375	0.500		
Smalls	269	0.359	$ 0.70	$0.25
Mediums	75	0.100	3.50	0.35
Larges	30	0.040	14.00	0.56
Jumbo	1	0.001	70.00	0.09
TOTAL	750			$1.25

Source: Petry & Stitzer (2002). Contingency Management: *Using Motivational Incentives to Improve Drug Abuse Treatment.* Yale University Psychotherapy Development Center Training Series No. 6.

Statewide Implementation of Contingency Management in Michigan

Starting October 1, 2024, the Michigan Department of Health and Human Services (MDHHS) will be launching the Recovery Incentives Pilot, a contingency management program for individuals with stimulant use disorder (StimUD), OUD, or both. In addition to being diagnosed with StimUD and/or OUD, eligible participants must be currently enrolled in Medicaid or Healthy Michigan Plan (HMP). The newly developed program mirrors California's Recovery Incentive Program in its overall goals (i.e., addressing the SUD crisis with evidence-based practices, and improving the health of those with SUD), and implementation, including several CM-specific areas (i.e., duration of the intervention, reinforcement schedule, total incentive amount per participant, electronic mechanism for calculating and delivering incentives). However, the emphasis on both StimUD and OUD differentiates Michigan's program from California's Recovery Incentives, which seems to prioritize abstinence from stimulant use (Peck et al., 2023).

Description of Michigan's Statewide Contingency Management Treatment Program

The version of CM used in Michigan's Recovery Incentives Pilot is grounded in the theoretical principle of behavioral reinforcement and provides motivational incentives to

individuals with StimUD and/or OUD for meeting treatment goals (MDHHS, 2024). Using an escalating schedule of reinforcement grounded in the early work of Budney & Higgins (1998) and a more recent Recovery Incentive Program implemented in California (Peck et al., 2023), the amount of reward (vendor-specific gift cards) increases with continued abstinence and treatment retention (12 weeks of CM followed by 12 weeks of a stabilization period).

Participants are subject to a UDT twice per week for the first 12 weeks and once per week for weeks 13-24. During the initial 12 weeks, participants start at $10 for each stimulant or opioid-free sample, escalating by $1.50 for each week of consecutive abstinence - assessed twice-weekly (e.g., a participant a total of $69 after third week of consecutive abstinence). In short, the longer the period of abstinence, the more the weekly rewards for continuous abstinence grow. During the initial 12 weeks, participants who start with a positive stimulant or opioid UDT, but show continued engagement in treatment, can earn a partial incentive of $5 during each of the two weekly CM visits. During weeks 13-24 (i.e., stabilization period), UDTs are collected once per week and substance-free samples are rewarded with either a $10 or $15 gift card, with a final possible gift card worth $21 in week 24.

A reset of the reward progression (referred to as “reset” hereafter) occurs when a participant submits a positive UDT or has an unexcused absence. The next time they submit a stimulant negative UDT, their reward level will “reset” to the initial incentive value (e.g., $10). After two consecutive substance-negative UDTs, the participant will “recover” their previously earned incentive level plus the next escalation of $1.50. The total amount of incentives per participant per calendar year is $599 (MDHHS, 2024). The program uses an incentive manager platform to record information regarding individual CM visits (i.e., UDT results), calculate appropriate incentive amounts, and deliver monetary incentives (i.e., gift cards or debit cards) to

eligible participants. Below is an example of the escalating schedule developed for the Recovery Incentive Program (See Figure 4).

Figure 4

Sample Contingency Management Reward Schedule

Table 2: Hypothetical Incentive Delivery Schedule for Consistent Abstinence					
Week	**Visit**	**UDT Result**	**Incentive Earned (For Visit)**	**Incentive Earned (Cumulative)**	**Notes**
1	1	Neg	$10.00	$10.00	
	2	Neg	$10.00	$20.00	
2	3	Neg	$11.50	$31.50	
	4	Neg	$11.50	$43.00	
3	5	Neg	$13.00	$56.00	
	6	Neg	$13.00	$69.00	
4	7	Neg	$14.50	$83.50	
	8	Neg	$14.50	$98.00	
5	9	Neg	$16.00	$114.00	
	10	Neg	$16.00	$130.00	
6	11	Neg	$17.50	$147.50	
	12	Neg	$17.50	$165.00	
7	13	Neg	$19.00	$184.00	
	14	Neg	$19.00	$203.00	
8	15	Neg	$20.50	$223.50	
	16	Neg	$20.50	$244.00	
9	17	Neg	$22.00	$266.00	
	18	Neg	$22.00	$288.00	N/A
10	19	Neg	$23.50	$311.50	
	20	Neg	$23.50	$335.00	
11	21	Neg	$25.00	$360.00	
	22	Neg	$25.00	$385.00	
12	23	Neg	$26.50	$411.50	
	24	Neg	$26.50	$438.00	
13	25	Neg	$15.00	$453.00	
14	26	Neg	$15.00	$468.00	
15	27	Neg	$15.00	$483.00	
16	28	Neg	$15.00	$498.00	
17	29	Neg	$15.00	$513.00	
18	30	Neg	$15.00	$528.00	
19	31	Neg	$10.00	$538.00	
20	32	Neg	$10.00	$548.00	
21	33	Neg	$10.00	$558.00	
22	34	Neg	$10.00	$568.00	
23	35	Neg	$10.00	$578.00	
24	36	Neg	$21.00	$599.00	**Total possible incentive amount**

Source: Michigan Department of Health and Human Services. (2024). *Proposed Policy Draft: Recovery Incentives (RI) Pilot.* https://www.michigan.gov/mdhhs/-/media/Project/Websites/mdhhs/Assistance-Programs/Medicaid-BPHASA/Public-Comment/2024/2427-BH-P.pdf?rev=8590a6dcc7064e01b701b3f10e4cee79&hash=7067C6C41741A17D0C3F8CCEC7C8A8CD

Literature Review Process

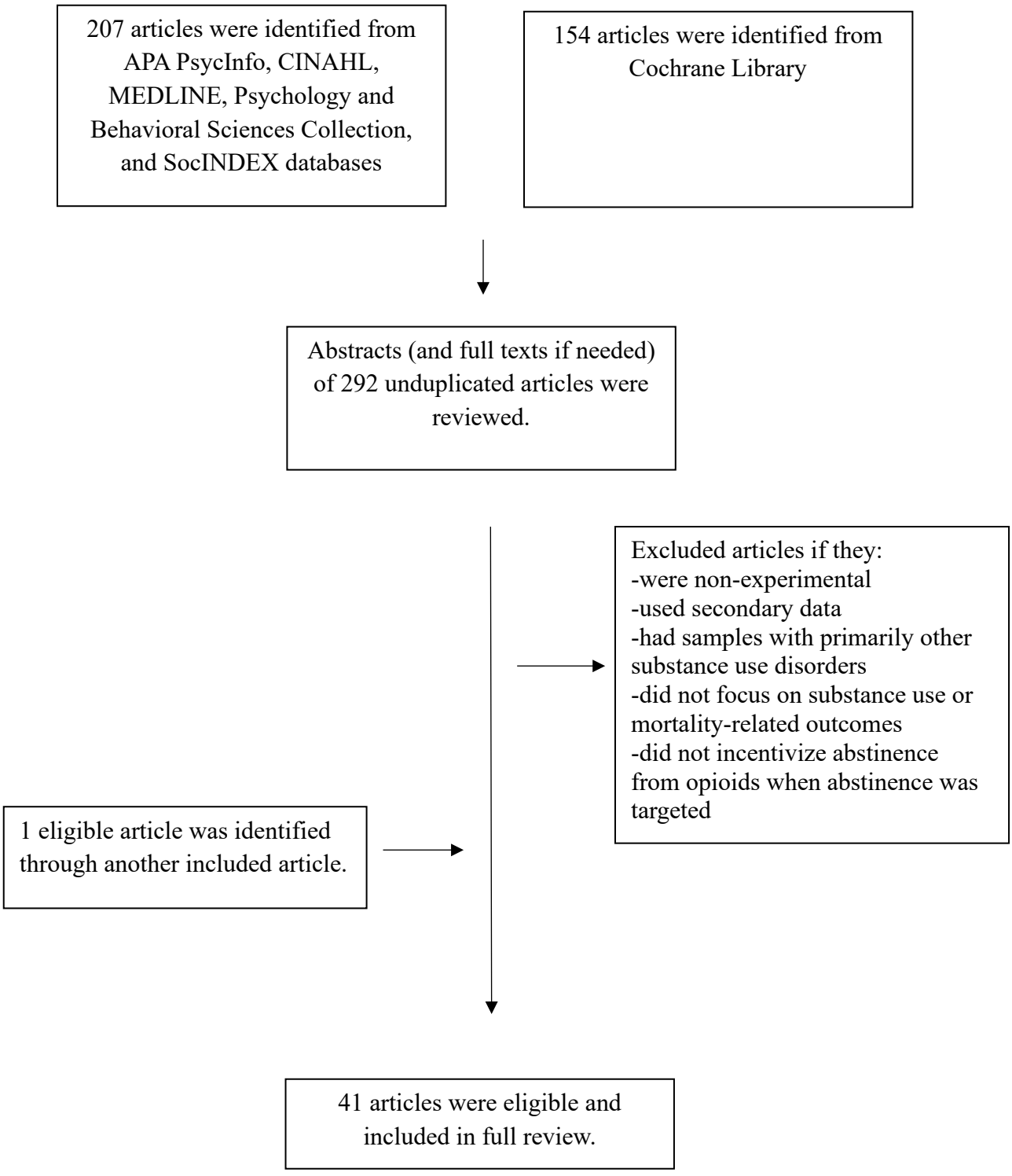
Literature reviews are often conducted to understand a topic in depth. The stages of a literature review involve creating a search strategy, identifying relevant sources, summarizing, and organizing them around relevant themes, and synthesizing the information that is presented by the sources. The purpose of this literature review was to assess the effectiveness and utility of contingency management (CM) by identifying and synthesizing relevant studies examining their outcomes.

The first phase of the literature review included developing and refining relevant search phrases that represent the topic of interest and identifying key social and behavioral sciences research databases for use in the literature search. Databases such as APA PsycInfo, CINAHL, MEDLINE, Psychology and Behavioral Sciences Collection, and SocINDEX were searched using "(contingency management or CM or voucher or prize) AND (opioid dependence or opioid addiction or opioid use disorder or opioid misuse or opioid abuse) AND (experimental or experimental study or experimental design or randomized controlled trial or rct or clinical trial)" phrases. The search was carried out in May 2024 and encompassed all existing literature up to that date. This search yielded a total of 207 unduplicated results. A related search in the Cochrane Library, a well-reputed healthcare and medical research database that includes clinical trials, systematic reviews, and meta-analyses (Cochrane, 2023), was carried out using "(contingency management) AND (opioid dependence or opioid addiction or opioid use disorder or opioid misuse or opioid abuse)" phrases. This search yielded 154 results. Abstracts and full texts of the articles from all databases were screened. Articles were included in the full review if they were experimental in design, used primary data, and had samples primarily with OUDs or opioid misuse. Articles were excluded if they were not experimental in design, used secondary data, did

not incentivize abstinence from opioids when abstinence was targeted, or did not focus on substance use or mortality-related outcomes. Forty articles were identified as eligible for an in-depth review. One additional related article was identified via one of the included articles, resulting in a total of 41 articles (see Appendix A for a full summary of the articles). All studies used experimental designs, where participants were randomly assigned to one of the treatment groups that were compared to identify statistically significant differences. Figure 5 illustrates the literature review process.

Figure 5

Literature Search Process Funnel for Identifying Contingency Management Outcome Studies



Summary of the Contingency Management Outcome Studies

All studies in this review used experimental designs where participants were randomly assigned to a contingency management (CM) group or a comparison group. A few studies used a version of experimental design where participants served as their own control. Contingency management was often combined with another treatment when assessing outcomes. Most studies (all but three) included samples receiving MAT. Fifteen studies focused on special populations, including pregnant women, sex workers, individuals with HIV or antisocial personality disorder, veterans, those with mental illness, unemployed individuals, and people engaging in risky behaviors such as syringe sharing.

A total of 31 studies provided vouchers and five offered prizes as incentives. Eight studies (not mutually exclusive with some of the studies that used vouchers) used opioid medication incentives (e.g., take-home doses, flexible schedules) or treatment privileges (e.g., selecting number of counseling sessions) as incentives. Follow-up assessments were conducted in nine studies, although one of these did not separate the follow-up outcomes. The majority of the studies (n=37) were conducted in the United States, while two took place in China, one in Israel, and one in the United Kingdom. Notably, only one study (Metrebian et al., 2021) actively monitored fidelity to CM implementation. Another study (Ling et al., 2013) reported providing CM booster sessions to staff members to enhance fidelity to CM. The sample sizes varied considerably across the studies, ranging from as few as 11 participants to as many as 552.

Drug Use Outcomes

Studies often screened urine drug samples to detect the presence of multiple substances. Some studies also used self-reported drug use outcomes in addition to testing urine drug samples. Opioid and cocaine use were the most frequently reported outcomes. Studies with

statistically significant results for opioid use or overall drug use outcomes are included under "Studies with Positive Results" section. Studies that reported non-significant results for opioid use; studies with multiple statistical analyses that yielded conflicting results; and those that found a statistically significant result in the short term or long term but not at both are included in the "Studies with Mixed Results" section. Finally, studies that did not find any statistically significant outcomes are included in the "Studies Reporting No Effect" section. Fidelity and training information was provided if the study reported them.

Studies with Positive Results

Seventeen studies demonstrated positive outcomes regarding opioid use, with positive outcomes defined as increased abstinence from opioids as reported by the study. The criteria for determining positive outcomes were multifaceted. In studies reporting both objective measures of abstinence (e.g., urinalysis) and self-reported opioid use, the results of the objective measure were given precedence. Thus, a study was classified as having a positive outcome even if self-reported data did not corroborate the objective findings. Additionally, studies were considered to have a positive result if outcomes were favorable when opioid and other drug use were reported jointly, even if opioid-specific outcomes were not positive in isolation. This approach allows for a comprehensive evaluation of interventions that may have broader impacts on substance use behaviors, while maintaining a focus on opioid-related outcomes.

All but one study (Kidorf et al., 2009) included study participants who were receiving some form of MAT. Sample sizes ranged from 11 to 388 across the studies, with the majority having more than 100 participants. Eleven studies focused on voucher-based CM and one of them had a therapeutic workplace component. Two studies evaluated prize-based CM and one of them included medication-based contingencies where participants earned draws for taking

methadone (Chen et al., 2013). Two studies evaluated medication- and voucher-based CM groups separately; and one study evaluated contingency contracting, where participants moved through treatment phases that encouraged abstinence, and the provision of methadone was contingent on abstinence (Calsyn et al., 1994). Sixteen studies incentivized abstinence, while one incentivized attendance only (Kidorf et al., 2009). In addition to incentivizing abstinence, three studies incentivized attendance, two studies incentivized compliance with opioid treatment medication, and one incentivized job performance. Of the studies that targeted abstinence, 14 incentivized abstinence from multiple drugs while two incentivized abstinence from opioids. Among the studies that examined additional drug use outcomes, some reported partially positive results for non-opioid substances.

Studies with Voucher-Based CM. Most of the studies lasted 12 weeks in duration. Ten out of 11 studies reported possible maximum amount of earnings, which ranged from $269 to $3,369. A study by Preston et al. (2000) hypothesized that CM combined with a methadone dose increase would be more effective together than separately for heroin abstinence. After a five week baseline treatment with methadone medication, 120 participants who were still using heroin were randomly assigned to one of the four interventions for the following 8 weeks: contingent vouchers (vouchers given for opiate-negative urine samples), dose increase (methadone hydrochloride dose increased from 50 mg/d to 70 mg/d and noncontingent vouchers), combined treatment (contingent vouchers plus methadone dose increase), and comparison standard (noncontingent vouchers and no methadone dose increase). Noncontingent groups received matching vouchers irrespective of urine drug test results. Participants in all groups received methadone medication and weekly individual counseling. Participants in the two CM groups received vouchers starting from $2.50 which increased by $1.50 for every

successive opiate-negative sample. Three consecutive opiate-negative urine drug samples earned $10 worth of bonus vouchers. Participants could earn a total of $554 for eight weeks of total abstinence. The results showed that abstinence among all four groups was improved during the intervention compared with baseline. Contingent vouchers statistically significantly increased the number of consecutive opiate-negative urine drug samples, and CM had an effect independent from that of the dose increase. Dose increase, but not CM, was statistically significantly associated with decreased self-reported opiate use. Contingency management and dose increase were independently and jointly associated with statistically significant reductions in cocaine use, as measured by urine drug samples.

Carroll et al. (2001a) assessed the efficacy of CM and significant other involvement (SO) in enhancing naltrexone treatment outcomes among 127 individuals seeking treatment for OUD. Participants were randomly assigned to one of the three conditions: standard naltrexone treatment, given three times a week; naltrexone treatment plus CM, with delivery of vouchers contingent on naltrexone compliance and drug-free urine specimens; or naltrexone treatment, CM, plus SO, where a family member was invited to participate in up to six family counseling sessions. All groups received weekly group cognitive behavioral therapy sessions. The trial used an escalating schedule of reinforcement that rewarded a participant $0.80 for the first opioid-free urine sample with the value of the voucher increasing by $0.40 for each consecutive drug-negative urine sample. Failure to submit a urine test or testing positive for opioids resulted in a reset to the baseline voucher value of $0.80. There were no bonuses for continued abstinence. The same reinforcement schedule with reset was used to reinforce weekly naltrexone compliance. Although the two tracks provided independent reinforcement, $561 was the maximum earning per participant given perfect compliance with both the naltrexone regimen

and all urine samples testing negative for opioids. Overall, participants across all study groups reported more than 90% abstinent days during treatment. Assignment to CM was associated with a statistically significantly greater reduction in opioid use (19 vs 14 opioid-free urine specimens) compared with standard naltrexone treatment. More specifically, participants in either of the CM groups had statistically significantly more mean days of abstinence from opioids, longer periods of consecutive abstinence from opioids, a higher total number of opioid-negative urine specimens, and a higher percentage of opioid-negative urine specimens compared with those in the standard naltrexone group. There was a trend towards increased abstinence from cocaine and alcohol in the CM groups, but these findings were not statistically significant.

Dallery et al. (2001) evaluated a voucher-based abstinence reinforcement procedure for reducing drug use among 11 treatment-resistant methadone maintenance treatment patients with opioid and cocaine use disorder. Participants underwent two 13-week experimental phases: Phase 1 included a 60 mg methadone dose plus membership in either a low-magnitude or high-magnitude CM condition (n=11) while Phase 2 included a 120 mg methadone dose plus low-magnitude CM or high-magnitude CM (n=8). They could earn up to $374 in vouchers during the low-magnitude condition or $3,369 in vouchers during the high-magnitude condition for providing opiate- and cocaine-free urine drug samples. The study found a statistically significant reduction in drug use (i.e., percentage of participants testing negative for opiates and cocaine and cocaine only but not for opiates only) over time in both low and high magnitude groups. The results from both phases revealed statistically significant trends toward greater abstinence in the high voucher condition for both drugs and cocaine only, but not for opiates only.

Kosten et al. (2003a) evaluated whether desipramine plus CM would result in a greater reduction in use than either CM or medication alone for 160 individuals who had opioid and cocaine use disorder and were stabilized on buprenorphine over a 12-week period. Participants were randomized into four groups: desipramine and CM (DMI + CM), desipramine and non-CM (DMI + NCM), placebo and CM (PLA + CM), and placebo and non-CM (PLA + NCM). Participants started on four mg of buprenorphine daily, with dosage increasing until symptoms were stabilized. During week two of the study, participants in the desipramine groups were given 50 mg daily, increasing by 50 mg every two days until reaching 150 mg total dosage. Urine drug samples were collected on Mondays, Wednesdays, and Fridays each week. During week one, participants in the CM groups began receiving $3 vouchers for each urine drug sample that was negative for heroin, cocaine, benzodiazepines, or barbiturates. Vouchers amounts increased by $1 with every consecutive negative sample and reset back to $3 if the drugs were detected or if the sample was missed. Contingency management participants could earn up to $738. Participants in the non-CM groups received monetary vouchers worth an average value of what the CM participants earned in the previous week, with a minimum of $3/week for providing at least one urine sample, regardless of results. The DMI+CM group had the largest rate of opiate-negative (65%), cocaine-negative (60%), and opiate plus cocaine-negative drug urine samples (50%) compared to other groups with a statistically significant difference. The DMI+CM group also had the longest duration of consecutive opiate and cocaine abstinence, averaging three weeks compared to 1.3 weeks for the other groups with the difference achieving statistical significance. The odds of having negative urine drug samples were the largest in the DMI + CM group, the smallest in the PLA + NCM group, and in between for the PLA + CM and the DMI + NCM groups.

Oliveto et al. (2005) compared the effectiveness of a high and low maintenance dose of a longer-acting opioid agonist maintenance medication, levo-alpha-acetylmethadol (LAAM) with and without CM (yoked group) on abstinence among 140 individuals with opioid and cocaine use disorder who were seeking opioid maintenance treatment. Participants were randomly assigned to one of four 12-week conditions where LAAM was delivered three times a week: LAAM (30, 30, 39 mg) with CM procedures (LC); LAAM (30, 30, 39 mg) without CM (LY); LAAM (100, 100, 130 mg) with CM (HC); and LAAM (100, 100, 130 mg) without CM (HY). Participants in conditions that did not include CM were considered "yoked" because the amount of incentive they received was based on the behaviors (and associated earnings) of the CM groups rather than based on their own behaviors. The study followed an escalating schedule of reinforcement with reset but no bonus. Urine drug samples were collected three times a week and tested for opioids and cocaine. For the CM group, submitting a urine drug sample negative for opioids and cocaine resulted in a voucher, starting with the initial value of $3 and escalating by $1 with each consecutive drug-free urine sample. A missed or positive urine sample resulted in the value of the voucher resetting back to $3. Participants who remained abstinent during the entire 12-week trial were able to earn a maximum of $738 in vouchers. Participants in the yoked group (without CM) received vouchers based on the participants' earnings in the CM group regardless of the urine drug test results. The HC group earned significantly higher mean voucher amount ($138.34) compared to the LC ($49.86) and the LY ($62.11) groups. The results showed that both the HC and HY groups had the highest rates of opioid abstinence. Specifically, both the HC (52.0%) and HY (51.0%) groups had a statistically significantly higher percentage of urine drug samples negative for opioids compared to the LC (29.8%) and LY (40.6%) groups. Opioid and cocaine use decreased most rapidly over time in the HC group compared to the other

three groups. All group differences were statistically significant. The study found that the highest rates of abstinence from both cocaine and opioids were observed in the group receiving a high dose of LAAM and CM. However, CM had little effect on opioid use, except in the high-dose group, where its addition accelerated the decrease in opioid-positive urine drug tests over time.

Brooner et al. (2007) examined the effectiveness of motivated stepped care (MSC) and contingent voucher incentives (CVI) on abstinence among 236 individuals who were receiving methadone maintenance treatment. The participants were randomized into four treatment conditions: MSC + CVI, MSC-only, CVI-only, or standard care (weekly individual counseling sessions). Motivated stepped care is an adaptive treatment model that adjusts the intensity of care based on client response. If clients do not adhere to treatment by not attending the sessions or submitting positive urine drug samples, the treatment becomes more intensive by increasing the number of treatment sessions that clients need to attend. If there is still no improvement, contingencies are applied to reinforce attendance and abstinence. Participants who were assigned to CVI received an initial voucher of $12 for submitting a drug-negative urine sample (i.e., opiates, barbiturates, cocaine, alcohol, and some benzodiazepines) and the value of the voucher increased with each consecutive drug-negative urine sample. An additional $30 bonus was awarded for every three consecutive negative urine drug samples. The value of the voucher was reset to its initial value of $12 when a positive urine drug sample was submitted. Each participant assigned to CVI could earn a total of $3201 if they stayed abstinent over the course of six months of treatment. Standard care participants received weekly counseling sessions. Treatment spanned six months, followed by a three-month follow-up period with additional treatment sessions but without incentives. The analyses showed that both CVI and MSC had

statistically significant positive effects on abstinence, with MSC showing particular effectiveness for sedative use and CVI for cocaine use. Participants in MSC conditions, including MSC + CVI and MSC-only, were three times more likely to test negative (97.7% vs 92.2% for non-MSC) for sedatives and 1.5 times more likely to test negative for any drug (54.7% vs 40.2% for non-MSC) than participants in non-MSC conditions. Participants in CVI conditions were 1.5 times more likely to test negative for cocaine (73.3% vs 63.5% for non-CVI) and twice as likely to test negative for any drug (54.5% vs 38.4% for non-CVI) than participants in non-CVI conditions. Overall, participants in the MSC + CVI were at a higher probability of submitting a negative urine sample for all drugs (i.e., opiate, cocaine, sedative, and any drug) and took less time to submit first negative urine drug sample as compared to those in the SC condition. This group also had higher odds of submitting negative urine drug samples (for any drug) at follow-up. All findings were statistically significant. There were no group differences in terms of alcohol use.

Bickel et al. (2008) evaluated the efficacy of a computer-based behavioral therapy intervention that was interactive and based on the community reinforcement approach (CRA) plus voucher-based CM. The study included 135 adult outpatients with OUD who received buprenorphine maintenance treatment and were randomly assigned to one of the following treatments: therapist-delivered CRA treatment with vouchers, computer-assisted CRA treatment with vouchers, or standard treatment. Participants in the voucher groups earned points for submitting opioid and cocaine-negative urine drug samples. Each voucher point was worth $0.25, and the first negative sample earned them 29 points or $7.25. Vouchers increased by one point with each consecutive negative sample. A $10 bonus applied for a week of negative samples. Continuous abstinence for the entire 23-week maintenance phase resulted in earnings

of $1,316.75. Voucher earnings in the therapist-delivered CRA (mean of $555.51) and computer-assisted CRA conditions (mean of $584.11) were comparable across groups. An opioid- and/or cocaine-positive urine sample, or failure to submit on schedule reset the voucher points to the baseline voucher value. Findings showed that therapist-delivered and computer-assisted CRA plus vouchers interventions resulted in comparable weeks of continuous opioid and cocaine abstinence (mean = 7.98 and 7.78, respectively). Both approaches produced statistically significantly greater number of weeks of abstinence than the standard intervention, with a small to medium effect size.

Epstein et al. (2009) examined the effectiveness of the combination of CM and methadone medication on abstinence from heroin and cocaine. A total of 252 methadone maintenance outpatients with a dual opioid and cocaine use disorder were randomized to receive a methadone dose (70 or 100 mg/day) and one of the 12-week voucher conditions following a five-week baseline period: Noncontingent (control), contingent on cocaine-negative urine drug samples, or contingent on cocaine- or opioid-negative urine drug samples ("split" contingency). All participants received weekly individual counseling and were required to provide urine drug samples three times a week during the intervention period. The study used a "split" contingency model where the total value of incentives was "split" between the two substances for cost-related reasons. The voucher system for both contingencies followed the escalating schedule of reinforcement with bonus and reset. The maximum value of vouchers was $1,155 with mean earnings of $416.87 per participant. The analyses showed that CM had a statistically significant positive effect on the number of cocaine-negative urine drug samples and the number of urine drug samples simultaneously negative for opiates and cocaine, but not for opiate-negative urine drug samples. There was no statistically significant effect of the split or cocaine contingency on

opiate-negative urine drug samples at either dose of methadone. However, for simultaneous abstinence from cocaine and opiates, the SplitHigh group (100mg methadone dose + split contingency) produced a statistically significantly higher percentage of opiate- and cocaine-negative urines compared to its same-dose noncontingent control group. The study also used self-reports when reporting on the drug use outcomes. Contingency management was statistically significantly effective for reducing self-reported cocaine use but it was not effective for self-reported opiate use.

Kidorf et al. (2009) evaluated the effectiveness of an intervention that combined a motivational intervention with incentives and treatment readiness groups on rates of substance use among a sample of 281 participants with OUD. Participants were randomly assigned to one of three study conditions over a four-month period: a motivational referral condition (MRC) consisting of eight individual motivational enhancement sessions and 16 treatment readiness group sessions, a motivational referral plus incentives (MRC+I) condition that provided monetary incentives for attending sessions and enrolling in treatment, or a standard care referral condition (SRC). Incentives for attending sessions included $10 in cash, a $10 gift card, and a $3 bus pass. Heroin use outcomes were measured via self-report. The authors found that participants who received MRC+I reported fewer days of heroin use per each 30-day assessment (19.5 days) compared to those in the MRC (25.1 days) and SRC (25.9 days) groups. Those in the MRC+I group also reported fewer days of injection use per each of the 30-day assessments (19.1 days) compared to individuals in the other two groups (MRC = 23.5 and SRC = 23.8 days). All differences were statistically significant. There were no group differences in terms of cocaine use.

Christensen et al. (2014) examined the benefit of adding an internet-delivered behavior therapy to a buprenorphine medication program and voucher-based CM. The study enrolled 170 participants with OUD and randomized them to either an internet-based community reinforcement approach intervention plus CM (CRA+) condition or CM alone condition. All participants received buprenorphine maintenance treatment and twice a month counseling for 12 weeks. Participants earned points for submitting opioid and cocaine-negative urine drug samples. Each point was worth $0.25, and the first negative urine drug sample was worth 10 points or $2.50. Subsequent consecutive negative specimens resulted in an increase of five points, and a $10 bonus was provided for each set of three consecutive negative samples. A positive urine drug sample or failure to submit one on schedule resulted in a reset to 10 points. Participants with urine drug samples that tested positive for benzodiazepines earned points but would not be allowed to redeem vouchers on that day. The maximum possible earning over the 12-week program was $997.50. Participants in the CRA+ condition earned a median total voucher value of $730.63, while CM-alone participants earned a median of $736.88 over the course of the study. On average, CRA+ participants had 9.7 more days of abstinence than participants in the CM-alone group, and this difference was statistically significant. Participants in the CRA+ group who had a history of treatment for OUD had statistically significantly longer periods of abstinence compared to their counterparts in the CM-alone group.

One of the voucher-based studies included a therapeutic workplace component. DeFulio et al. (2022) conducted a preliminary evaluation of the Therapeutic Workplace (TW) intervention for opioid-dependent sex workers who had been arrested and were currently in a specialized diversion program. The study recruited 37 participants who were randomly assigned to either a specialized diversion program or a diversion program plus TW for four months.

Testing was done gradually, with study staff increasing the number and types of drugs (cocaine, opioids, cannabis, amphetamines, and phencyclidine) that were tested over time. The final set of abstinence requirements were the complete panel of drugs typically used in pre-employment drug screening. Participants were paid $8 per hour for a maximum of four hours each day. Participants also earned performance-based bonus pay on the job training programs (approximately $2 per hour for average performance). Participants could request to have electronic funds converted to gift cards that could be used at common retail stores. Additionally, participants could earn access to the workplace (and wages) upon provision of a urine sample every Monday, Wednesday, and Friday. For the first fortnight, access was not contingent on the results of the urine test for participants in the TW group. After that initial period, drug abstinence reinforcement started and cocaine abstinence was the first drug use-related behavior targeted. If the sample tested positive or was not submitted, participants could not enter the workplace, and their hourly wage was decreased to $1.00. Subsequently, each day the participant accessed the workplace their base pay was increased by $1.00 per hour until fully restored. Participants who submitted a minimum of 10 drug negative urine samples across the last 12 samples and attended at least 10 days in the last 20 possible workdays qualified for the 4-month wage supplement program. Under this program, participants who would be employed in the community or who were engaging in verifiable job search activities were paid $4 per hour, up to 40 hours per week. During this time, drug testing of urine samples was required once a week (on average) to measure drug abstinence. Analyses showed that the TW group experienced statistically significant increases in abstinence from opioids but not from cocaine in comparison with usual care.

Studies with Prize-Based CM. Three studies utilized prize-based CM and one of them included a component of medication-based contingency where participants earned draws for taking methadone in addition to being abstinent from morphine (Chen et al., 2013). The first study by Petry and Martin (2002) assessed the effectiveness of a low-magnitude CM intervention on reducing drug use among 42 individuals with both cocaine and opioid use disorders enrolled in a methadone maintenance treatment program. Participants were randomly assigned to 12 weeks of standard treatment (ST), or ST plus CM. Standard treatment consisted of methadone maintenance and monthly individual counseling sessions. Individuals assigned to the CM group earned the opportunity to draw from a bowl and win prizes ranging from $1 to $100 in value for submitting samples negative for either cocaine or opioids alone. Bonus draws were provided when participants were simultaneously abstinent from both cocaine and opioids. Participants could earn a maximum number of 234 draws and on average, participants in the CM condition earned prizes worth a total of $137. The study found statistically significant differences between the two groups with respect to duration of continuous abstinence from both substances. Specifically, participants in the CM condition achieved about two more weeks of consecutive abstinence from opioids and cocaine than did patients in the standard condition. The positive effects of CM were sustained at 6-month follow-up assessment with a statistically significant difference.

The study by Peirce et al. (2006) investigated whether a low-cost prize-based CM program was still effective for decreasing stimulant, alcohol, and opioid use among a sample of 388 participants with multiple substance use disorder diagnoses. Participants were enrolled in a large, multi-site study in a 12-week methadone treatment program and randomly assigned to CM or control conditions (usual care). The CM group utilized an abstinence incentive procedure

that included drawing prizes marked on plastic chips with a range of values from $1 to $100 for each stimulant and alcohol negative urine drug sample. Two bonus draws were provided when the participants also tested negative for opioids. Participants could earn a maximum of $400, and the average value of the prizes earned through the study was $120. Urine drug samples were collected twice weekly on non-consecutive days to determine abstinence from stimulants and alcohol. Results suggested that the CM group was twice as likely to submit stimulant- and alcohol-free tests as the control group. The CM group was also 1.5 times more likely to submit opioid-negative urine drug samples than the control group. Stimulant and alcohol use outcomes were compared at the 6-month follow-up assessment, but there were no statistically significant differences between the groups.

Chen et al (2013) assessed the impact of CM on drug abstinence and treatment attendance among 246 participants with OUDs in China. They compared CM plus methadone maintenance treatment with methadone maintenance treatment alone in a 12-week trial delivered in rural and urban clinics. The CM intervention in this study primarily aimed to encourage daily methadone use, with a secondary goal of promoting abstinence. Participants in the CM group received usual treatment plus weekly prize draws. For prizes, this program used vouchers that could be applied towards treatment fees. Participants had a 50% chance of not winning a prize, 41.8% chance of winning 5 Yuan (US$0.8), 8% chance of winning 10 Yuan (US$1.6), and 0.2% chance of winning 100 Yuan (US$16). These prizes offset the required daily treatment cost of 10 Yuan. Each morphine-negative urine drug test earned one draw, whereas consecutive daily methadone intake earned draws on an escalating schedule, starting with one draw for the first week and increasing to 12 draws by the 12th week of uninterrupted attendance. Unexcused absences or positive drug tests reset the draw count to one. Participants could earn up to 84 total draws. Both

treatment groups demonstrated an increase in negative urine drug tests, but CM participants outperformed UT participants significantly. Overall, CM participants were 1.91 times more likely to submit negative samples. The effect was stronger in rural areas, where CM participants were 2.42 times more likely to have negative tests, compared to 1.73 times in urban areas. The study concluded that despite decreasing the frequency of monitoring and incentive value in this study compared to previous studies, the CM intervention significantly improved attendance as well as reduced drug use for a sample based in China.

Other Studies with Medication Contingency Components. Two studies evaluated medication- and voucher-based CM groups separately. A third study evaluated contingency contracting, where participants moved through treatment phases that encouraged abstinence and gave participants access to methadone doses contingent on abstinence (Calsyn et al., 1994).

A study by Gross et al. (2006) compared the efficacy of low-value, contingent cash vouchers, contingent buprenorphine medication, and standardized counseling in promoting abstinence from opioids and cocaine for opioid-dependent adults. After an 8-week baseline period where participants received buprenorphine maintenance treatment without contingencies, 60 participants were randomly assigned to one of three treatment groups that ran for 12 weeks. For each cocaine and opioid negative urine drug sample, participants in the voucher group earned vouchers according to an escalating schedule. The first negative specimen was worth 29 points (each point was worth $0.125) and every subsequent consecutive negative urine sample increased the voucher value by 1 point. As further incentive for continuous abstinence, a $5 bonus was provided for each set of three negative consecutive samples. Thus, continuous abstinence for 12 weeks (during weeks 9–20) could result in a patient receiving $269 worth of vouchers. Submitting a urine sample that tested positive for opioids or cocaine or failing to

submit a scheduled specimen resulted in a reset. After a positive or missed sample, the next time a participant submitted samples testing negative for both drugs, the value of the voucher was set to the initial $3.63 level (29 points). Participants in the medication contingency group received half of a scheduled buprenorphine dose for abstaining from opiates and cocaine and another half for clinic attendance. Participants in the standard treatment condition did not receive programmed consequences that were contingent on results of urinalysis. All participants received buprenorphine according to a 3-times-per-week dosing regimen as well as behavioral drug counseling. Participants in the medication contingency group achieved statistically significantly more weeks of continuous abstinence from opiates and cocaine compared with participants in the voucher group (5.95 weeks and 2.90 weeks, respectively). The standard counseling group did not differ significantly from the other groups.

Chopra et al. (2009) compared the impacts of three treatment conditions on abstinence among 120 buprenorphine-maintenance participants with random assignment to each condition. The conditions included a medication contingency condition with community reinforcement approach (CRA), a voucher contingency condition with CRA, and a standard counseling condition. In the medication contingency condition with CRA, participants had to submit an opioid- and cocaine-negative urine sample to receive buprenorphine. Specifically, negative tests earned participants access to take-home buprenorphine doses three times a week, while positive tests resulted in daily attendance requirements until three consecutive negative samples were submitted. Additionally, drug-positive tests led to a 50% dose reduction until a drug-negative test result was achieved and if a participant submitted a positive test on Friday, they received a double instead of a triple weekend dose. In the voucher contingency condition, the first opioid- and cocaine-negative urine sample was rewarded with a voucher valued at $2.50 and increased

by $1.25 for each consecutive negative drug urine sample. An additional $10 bonus was given for every three consecutive negative urine drug samples. The maximum potential earnings over the course of 12 weeks of treatment was $997.50. In the standard counseling condition, participants received thrice-weekly buprenorphine/naloxone doses and weekly counseling sessions without contingencies. For combined opioid and cocaine abstinence, the medication contingency group achieved 1.5 more continuous weeks of abstinence than standard treatment, while the voucher incentive group had two more total weeks of abstinence compared to standard treatment. Both findings were statistically significant. For opioid abstinence alone, both medication and voucher contingency groups achieved statistically significantly more continuous weeks of abstinence than standard treatment. Additionally, the voucher contingency group achieved statistically significantly more total opioid-free weeks and a higher percentage of opioid-negative UDTs (84% vs. 72%) compared to standard treatment. A higher percentage of the medication contingency group had opioid-negative UDTs compared to standard treatment, but the difference was not statistically significant. There were no group differences in terms of cocaine use.

Finally, Calsyn et al. (1994) examined the effectiveness of contingency contracting for encouraging abstinence among a sample of 360 participants who were undergoing methadone maintenance treatment. Participants were randomly assigned to one of six treatment conditions that varied in level of counseling and contingency contracting condition. The three levels of counseling were medication (methadone) only, standard counseling, and enhanced services. Within each level of counseling, participants were further assigned to one of two contingency contracting conditions: no contingencies (NC) or contingency contracting (CC). All clients received standard medication evaluation which included intake, dose evaluations, yearly

physical examinations, HIV testing, and counseling. The medication-only group met with a counselor once a month to complete standard treatment contracts and referrals. The standard counseling group received at least twice a month individual counseling based on the client's treatment plan with an option to attend drug education classes. The enhanced condition included all components of the standard treatment, with the addition of twice weekly relapse prevention skills group and other group treatment as well as couples counseling. The NC groups submitted weekly urine drug samples and discussed the results with a counselor. No contingencies were placed on the urine drug samples. In the CC groups, clients underwent a 60-day stabilization period with no contingencies on urine drug samples. After this period, if a client had three positive urine drug samples (i.e., amphetamines, barbiturates, cocaine, benzodiazepines, methadone, propoxyphene, and opiates) within a 90-day period, they were placed on a Phase 1 contract with a 'warning' status and required to set a goal for abstaining from drug use. If a client submitted two positive urine drug samples within 60 days of being placed into Phase 1, they were moved to a Phase 2 contract. In Phase 2, the client was required to attend treatment team meetings and establish new goals for abstinence. During this phase, methadone dose was contingent on abstinence such that each drug-positive urine drug sample resulted in a 5-mg reduction in methadone dose, while a negative urine drug sample resulted in a 5-mg increase up to the starting dose. When a client's dose reached half of their starting dose, they were placed in a 21-day detoxification program and discharged upon completion. Membership in a CC condition was statistically significantly associated with reduced number of weeks with drug positive urine drug samples (i.e., any substance, opiate, and cocaine) and alcohol use. Younger participants had more positive urine drug samples and this finding was statistically significantly. For opiate use alone, CC was effective in reducing opiate use only within the standard

counseling condition. Younger subjects and those with lower pretreatment heroin use had statistically significantly more urine drug samples that tested positive for substances. For cocaine use alone, higher frequency of pretreatment cocaine use was a statistically significant predictor of use during treatment.

Studies with Mixed Results

Thirteen studies had mixed outcomes, defined as having positive results for drugs other than opioids but not for opioids, having positive outcomes during the intervention but not at follow-up assessment, or having both positive and negative outcomes for opioid use depending on the timing of measurement or analytic method. All studies included samples receiving MAT except for one study, where only two of the four treatment groups received MAT (i.e., Jarvis et al., 2019). Sample sizes ranged from 20 to 552 across the studies, with six out of 13 studies having more than 100 participants. Eleven studies included voucher-based CM, one included prize-based CM, and one study used a preferred take-home schedule of methadone medication as an incentive. Three out of 11 voucher-based CM studies delivered vouchers in a therapeutic workplace setting. All studies incentivized abstinence from drug use with five studies incentivizing abstinence from opioids only and eight incentivizing abstinence from multiple drugs. Three studies incentivized compliance with opioid treatment medication in addition to abstinence. Studies in this section are organized into two groups: those with follow-up assessments and those without.

Studies with Follow-up. Among the studies with mixed findings, four reported follow-up assessment outcomes. The most commonly used evaluation period was a six-month follow-up. Two studies used two or more follow-up assessment points (i.e., Preston et al., 2002; Hser et al., 2011). Three out of four follow-up studies had reinforcement schedules targeting medication

compliance in addition to abstinence. Two studies reinforced medication compliance or abstinence (Carroll et al. 2001b; Hser et al., 2011) while one reinforced medication compliance and abstinence (Holtyn et al., 2014).

The study by Carroll et al. (2001b) examined the effectiveness of voucher-based CM in improving naltrexone compliance and opioid use and then compared the effectiveness of lower vs. higher magnitude vouchers on these outcomes. The study enrolled 55 individuals with OUD who were entering treatment at a naltrexone maintenance program. Participants were randomized into three 12-week conditions: Standard naltrexone maintenance, standard naltrexone plus low-value CM, or standard naltrexone plus high-value CM. Participants in the two CM groups could earn vouchers for either complying with naltrexone treatment or submitting drug-free urine specimens (i.e., cocaine, opioids, and benzodiazepines). The study used an escalating schedule of reinforcement with reset but no bonus. Participants were expected to submit urine drug samples and comply with naltrexone dosage three times a week. Participants in the low-value CM group received a $0.80 voucher for the first negative urine specimen or naltrexone ingestion. The value of the vouchers increased by $0.40 for each subsequent negative urine specimen or for naltrexone ingestion. Participants in the high value CM received a $2 voucher for the first negative urine specimen or naltrexone ingestion, and the voucher value increased by $0.80 for each subsequent negative urine sample or naltrexone ingestion. A reset to the initial voucher value occurred when a participant failed to submit a urine drug sample, had a positive urine sample, or missed a naltrexone visit. The maximum available value of reinforcement per participant was $561 in the low-value CM group and $1,152 in the high-value group. Participants assigned to the low-magnitude CM group earned an average of $155 in vouchers, while participants in the high-magnitude CM condition earned

$333 on average. Assignment to either CM condition was associated with statistically significant reductions in opioid and cocaine use over time compared with standard naltrexone treatment. There were no statistically significant differences between the high- and low-value CM groups, suggesting no relative benefit of high-magnitude over low-magnitude vouchers for improving opioid or cocaine abstinence. At 6-month follow-up, no statistically significant differences were found between the CM condition and standard naltrexone treatment.

Preston et al. (2002) examined the effectiveness of a stepdown maintenance contingency among 110 participants who were maintained on methadone (50 or 70 mg/day) and who had completed a previous CM trial (i.e., Preston et al., 2000). Participants from the previous trial (induction phase) were re-randomized to one of two 12-week study conditions (maintenance phase): contingent vouchers and take-home methadone doses (contingent group) or noncontingent vouchers and take-home doses (noncontingent group). Participants in the contingent group were incentivized with $10 vouchers for each opiate-negative urine drug sample, with testing occurring three times a week. The voucher values did not escalate with each consecutive negative sample. Additionally, those submitting two negative samples per week earned a take-home methadone dose for Sunday. Participants in the noncontingent group were yoked to individual participants in the contingent group and received matching incentives regardless of their own urinalysis results.. Similar to the previous trial, all participants continued to receive methadone medication and weekly individual counseling. Including the voucher status of participants from the induction phase and maintenance phase, there were four groups: Contingent/Contingent (C/c), Noncontingent/Contingent (N/c), Contingent/Noncontingent (C/n), and Noncontingent/Noncontingent (N/n). Considering only the maintenance phase regardless of the induction status of the participants, the proportion of opiate negative urine drug

samples was higher in the contingent group (50.5%) compared to the noncontingent group (45%), but the difference was not statistically significant. When considering the induction phase, the results showed that the C/c group, which received contingent vouchers both in the induction and maintenance phase, had a higher percentage of opiate-negative urine drug samples at some points, the longest durations of abstinence, and less variation in the opiate-negative urine drug samples compared to the other groups. These differences were statistically significant. Abstinence rates as measured by the percentage of opiate-negative urine drug samples were statistically significantly lower in the group that received 50 mg methadone (lower dose) and received noncontingent vouchers in both studies. The contingent groups also self-reported less frequent use of heroin. Cocaine abstinence rates exhibited statistically significant variations over time in relation to the maintenance phase contingency. Additionally, the combined effects of induction and maintenance phase contingencies on cocaine abstinence also varied significantly across the study period. Generally, participants who received incentives contingent on opiate abstinence during the maintenance phase tended to have higher rates of cocaine abstinence, though these rates fluctuated considerably over time. Analyses for three-, six-, and 12-month follow-up assessments revealed no statistically significant impact of induction contingency, maintenance contingency, or methadone dose on opiate abstinence. However, follow-up time point and current methadone maintenance status significantly affected outcomes. As such, heroin abstinence rates increased over time and were higher among participants still receiving methadone maintenance.

Hser et al. (2011) tested whether prize-based CM could improve treatment retention and reduce drug use among 319 individuals in a community-based methadone maintenance treatment program in China. Participants were randomly assigned to 12 weeks of either usual

care (UC) with incentives or UC without incentives. The UC included a physical examination, weekly urine testing for opiates and daily methadone ingestion under supervision. Incentives were contingent on abstinence from opioids, based on urine screens or compliance with methadone dose. Each participant who submitted a negative urine sample for opioids or ingested the prescribed methadone dose earned a draw for a chance to win prizes, and the number of draws earned increased with continuous abstinence or medication compliance. Missed attendance or submitting positive urine drug samples resulted in a reset of draws. A single cash bonus was available to participants who demonstrated two weeks of consecutive attendance or opiate abstinence. The average total prize value per participant was $55. Results showed that participants in the incentive group had statistically significantly longer periods of sustained abstinence compared to participants in the UC group. However, there were no statistically significant differences in percentage of opioid-negative urine drug samples between the groups. Although the study reported an increase of negative urine results across the 12 weeks of treatment, there were no statistically significant differences by group assignment, indicating that CM had no effect on improving drug use outcomes. Self-reports of opiate use were statistically significantly different between the two groups at one-month follow-up, favoring the CM group. However, there were no statistically significant group differences in self-reported opiate use at the 3- and 6-month follow-ups.

The primary aim of the randomized controlled trial conducted by Holtyn et al. (2014) was to examine whether employment-based reinforcement increased methadone treatment engagement and drug abstinence among 98 injection drug users with an OUD. Following a four-week induction period where participants were exposed to the workplace, they were randomized to one of the following 26-week conditions: work reinforcement; methadone & work

reinforcement; or abstinence, methadone, & work reinforcement (enrollment in methadone treatment was compulsory). In order to earn vouchers, participants in the abstinence, methadone, & work reinforcement condition had to attend weekly methadone treatment and provide negative urine drug samples three times a week. Once the participants enrolled in methadone maintenance treatment for three weeks, the CM component (which focused on abstinence from opiates and cocaine) was gradually introduced. For every sample that tested negative for opioids, participants' base pay increased by $1 per hour to the maximum of $8 per hour. The increased pay rate applied for every day that the participant provided a negative sample and worked for at least five minutes. Any positive urine samples resulted in the base pay being reset to $1. After being abstinent from opioids for three consecutive weeks, the CM component was expanded to include abstinence from cocaine. The methadone and work reinforcement group had to enroll in a methadone maintenance program to be able to work and earn vouchers. The work reinforcement group was able to work and earn vouchers regardless of their urine drug sample test results and enrollment in methadone maintenance program. The maximum possible value of vouchers participants could earn for 30 weeks of participation was $6,000. The abstinence, methadone, & work reinforcement group provided statistically significantly more opiate-negative urine drug samples and cocaine-negative urine samples than work reinforcement participants provided (opiate-negative: 75% vs 54%; cocaine-negative: 57% vs 32%). At six-month follow-up, there were no significant between-condition differences in opiate and cocaine use.

Finally, the study by Novak et al. (2022) investigated the effects of a CM program that utilized employment and wage supplements conditional on abstinence among 91 unemployed adults enrolled in an OUD treatment program. The intervention included a 90-day baseline

period and 12 months of intervention, followed by a 12-month post-intervention assessment period. Participants were randomly assigned to either an abstinence-contingent wage supplement group (CM) or a usual care control group. In the CM group, participants earned stipends for abstinence (initially from opiates alone and then from both opiates and cocaine), engaging with an employment specialist, and engaging in job-seeking behaviors. Wage and/or performance supplement pay was earned for engaging in job-seeking behaviors. Urine drug samples were initially collected three times per week and tested for opioid use only. Later, collections transitioned to a random schedule for the remainder of the intervention, with samples tested for both opiates and cocaine. The abstinence-contingent wage supplement group (CM) provided statistically significantly more opiate- and cocaine-negative urine samples (63.6% vs. 44.1%) during the intervention. However, there were no statistically significant differences at the 12-month follow-up assessment.

Studies without Follow-up. Eight studies with mixed findings did not have a follow-up assessment. Seven studies had reinforcement schedules targeting abstinence only. One study reinforced treatment attendance in addition to abstinence (i.e., Metrebian et al., 2021).

In an older study by McCaul et al. (1984), the effectiveness of a CM program during outpatient methadone detoxification was assessed over a 90-day (13 week) period with 20 male participants with OUD. Participants were randomly assigned to a CM or control condition. All participants were stabilized on 30 mg/day of methadone for the first three weeks (baseline period), followed by a gradual dose reduction starting in the 4th week (intervention period). Urine drug samples were tested twice a week, and the CM group received $10 and a take-home dose of methadone for each opiate-free urine sample, while the control group received $5 regardless of their urine drug test results. Urine drug samples were tested on Mondays and

Fridays for opiates. The CM group showed a statistically significantly higher percentage of opiate-free urine specimens (80%) compared to the control group (60%) during weeks 4 through 9 of the intervention when methadone reduction protocol began. However, after methadone reduction was completed and participants were only ingesting cherry syrup during weeks 10 – 12, the difference between groups was no longer significant with only 35% of urine drug samples from the CM group and 25% of samples from the control group testing negative for opiates.

Schmitz et al. (1998) examined whether 32 opiate-dependent participants who received a preferred take-home schedule of methadone medication would have more success with abstinence than the control group, which did not receive a preferred take-home schedule. During Phase 1, all participants attended the clinic five days per week and had their methadone dose increased and stabilized at 75 mg. During Phase 2 (8 weeks), none of the participants had contingencies on collateral drug use. Participants in one group attended clinic on Mondays and Thursdays and received five take home doses for the intervening days. Participants in the other group attended clinic five days a week and received two take-home doses for the weekend. During Phase 3 (12 weeks), take-home frequency (two days vs five days) was contingent on drug screen results. Urine drug samples that tested negative for opioids, cocaine, benzodiazepines, and barbiturates resulted in allowances for more take-home doses. Phase 4 was a four-week period without contingencies where participants returned to their groups from Phase 2. One hour of behavioral therapy was provided each week for both groups. Participants had to complete a minimum of 75% of all data collection requirements to continue participation. During the final week of Phase 2, participants were notified that for the next 12 weeks, weekly urine tests would determine the number of take-home doses for the following week (two vs

five). During the first six weeks of the CM phase of the study, the intervention group with higher frequency of take-home doses submitted more drug free urines than the control group, but this difference was not maintained during the second six weeks of this phase. Overall, participants using multiple substances showed poorer responses to CM compared to those using a single drug.

Downey et al. (2000) assessed the effectiveness of voucher-based reinforcement therapy (VBRT) for improving abstinence from both heroin and cocaine among 41 individuals engaging in polysubstance use and enrolled in a buprenorphine maintenance treatment program. Participants were randomly assigned to a 12-week VBRT or a yoked control condition. Following an escalating schedule with bonus and reset, participants earned vouchers for each polydrug-negative sample (i.e., amphetamine, barbiturates, cocaine, heroin, and phencyclidine plus negative breathalyzer readings). The value of the first voucher was set at $2.50 and increased by $1.25 for consecutive negative urine drug samples. Three consecutive negative samples earned a $10 bonus. The VBRT group earned a mean of $126 during the intervention period. There were no statistically significant differences between VBRT and YC groups on the percentage of drug-free urine samples and longest continuous abstinence during the intervention phase. However, participants in the VBRT group who submitted at least one urine drug sample that was free from all drugs achieved a higher number of cocaine-negative urine drug samples compared to the control group. This difference was found to be statistically significant.

Katz et al (2004) studied the effect of abstinence-based incentives on outpatient opiate detoxification program outcomes. Participants (n=211) could earn a $100 voucher, either contingent on abstinence or noncontingently on the last day of the detoxification program. The abstinence-contingent CM group received vouchers for opiate- and cocaine-negative tests, while

the noncontingent group received vouchers based on the contingent group's success rate. Among abstinence-contingent CM participants, 31% were negative for opiate and cocaine on the last day of the detoxification program. In contrast, 18% of the noncontingent control group tested negative for opiate and cocaine use. The difference was statistically significant. Fewer (12–13%) participants were negative for opiate and cocaine in each group after the completion of the detoxification program and the difference between groups was no longer statistically significant.

Schottenfeld et al. (2005) compared the effects of combining CM with buprenorphine and methadone treatment among 162 individuals with co-occurring cocaine and opioid use disorder. Participants were randomly assigned to one of the 24-week conditions: methadone with CM, methadone with performance feedback (PF), buprenorphine with CM, or buprenorphine with PF. All participants received manual-guided counseling with CRA twice weekly during the initial 12 weeks and once a week during the last 12 weeks. Performance feedback subjects received slips of paper indicating their urine test results. Those in the CM conditions received monetary vouchers for submitting urine drug samples that tested negative for both opioids and cocaine. During the initial 12 weeks, the study followed an escalating schedule with the initial value of the voucher set at $2.50 and increasing by $1.25 with each successive drug-free urine sample. Participants earned a $10 bonus voucher for providing three consecutive drug-free urine samples, while a reset occurred after submitting a drug-positive urine sample. During the last 12 weeks of treatment, participants in the CM groups received vouchers with a $1.00 value. The maximum possible value of the vouchers per participant in the CM group was $1,033.50. The study found that cocaine and opiate use decreased significantly over time across all conditions. The effects of CM were significant during the first 12 weeks with participants achieving significantly longer periods of abstinence and a greater proportion drug-free tests, compared with those who received

PF. Those differences, however, were not sustained during the entire 24-week study. In addition, authors argued that a lack of significant interaction between the type of medication and CM suggests that CM improves outcomes comparably when combined with methadone or buprenorphine.

Poling et al. (2006) examined combining CM with bupropion with 106 opiate-dependent, cocaine abusing veterans. Participants were randomized into four groups: CM and 300 mg/day of bupropion hydrochloride (CMB), CM and a placebo (CMP), voucher control and bupropion (VCB), and voucher control and placebo (VCP). For the first half of the 25-week study (e.g., weeks 1-13), participants in the two CM groups received vouchers for urine samples negative for both cocaine and opiates, beginning with $3 for each negative sample and increased by $1 for each subsequent negative sample, with a maximum of $15/sample. Urine drug samples were drawn three times per week, so CM participants could earn up to $45/week. Any positive or missed samples reset the voucher amount to $3. During weeks 1-25, abstinence-related activities, such as attending 12-step meetings, were rewarded at $3 per activity. Each subsequent activity resulted in an increase of $1 up to a maximum of $10/activity for two activities per week ($20/week). The voucher control group received $3 vouchers per urine sample submitted, regardless of results, with an additional $1 for submitting all three samples per week, earning a maximum of $10/week for weeks 1-25. Participants in the CM group could earn a maximum of $462 for submitting all negative urine samples, plus a maximum of $472 for meeting the maximum goals each week for abstinence-related activities. Voucher control group participants could earn a maximum of $250 for submitting all required urine samples for the 25 weeks of the study. All study participants received methadone medication, stabilizing dosage between weeks 1-3 of the study. Opiate use decreased significantly for all groups, with no statistically significant

differences between groups. The CMB group showed a statistically significant reduction in cocaine-positive urines compared to the other three groups, in addition to more consecutive weeks of abstinence. The CMP group showed a statistically significant increase in cocaine-positive urines during weeks 3-13, but then showed a decrease from weeks 14-25. Both non-CM groups showed no statistically significant improvements in cocaine use.

Jarvis et al. (2019) evaluated the effects of combining extended-release injectable naltrexone (XR-NTX) with incentives for opiate abstinence among 84 individuals with OUD. The study was conducted in a therapeutic workplace and required participants to complete opioid detoxification before they were randomly assigned to usual care, XR-NTX, abstinence incentives (AIs), or XR-NTX plus AIs. The intervention period spanned six months. All participants were offered substance use counseling and referral to specialized services. Participants receiving AIs were required to submit opiate-negative urine drug samples three times a week to maintain the maximum base salary ($8 per hour). An opiate-positive or missed urine drug sample resulted in the base salary reset to $1 per hour, while submitting an opiate-negative urine drug sample and attending the workplace increased the base pay by $1 per hour. Participants in the XR-NTX plus AIs group provided statistically significantly more opiate-negative urine samples than XR-NTX participants. Participants receiving XR-NTX plus AIs were statistically significantly more likely to submit opiate-negative samples compared to the AIs and usual care participants when the urine drug sample count excluded missing urine drug samples. However, these effects were not statistically significant when missing urine drug samples were counted as positive. Cocaine abstinence rates were low and did not differ across the four groups.

Finally, Metrebian et al (2021) studied the use of a low-cost CM program for promoting heroin abstinence among those undergoing opioid agonist treatment (OAT) for heroin use

disorder in the United Kingdom (UK). The study employed a version of CM that was adapted from US-based models for use in substance use treatment services in the UK. A total of 552 participants were randomly assigned to OAT plus weekly appointments for 12 weeks with CM targeted at opiate abstinence for appointments (CM Abstinence), CM targeted at timely attendance at appointments (CM Attendance), or no CM (treatment as usual; TAU). Participants in the CM Abstinence group received a fixed voucher of £10 for attendance in weekly sessions and abstinence from opiates starting in week five. Treatment staff received one day of training on principles of CM and practiced it via role-play. Training was based on a CM handbook that was designed for substance use treatment in the UK. Fidelity to CM was monitored via audio recordings which were rated on a 10-item scale adapted from the Yale Adherence and Competence Scale (YACS; Carroll et al., 2000). Fidelity was scored as poor (<33%), adequate (33%–66%) or good (>66%). The current study reported adequate levels of fidelity for both CM conditions. Results showed that CM Attendance was superior to TAU in promoting abstinence from heroin. In weeks 9-12, participants in the CM Attendance group were twice as likely to provide heroin-negative urine samples compared to those in TAU and this finding was statistically significant. The CM Abstinence group did not show statistically significant improvements in the number of heroin-negative urine samples over either the TAU or CM Attendance groups. Groups did not differ significantly in the number of heroin-negative urine samples at the 24-week assessment. There were no differences between groups in self-reported heroin use at 12-week and 24-week assessments. The study concluded that this adapted CM intervention could be moderately effective in UK substance use treatment services for heroin abstinence compared with not using CM, but only if targeted at attendance.

Studies Reporting No Effect of Contingency Management

Eleven studies reported no significant effect of CM. Sample sizes ranged from 16 to 212 across the studies, with only four of the studies having more than 100 participants. Seven of the studies used voucher-based CM, one used prize-based CM, two offered opportunities for treatment privileges such as take-home methadone doses, and one offered take-home methadone doses along with an aversive consequence for not meeting the CM requirements. Seven studies reinforced abstinence only and all except one study required that participants abstain from multiple drugs to earn incentives. Two studies reinforced abstinence and treatment attendance simultaneously and one reinforced attendance and compliance with medication. Finally, one study reinforced attendance in psychiatric care.

Iguchi et al. (1988) evaluated the effectiveness of a 20-week CM program within a methadone maintenance treatment program to reduce illicit opiate use and improve treatment retention. A sample of 16 participants was chosen from a total population of 30 individuals with an identified history of OUD who were already enrolled in an outpatient detoxification program. Participants were selected based on their ability to provide at least three opiate-free urine samples out of six during the initial baseline screening period, and then were randomly assigned to either a combined or single CM group. The combined CM condition included take-home methadone medication for drug-free urine samples and an aversive consequence for positive urine drug samples. Participants in the combined CM group could earn the benefit of take-home doses of methadone for opiate-free samples. The aversive consequence was a reduction in methadone dose for urine drug samples that came back positive for opiate and other illicit drug use. The single CM group received the same incentives for take-home methadone doses, but instead of an aversive consequence, a positive urine drug sample only resulted in a loss of take-

home methadone dose privileges. Urine drug samples were collected and analyzed twice weekly to monitor opiate and non-opiate illicit drug use. Results of the study indicated that during the intervention phase, the average percent of negative urine samples for illicit drug use in any 2-week period ranged from 35% to 65%, with no statistically significant difference between the combined and single CM groups. Therefore, it was concluded that the introduction of aversive consequences into CM procedures did not improve efficacy of the intervention. In fact, the authors note that it could be argued that addition of aversive contingencies detract from overall treatment efficacy because the aversive consequences resulted in participants leaving treatment.

Brooner et al. (1998) evaluated the effectiveness of CM among 40 individuals with substance use disorder and antisocial personality disorder enrolled in methadone maintenance treatment. Participants were randomly assigned to either an experimental or control condition, each lasting 13 weeks. The experimental condition consisted of counseling, a methadone dose, as well as rapid delivery of either positive or negative consequences based on abstinence and attendance at counseling sessions. Positive consequences were delivered for abstinence from all drugs being monitored and counseling attendance, while negative consequences were delivered for drug use or missed counseling sessions. The control condition involved a methadone dose of 55 mg. Participants in the experimental group who abstained from all drugs (i.e., opioids, cocaine, alcohol, sedatives, cannabis, and other stimulants) and attended counseling sessions earned an opportunity to move to a "higher step" (i.e., earning take-home methadone doses, selecting number of counseling sessions). The experimental and control groups submitted a similar number of opioid-negative (9.4 vs. 8.4) and cocaine-negative (9.4 vs. 8.4) urine drug samples, and the difference was not statistically significant. Interestingly, participants in the CM

group self-reported fewer days of heroin use and more days of cocaine use at three months, but there were no statistically significant differences between the two groups.

Katz et al. (2002) examined the effectiveness of a three-month abstinence-contingent voucher incentive program on treatment retention and abstinence. The study enrolled 52 individuals with OUD who were enrolled in an outpatient treatment program that did not include medication treatment. Participants were randomly assigned to a voucher or a no-voucher group and both groups received intensive cognitive-behavioral counseling. Participants in the voucher group received vouchers for each urine drug sample testing negative for both opioids and cocaine. The samples were collected three times a week at the clinic. The study used an escalating schedule of reinforcement ($2.50 for the first sample, with value escalating by $1.25 for each consecutive negative sample) with bonus ($10 for three consecutive negative samples) and reset. This study also included a one-time, $100 bonus for the first three consecutive opiate- and cocaine-negative urine samples. The maximum earning for a continuously abstinent participant in the first three months of treatment was $1,087.50. The study found no statistically significant differences between the voucher and no-voucher groups on the mean number of opiate- and cocaine-negative urines submitted (8.3 vs. 6.2), longest duration of continuous abstinence (16.8 vs. 12.1 days), or percentage of participants abstinent for four weeks (20.7% voucher vs. 9% no voucher). Despite the lack of significant between-group differences in drug use outcomes, a positive urine drug sample at intake was strongly associated with poor outcomes, suggesting that individuals who actively use opioids may not be suitable for a program that does not offer MAT.

In a follow-up study with 75 participants who completed a previous 12-week study (Kosten et al., 2003a), Kosten et al. (2003b) examined whether eliminating the escalating CM

schedule and increasing the requirements to earn a voucher would result in decreases in drug-free urines in CM groups when compared with non-CM groups. The treatment groups were desipramine (150 mg) plus contingencies (DC), desipramine without contingencies (DNC), placebo plus contingencies (PC), placebo without contingencies (PNC). All participants received buprenorphine medication. The CM groups followed a specific schedule: during weeks 13-16, participants received a $3 voucher for each urine drug sample that tested negative for opiates, cocaine, benzodiazepines and barbiturates. During weeks 17-20, two drug free urine samples were required to earn a $6 voucher, and during weeks 21-24, three drug free urine samples were required to earn a $9 voucher. This resulted in a total possible earnings amount of $108 for weeks 13-24. Participants in the non-CM groups received vouchers equal to the average value of what the CM participants earned in the previous week, with a minimum of $3/week for providing at least one urine sample, regardless of results. The efficacy of CM statistically significantly diminished when the rates of opioid and cocaine-negative urine drug samples are compared with the previous study. Similar patterns were observed when opioid and cocaine negative samples were compared separately. The study concluded that increasing the requirement for earning vouchers and eliminating an escalating CM schedule warrants further research.

Neufeld et al. (2008) evaluated the effects of combining methadone with a structured protocol reinforcing abstinence from opiates, cocaine, sedatives, and alcohol as well as adherence to scheduled counseling sessions. The study enrolled 72 opiate-dependent individuals with antisocial personality disorder over a six-month period. Nine steps of care were designed to provide rapid delivery of predictable and increasingly positive consequences for attendance to counseling sessions and abstinence (Steps +1 to +4) and increasingly negative consequences for

missed sessions and drug use (Steps -1 to -4). Participants entered the study at step 0 and received a methadone dose of 55 mg/day, two individual counseling sessions per week, and medication dispensing times beginning at noon each day. Opportunities for movement to higher steps (positive reinforcement) occurred every two weeks and were based on negative urine drug screens and attendance to all sessions for both weeks. Missing a session or testing positive resulted in moving to a lower step (negative reinforcement). Meeting criteria for one week out of two resulted in the participant remaining at the same level. The control group received a methadone dose of 55 mg/day and two counseling sessions per week. Changes to dosage were possible once every two weeks and were clinic-determined based on rates of opioid use. The CM strategies implemented in this study consisted of participant decision-making regarding methadone dosage levels and dispensing times as well as the number of weekly take-home doses, ranging from zero to three take-home doses per week. In addition, participants earned the right to make decisions around how many weekly counseling sessions they were required to attend, from one to three. This study included a built-in "therapeutic transfer," in which participants were transferred out of the study and moved to routine care if 50% or more of their weekly urine samples tested positive and/or if they attended less than 50% of their scheduled counseling sessions over the first 90 days. The study found no statistically significant differences in drug use between groups.

The study by Kidorf et al. (2013) assessed the effectiveness of CM in enhancing attendance at psychiatric services within a community-based methadone maintenance program. A total of 125 participants with dual mental health and OUD diagnoses were enrolled and randomly assigned to either the Reinforced On-Site Integrated Care (ROIC or CM/experimental) group or the Standard On-Site Integrated Care (SOIC or control) group. The

intervention lasted 12 weeks. The ROIC participants received $25 vouchers for adhering to their weekly psychiatric service schedule, which included individual psychiatrist appointments, individual mental health counseling sessions, and group mental health education and support sessions. Urine drug samples were collected weekly using a random schedule and tested for opioids, cocaine, and benzodiazepines. The results indicated no significant differences in drug-positive urine samples between the two groups and suggested that incentives that are placed on adherence/service utilization but not on reduction in substance use or abstinence are unlikely to address this outcome.

Ling et al (2013) studied a randomized controlled trial comparing the effectiveness of four behavioral treatment conditions involving buprenorphine and medical management (MM) for treating OUD with 202 participants. Beginning with a 2-week buprenorphine induction/ stabilization phase, participants were randomized for 16 weeks to one of the following: Cognitive behavioral therapy (CBT), CM, both CBT and CM (CBT + CM), or no additional behavioral treatment (NT). Participants in the CM conditions earned draws from a prize bowl containing 100 chips with one of four dollar amounts for submitting opioid-negative urine drug samples. Consecutive opioid-negative urine drug samples increased the number of draws. Each opioid-positive urine drug sample or missed visit earned no draws and reset the number of draws to the initial starting value. Mid-study cost-cutting procedures reduced potential earnings ranges from $528-$2,196 to $230-$1,460 across sessions. Analysis showed no impact of this change on opioid use between the original and revised payment schedules. The study implemented CM training booster sessions to increase fidelity to CM. The CM + CBT group had the highest proportion of three and six consecutive opioid-negative samples compared to the other groups, but the difference was not statistically significant. Participants across all treatment

groups reported statistically significant decreases in heroin use but not in other drug use (i.e., cocaine amphetamines, sedatives, cannabis).

Dunn et al. (2014) evaluated the effectiveness of an employment-based abstinence reinforcement intervention on opioid, cocaine, and alcohol use among 46 HIV-positive individuals with opioid and/or cocaine use disorders Participants were randomly assigned to one of three groups after a three-day inpatient detoxification period: abstinence & work, work-only, or no-voucher control groups. The researchers originally planned to include 156 participants; however, the study was terminated after enrolling 46 participants and authors cited difficulties with instilling abstinence. Both the abstinence & work and work-only groups received vouchers for attendance and productivity in typing and keypad programs, with a maximum base pay of $30. Hourly wages started at $2 and escalated by $0.50 with each consecutive workday. The maximum hourly pay was $7.50. The hourly wage was reset to the initial starting value of $2 for each violation of the expectations. For the abstinence & work group, the access to workplace incentive was contingent on being abstinent from opioids, cocaine and alcohol, whereas the work-only group was not subject to this rule. The maximum potential earnings for both groups was $6,800 over the course of 26 weeks. The no-voucher group did not receive any vouchers for work. During the intervention period, 45% of the abstinence & work group, 31% of the work-only group, and 42% of the no-vouchers group submitted opioid-negative urine samples. At the 12-month follow-up, these rates were 62%, 33%, and 27%, respectively. For combined opioid and cocaine use during the intervention period, 42% of participants in the abstinence & work group, 24% in the work-only group, and 36% in the no-vouchers group submitted negative drug urine samples. At the 12-month follow-up, these rates shifted to 50%, 20%, and 27%, respectively. The proportions were not statistically significantly different from one another.

Peles et al. (2017) evaluated the effectiveness of CM for reducing substance use, cigarette smoking, and/or alcohol use among 35 pregnant women who were undergoing methadone/buprenorphine maintenance treatment in Israel. Participants were randomly assigned to either CM plus standard treatment or standard treatment only. The standard treatment consisted of education on reducing substance use, general health, and healthcare follow-up. The CM group received an initial voucher of $6 for drug-negative urine samples and self-reported substance use. Substances were ranked from most severe (which included cocaine and opioids), to least severe (which included nicotine), and escalation of the voucher value was contingent on abstinence from the most severe substances first. The study found that all women in the CM groups (vs. 68.8% of the control group) used substances during pregnancy, and the difference was statistically significant. After one year of childbirth, 44% of the CM group and 7% of the control group used drugs, and this was also a statistically significant difference. The two groups were statistically significantly different from one another in methadone/buprenorphine medication dose and intake period, which might have influenced the treatment outcomes. The women in the CM group had lower medication doses and were relatively new to the methadone/buprenorphine maintenance program compared to women in the standard treatment group.

Kidorf et al. (2018) compared the effectiveness of three treatment initiation strategies on retention in methadone maintenance treatment among 212 individuals with OUD who were enrolled in a syringe exchange program. Participants were randomized to one of the three-month conditions: Low threshold intervention (LTI), voucher reinforcement intervention (VRI), or standard care. The VRI condition included monetary incentives contingent on adherence to pharmacotherapy and adaptive counseling. Participants in the VRI condition could earn

vouchers ranging from $12 to $174 in value, plus bonuses, for consecutive adherence to a daily methadone dose and counseling. A reset occurred when a participant missed at least one scheduled methadone dose or counseling session during a week. The maximum monetary value of vouchers earned per participant was $1,329.00. Participants in the standard care and VRI groups received an adaptive treatment model depending on their abstinence status. Treatment intensity was adjusted and various reinforcement strategies (i.e., restricting methadone dosing time) were used to encourage compliance with treatment. The LTI group did not receive an adaptive treatment model, instead they attended monthly counseling sessions and received methadone medication. Despite an overall reduction in the percentage of drug-positive urine samples (i.e., opioids, cocaine, and benzodiazepines) across all three conditions, the authors found that the odds of submitting a positive urine drug sample for any of the substances did not decline significantly more in the VRI condition compared to the standard care and LTI conditions.

Tuten et al. (2012) compared the effectiveness of three CM conditions for initiating and sustaining abstinence from opioids and cocaine among 133 pregnant women attending a methadone maintenance treatment program. Participants were randomly assigned to one of three 13-week conditions: an escalating reinforcement condition, a fixed reinforcement condition, or an attendance control condition. Abstinence was measured using urine drug samples for both cocaine and opioids collected three times a week. Participants in the escalating schedule conditions could earn a $7.50 voucher for their first opioid- and cocaine- negative urine sample. The value of the voucher increased by $1 for each day that specimens were collected. The value of the voucher reset to $7.50 after a participant submitted a positive urine sample. The maximum earnings per participant was $1,364. In the fixed schedule conditions, participants

earned a $25 voucher for every drug-negative urine sample. The maximum earnings per participant was $950. Participants in the attendance control group received vouchers contingent on the compliance levels in the escalating or fixed schedule groups. No statistically significant differences in drug abstinence were found between the escalating and fixed conditions. Furthermore, there were no statistically significant differences in the average length of abstinence among the three groups. The mean number of negative urine drug tests for both opioids and cocaine was comparable across the groups. Although participants in the escalating CM condition abstained from opioids and cocaine longer than those in either the fixed CM or control conditions, that difference was not statistically significant.

Summary of Drug Use Outcomes

The reviewed studies present a mixed picture of CM's effectiveness for treating OUD. While many studies found that CM had positive effects on OUD outcomes, particularly in the short-term, others found mixed results or no significant effects. Among the studies, 17 reported positive outcomes regarding opioid use, with most finding increased abstinence from opioids during the intervention period. However, 13 studies found mixed outcomes, such as positive results for drugs other than opioids, positive outcomes during intervention but not at follow-up, or conflicting results depending on timing or analysis method. Additionally, 11 studies reported no significant effect of CM on opioid use outcomes.

When comparing types of CM, voucher-based CM was the most common type studied and generally showed positive outcomes. Prize-based CM was less frequently studied but also showed some positive results. There was no clear superiority of one method over the other based on the reviewed studies. Many studies incentivized abstinence from multiple drugs rather than focusing exclusively on opioids and some studies also targeted other behaviors like

treatment attendance or medication compliance. Studies targeting one or multiple behaviors showed positive outcomes, suggesting flexibility of the CM approach.

The magnitude of reinforcement varied widely across studies in terms of maximum potential earnings for participants. For example, in the study by Dunn et al. (2014), participants could earn up to $6,800 over the course of 26 weeks in a therapeutic workplace setting, while in Gross et al. (2006), the maximum potential earnings for the voucher group for 12 weeks were $269. Regarding the effectiveness of different magnitudes, Carroll et al. (2001b) found no relative benefit of high-magnitude CM (maximum potential earnings $1,152) for improving opioid or cocaine abstinence over low-magnitude CM (maximum potential earnings $561). Concerning the duration of effects, many studies showed positive effects during the intervention period. Several studies with follow-up assessments found that these effects often diminished after the intervention ended. For instance, Holtyn et al. (2014) found significant differences between conditions during the intervention, but these differences were not maintained at the six-month follow-up. Similarly, Preston et al. (2002) reported no significant impact of CM on opiate abstinence at three-, six-, and 12-month follow-ups, despite observing positive effects during the intervention period.

Two studies compared medication- and voucher-based CM and differed in their findings regarding the relative effectiveness of medication versus voucher contingencies. As such, Gross et al. (2006) found that the medication contingency group achieved significantly more weeks of continuous abstinence from opiates and cocaine compared to the voucher group (5.95 weeks vs. 2.90 weeks). In contrast, Chopra et al. (2009) reported that while both medication and voucher contingency groups showed significantly more continuous weeks of abstinence than standard treatment, the voucher contingency group demonstrated slightly better outcomes. The studies

varied in their potential maximum earnings for the voucher CM groups. The potential earnings in the study by Gross et al. (2006) was lower than the other study.

Retention Outcomes

A total of 33 studies examined retention outcomes. Seven studies found positive effects of CM, five showed mixed results, and 21 found no effect of CM for treatment retention. Retention was often measured as length of stay in treatment, treatment completion, and dropping out of treatment.

Studies with Positive Results

Seven studies demonstrated positive benefits of CM on retention outcomes. Six of the seven studies reporting positive findings implemented voucher-based CM. One of the voucher-based CM studies compared voucher-based CM to medication-based CM (Chopra et al., 2009) and another study was implemented within the context of a therapeutic workplace (Dunn et al., 2014). The remaining study evaluated prize-based CM (Hser et al., 2011).

Carroll et al. (2001a) assessed the efficacy of CM and significant other involvement in enhancing naltrexone treatment outcomes. The study reported that CM was associated with statistically significant improvements in treatment retention compared with standard naltrexone treatment (7.4 vs 5.6 weeks). Despite the lack of significant differences between the significant other plus CM and CM-only groups, treatment completion rates were highest in the significant other plus CM group (47%), followed by the CM-only (42.9%) and standard naltrexone (25.6%) groups.

Brooner et al. (2007) compared retention rates across participants receiving motivational stepped care (MSC), contingent voucher incentives (CVI), or standard care. Adaptive stepped-care conditions (MSC + CVI and MSC-only) statistically significantly improved treatment

attendance during the 6-month randomized phase, with MSC + CVI maintaining higher attendance at 3-month follow-up. Retention rates varied across treatments, with CVI-only resulting in the highest (72.9%) and MSC-only resulting in the lowest (44.1%) retention rates over the 9-month trial.

Chopra et al. (2009) compared retention rates at the end of 12 weeks of treatment across participants receiving medication contingency, voucher contingency, or standard treatment. The type of treatment had a statistically significant impact on the treatment completion (voucher contingency group: 85.4%; medication contingency group: 59.5%; standard treatment: 75.7%). The proportion of participants completing the 12-week treatment was statistically significantly higher in the voucher contingency group compared to the medication contingency group. The proportion comparisons between other groups did not significantly differ.

In their evaluation of employment-based abstinence reinforcement intervention, Dunn et al. (2014) found that participants in the no-voucher group dropped out at a statistically significantly higher rate (93%) compared to those in the work-only (67%) and abstinence & work (81%) conditions.

Kidorf et al. (2009) compared attendance rates between motivated referral condition (MRC) and MRC plus incentives (MRC-I) participants. The study found that participants in the MRC+I group attended a statistically significantly higher proportion of motivational enhancement and treatment readiness group sessions compared to those in the MRC group.

Hser et al. (2011) tested whether prize-based CM can improve treatment retention. The study found that significantly more participants in the CM group (81%) remained in treatment in comparison to participants receiving usual care (67%). Participants in the CM group were also significantly less likely to drop out of treatment compared to those in the usual care group.

Christensen et al (2014) found that participants in the CRA+ group had a higher retention rate (80%) than those in the CM-alone condition (64%). This difference was supported by statistical comparisons of retention. Participants in the CM-alone condition were twice as likely to drop out of treatment compared to the CRA+ participants. Additionally, CRA+ participants were twice as likely to complete the 12-week treatment compared to CM-alone participants. The study also evaluated whether prior treatment status affected retention. Those in the CM-alone group with a history of receiving OUD treatment were about 6.5 times more likely to drop out of treatment compared to their counterparts in the CRA+ group.

Studies with Mixed Results

Five studies reported some positive findings for CM, but also some null or negative results. The effects often varied depending on specific conditions or subgroups. Three studies evaluated voucher-based CM, and one of these studies also included take-home methadone doses as part of the incentives (McCaul et al., 1984). One study provided methadone medication dose increases or decreases as the incentive (Calsyn et al., 1994), while another provided opportunities to earn prizes (Chen et al., 2013).

A study by McCaul et al. (1984) evaluated the effectiveness of a CM program within an outpatient methadone detoxification program over a 90-day (13 week) period. Participants were randomly assigned to CM and control conditions and stabilized on 30 mg/day of methadone for the first three weeks (baseline period), followed by a gradual dose reduction starting in the fourth week (intervention period). Retention rates were statistically significantly higher in the CM group, with 70% completing the detox program compared to 20% in the control group. However, the average number of days in treatment did not differ significantly between the groups.

Calsyn et al. (1994) compared retention across contingency contracting (CC) and no contingency (NC) groups coupled with various levels of counseling (medication only, standard, and enhanced). Participants were receiving methadone maintenance treatment. The CC groups had statistically significantly higher discharge rates compared to those in the NC group, particularly in the second six months. At six months, dropout rates were similar (CC: 31%; NC: 32%), but by 12 months, CC had a higher dropout rate (CC: 76%; NC: 54%). Participants in the CC condition had statistically significantly shorter out of treatment periods before readmission. By 12 months, 45% of discharged CC participants were readmitted, compared to 30% of those in the NC group. Level of counseling had no statistically significant effect on discharge or readmission rates.

Chen et al (2013) found that by the end of 12 weeks of treatment, 81.7% of CM plus methadone maintenance treatment participants and 67.5% of methadone maintenance alone participants were retained in treatment with a statistically significant difference. A statistically significantly higher percentage of those receiving CM in rural areas (83.1%) compared to those receiving methadone maintenance only (59.5%) completed 12 weeks of treatment, however, the difference between the two groups in urban areas was not significant (80.0% vs. 69.8%). The CM participants had higher treatment attendance on average than the methadone maintenance treatment participants (65.3 vs. 58.0 days). This difference was statistically significant and consistent in both urban (68.0 vs. 59.5 days) and rural (63.1 vs. 54.7 days) clinics.

Kidorf et al. (2013) compared attendance rates between a Reinforced On-Site Integrated Care (ROIC or CM/experimental) group and a Standard On-Site Integrated Care (SOIC or control) group. The study enrolled a sample of participants who had dual mental health and OUD diagnoses and were receiving methadone maintenance treatment. Compared to the control group,

CM participants attended more individual and group mental health sessions each month (months 1, 2, and 3) with a statistically significant difference. They also attended statistically significantly more psychiatry sessions, although the difference for month 3 was not statistically significant.

Metrebian et al (2021) compared retention rates between CM targeted at opiate abstinence for appointments (CM Abstinence), CM targeted at timely attendance at appointments (CM Attendance), or no CM (treatment as usual; TAU) among a sample receiving opioid agonist treatment. A higher proportion of the CM Attendance group achieved full 12-week attendance (56%) than either the CM Abstinence (39%) or TAU (30%) groups. Membership in the CM Attendance group was associated with statistically significant higher odds of full attendance than TAU membership, while attendance outcomes for the CM Abstinence participants did not differ significantly from those of the TAU participants. The CM Abstinence group had a statistically significant higher risk of dropping out of treatment compared to both the CM Attendance and TAU groups.

Studies with No Effect of Contingency Management

The majority of studies (21 out of 33) found no significant effect of CM on retention outcomes. One study by Iguchi et al. (1988) only provided descriptive results, most likely due to the very small sample size. Many studies found that CM groups had higher retention rates, but the findings did not reach statistical significance. Seventeen studies evaluated voucher-based CM, with one of them also including a medication-based CM group (Gross et al., 2006). Two studies offered privileges as CM incentives (Iguchi et al., 1988; Brooner et al., 1998) and another two offered opportunities to earn prizes (Petry & Martin, 2002; Ling et al., 2013).

Iguchi et al. (1988) compared a combined CM condition that included aversive consequences (i.e., reduction in methadone dose) to a single CM condition that did not have an

aversive consequences component. The study found that those in the single CM group exhibited better treatment retention, with more participants completing the entire program (n = 6) than those in the combined CM group (n = 3). The single CM group had two participants drop out due to incarceration, whereas the combined, aversive CM group had a total of five participants drop out of the study due to incarceration (n = 2), declined transfer (n = 2), and voluntary transfer (n = 1).

Brooner et al. (1998) evaluated the effectiveness of a CM intervention among individuals with substance use and antisocial disorder enrolled in methadone maintenance treatment. Thirty percent of the CM group compared to the 10% of the control group that received only methadone medication failed to complete the 13-week treatment, but this difference was not statistically significant. The study also compared post-treatment routine care utilization rates and found that a statistically significantly smaller proportion of participants in the CM group (14%) were therapeutically transferred to routine care compared to those in the methadone dose only group (56%).

Downey et al. (2000) assessed the effectiveness of voucher-based CM for improving abstinence from both heroin and cocaine. The authors found no statistically significant difference in retention between the voucher and the yoked control groups, even though participants in the voucher group attended a mean of 43.5 visits as compared to a mean of 38.8 visits attended by the control group.

Preston et al. (2000) compared retention rates among contingent vouchers (vouchers given for opiate-negative urine samples), dose increase (methadone hydrochloride dose increase to 70 mg/d and noncontingent vouchers), combined treatment (contingent vouchers plus methadone dose increase), and comparison standard (noncontingent vouchers and no methadone

dose increase) groups. Retention in treatment was very high (93% completion rate) and there were no statistically significant differences between groups in retention, although the comparison standard group had a trend of poorer treatment attendance compared to others. A study by Preston et al. (2002) compared retention rates across groups in the maintenance phase using a study sample that included some of the participants who had completed an earlier study by Preston et al. (2000). Seventy-five percent of participants completed the study and there were no statistically significant differences in retention rates between participants randomized to the contingent and noncontingent groups.

Carroll et al. (2001b) examined the effectiveness of voucher-based CM in improving naltrexone compliance and opioid use and then compared the effectiveness of lower vs. higher magnitude vouchers on these outcomes. Although participants in both the low and high voucher conditions tended to remain in treatment longer than those in standard naltrexone treatment, this difference was not statistically significant. There was no significant difference in retention by magnitude of reinforcement.

Katz et al. (2002) examined the effectiveness of a three-month abstinence-contingent voucher incentive program on treatment retention and abstinence. The authors found no statistically significant differences between the voucher and no-voucher groups in terms of mean days retained in treatment (35.9 vs. 39.3 days).

Petry & Martin (2002) assessed the effectiveness of a low-magnitude CM intervention on reducing drug use. The authors found no statistically significant differences in retention rates between the CM (89%) and standard treatment (87%) groups during the full six months of treatment.

Two studies conducted by Kosten et al. (2003a, 2003b) examined whether desipramine plus CM would result in greater retention than either CM or medication alone. Each article described results from a different phase of a larger study, with Phase 1 covering weeks 1-12 (Kosten et al, 2003a) and Phase 2 covering weeks 13-24 (Kosten et al, 2003b). The studies found no statistically significant differences in retention rates between groups. In Phase 1, participants had an average retention of 9.2 weeks, with 49% of participants completing the study. During Phase 2, 63 of 75 participants completed treatment through week 16, 54 participants completed treatment through week 20, and 42 (56%) participants completed the entire 24-week trial.

Oliveto et al. (2005) explored how varying doses of a longer-acting opioid agonist maintenance medication called levo-alpha-acetylmethadol (LAAM) with and without CM might affect retention. Fifty-three percent of the total sample completed the 12-week treatment. The study found no statistically significant differences between the experimental groups in treatment retention, suggesting no effect of combining LAAM at either a high or low maintenance dose with CM.

Schottenfeld et al. (2005) compared the effects of combining CM or performance feedback with buprenorphine and methadone treatment. There were no significant differences in retention between the CM and the performance feedback groups.

Gross et al. (2006) hypothesized that a negative-reinforcement medication contingency strategy would result in greater control over abstinence and treatment retention. Participants in the contingent medication, voucher, and control groups stayed in treatment on average of 10.4 weeks, 11.3 weeks, and 11.8 weeks, respectively. Eighty percent of participants in the voucher group, 65% of participants in the medication contingency group, and 80% of participants in the

control group completed the 12-week treatment. None of these differences were statistically significant.

In the study by Poling et al. (2006), CM was combined with bupropion with cocaine-using veterans who were stabilized on methadone. Participants were randomized into four groups: CM and 300 mg/day of bupropion hydrochloride (CMB), CM and a placebo (CMP), voucher control and bupropion (VCB), and voucher control and placebo (VCP). There were no differences in rates of retention between the intervention and control groups over the 25-week study.

Peirce et al. (2006) found that retention and participation in counseling outcomes were comparable across groups. By the end of the study, 67.1% of CM participants and 64.8% of control participants were retained in the study, with no statistically significant difference between the two groups.

Bickel et al. (2008) found that an average of 58%, 53%, and 62% of participants in the standard, therapist-delivered CRA plus vouchers, and computer-assisted CRA plus vouchers conditions, respectively, were retained in the 23-week treatment. The percentage of participants retained in treatment did not significantly differ across treatment conditions.

Epstein et al. (2009) tested whether a combination of CM and methadone dose increase would promote abstinence from heroin and cocaine. The study found that retention did not significantly differ by either the methadone dose or the contingency. Mean retention across all three experimental groups was 15.1 weeks out of 17 for baseline and intervention only and 20.8 weeks out of 27 for the whole study.

Tuten et al. (2012) compared the effectiveness of three CM conditions for initiating and sustaining abstinence from opioids and cocaine. The authors reported an overall retention rate

exceeding 80% across the groups with no statistically significant differences between participants in the escalating and fixed conditions.

Ling et al (2013) compared treatment completion rates across four treatment groups: cognitive behavioral therapy (CBT), CM, CBT+CM and no additional treatment (NT). All conditions involved buprenorphine and medical management. A higher proportion of the CBT + CM group (73.5%) completed treatment, followed by CBT (71.7%), CM (69.4%), and NT (64.7%). The mean number of weeks in treatment were comparable across the groups ranging from 14.6 weeks to 15.3 weeks. None of the comparisons yielded statistically significant differences.

Holtyn et al. (2014) evaluated whether employment-based reinforcement increased methadone treatment engagement. The study found no statistically significant differences between study groups in methadone enrollment at any of the assessment time points.

Peles et al. (2017) compared retention rates between CM plus standard treatment or standard treatment only among a sample of pregnant women who were receiving medication maintenance treatment. The study found that the CM group had a higher retention rate (100%) compared to standard treatment (87.5%) in a methadone/buprenorphine maintenance program at follow-up, but the difference was not statistically significant.

Kidorf et al. (2018) compared the retention rates across voucher reinforcement, low threshold, and standard care intervention groups. There were no statistically significant group differences in retention rates over the 3-month and 6-month observation periods.

Jarvis et al. (2019) randomly assigned participants into XR-NTX, abstinence incentives (AIs), XR-NTX plus AIs, or usual care with an intervention period spanning six months. The study reported that participants spent a mean of 58.7% of days attending the therapeutic

workplace during the intervention and were retained in the workplace intervention for an average of 20.3 out of 24 weeks. The XR-NTX plus AIs group had the highest average percentage of days in the workplace intervention (63.5%) followed by the AIs (61%), usual care (59.2%), and XR-NTX (52.4%) groups, with no statistically significant differences. In a comparison of the mean number of weeks in the workplace, participants in the usual care condition spent the longest time in the workplace (22.7 weeks), followed by XR-NTX plus incentives (20 weeks), abstinence incentives (19.5 weeks), and XR-NTX (19.4 weeks), but these differences were not statistically significant.

Summary of Retention Outcomes

An overwhelming majority of the studies did not find statistically significant effects of CM. However, many of the studies still favored CM in retention outcomes. The effectiveness of CM appears to be influenced by various factors, including the specific implementation of CM, the treatment context, and comparison groups.

Mortality/Morbidity Related Outcomes

Seven studies examined mortality and morbidity related outcomes. All of them evaluated voucher-based CM and four studies were conducted in a therapeutic workplace setting. Studies often examined HIV related risk behaviors. Two studies also reported participant death during the follow-up period (Carroll et al., 2001b; Jarvis et al., 2019). None of the studies found statistically significant differences between the CM and comparison groups in mortality and morbidity related outcomes.

In their study examining the efficacy of CM and significant other involvement in enhancing naltrexone treatment outcomes, Carroll et al. (2001a) reported that one participant died of an accidental overdose one month after he had successfully completed the study and had

been transferred to a long-term naltrexone maintenance program. The study found a statistically significant reduction in the frequency of drug-related risk behaviors over time across groups, but there was no effect in favor of CM compared to standard naltrexone treatment. There were no statistically significant effects for time or treatment group on frequency of sexual risk behaviors.

Carroll et al. (2001b) compared standard naltrexone maintenance, standard naltrexone plus low-value CM, or standard naltrexone plus high-value CM in their study. There was a significant reduction in in the frequency of self-reported drug- and sex-related risk behaviors over time across groups, suggesting significant reductions in HIV risk behaviors for participants in all conditions significantly during treatment. There was no differential effect of CM or magnitude of reinforcer compared with standard naltrexone treatment. The study also reported that three participants died, one due to complications related to a head injury and two of suspected drug overdose, during the 6-month follow-up period.

Kidorf et al. (2009) compared the effectiveness of an intervention that combined a motivational intervention and incentives on syringe sharing behavior. There were no statistically significant differences between those who received incentives and those who did not.

Dunn et al. (2014) examined the effectiveness of employment-based CM on HIV-related risk behaviors among HIV-positive participants using injection drugs. There were no significant differences in the changes of the frequency of drug injection, sharing needles, exchanging sex for drugs, or receiving money for sex across abstinence & work, work-only and no-voucher groups during the intervention period or at 12-month follow-up assessment.

Holtyn et al. (2014) compared HIV risk behaviors among a sample of participants enrolled in a therapeutic workplace and assigned to one of three study conditions with varying CM conditions. They found lower rates of sharing needles or works, trading sex for drugs or

money, going to a shooting gallery or crack house, and injecting drugs across all study conditions during the intervention evaluation period and follow-up as compared to intake. Statistical analyses for these comparisons were not conducted.

Jarvis et al. (2019) reported that study-related adverse events such as chills and sweating were rare and did not differ across groups. One participant in the abstinence incentives group died of unknown cases approximately six months after the intervention ended.

In their preliminary evaluation of therapeutic workplace program for sex workers, DeFulio et al. (2022) compared HIV-risk behaviors between those who were assigned to a diversion program plus therapeutic workplace condition and those who were only enrolled in a diversion program for four months. Participants in the therapeutic workplace group had lower rates of HIV-risk behaviors at the end of the program, but the difference was not statistically significant.

Craving Outcomes

Only two studies reported craving outcomes. Preston et al (2000) compared craving outcomes among four conditions: contingent vouchers (vouchers given for opiate-negative urine samples), dose increase (methadone hydrochloride dose increase to 70 mg/d and noncontingent vouchers), combined treatment (contingent vouchers plus methadone dose increase), and comparison standard (noncontingent vouchers and no methadone dose increase). To measure craving, participants answered a questionnaire about how much they wanted cocaine and heroin during the past week on a scale from 0 (not at all) to 4 (extremely). Only the dose increase group statistically significantly reduced opiate craving scores, suggesting that CM did not have an effect on craving. A later study by Preston et al. (2002), which included some of the participants who completed the study by Preston et al. (2000), found that heroin craving statistically

significantly increased over the maintenance phase, regardless of contingency or methadone dose status.

Limitations

The studies included in this review were characterized by strong research designs and showed promising results of CM for treating OUDs, however, they had some limitations. The studies varied considerably in sample sizes, ranging from 11 to 552 participants. Thus, some of the smaller studies may have been underpowered to detect statistically significant differences between the CM and comparison groups.

The studies used various CM approaches, including different incentive types (e.g., vouchers, prizes, or treatment-related privileges), magnitudes of reinforcement, and target behaviors such as medication compliance and abstinence from single or multiple drugs. In addition, the study designs varied in terms of the comparison groups. Many studies compared CM to treatment as usual or no additional treatment, while others used yoked control designs where control participants received non-contingent rewards matched to those earned by CM participants. Some studies, like Preston et al. (2000), included multiple comparison groups with contingent and non-contingent vouchers, medication dose increases, and their combinations. This heterogeneity in both CM approaches and study designs makes it challenging to draw definitive conclusions about the most effective CM strategies.

Many studies focused on short-term outcomes, with limited data on the long-term effectiveness of CM interventions. This gap in knowledge makes it difficult to assess the sustained impact of CM on OUD treatment.

Finally, only one study actively monitored fidelity to CM implementation, while another reported providing CM booster training sessions to staff. The lack of consistent fidelity measures across studies may impact the reliability and generalizability of the findings.

Conclusion

This literature review aimed to assess the effectiveness of CM on drug use, treatment retention, and mortality/morbidity outcomes among individuals with OUD. The findings from the review showed that CM has potential as an adjunctive treatment for OUD, particularly when combined with MAT.

Overall, CM shows promise in reducing opioid use, as evidenced by the positive findings of 17 out of 41 studies. However, findings on effectiveness varied across studies, with some showing significant positive outcomes and others reporting mixed or no effects. While some studies found positive effects of CM on treatment retention, the majority did not show statistically significant differences between the comparison groups. Unexpectedly, no clear themes regarding CM best practices emerged, either in terms of CM type or the number of targeted drugs. This suggests that the impact of CM on both opioid use and retention may be context-dependent or influenced by specific implementation factors.

The review also found limited evidence on CM's impact on mortality, morbidity, and craving outcomes. Mortality and morbidity-related outcomes were mostly limited to HIV-risk behaviors. A more comprehensive picture of mortality and morbidity outcomes needs to be examined in the future. This will help understand the potential benefits of CM in these areas.

Findings suggested that CM could be more effective during the intervention period, with effects often diminishing after the intervention ends. This highlights the need for strategies to maintain the benefits of CM over time.

The review revealed a wide range of possible CM implementation strategies, including different types of incentives, reinforcement schedules, and target behaviors. This variability, while making it challenging to identify the most effective CM strategies for OUD treatment, also points to the flexibility of CM when implementing it with different client populations.

Some studies suggested that CM may be most effective when combined with other treatments, such as MAT or cognitive-behavioral therapy. Further research on optimal treatment combinations is warranted. Future studies should also address the limitations (e.g., lack of fidelity monitoring and small sample sizes) identified in this review to provide more definitive evidence on the role of CM in OUD treatment.

In conclusion, while CM shows promise as a treatment component for OUD, more research is needed to optimize its implementation, understand its long-term effects, and determine how best to integrate it with other evidence-based treatments. Although the variability in CM approaches makes it difficult to draw definitive conclusions, it also demonstrates that CM is a highly adaptable approach. This flexibility allows for tailoring CM to meet the unique needs of client populations and diverse treatment settings in real-world clinical practice.

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