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Matthew Holkup

University of St. Thomas, Minnesota, mholkup@comcast.net

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Contingency Management Effect on Cocaine Use While Using Methadone

by

Matthew J. Holkup, B. A.; L.S.W.; L. A. D. C.

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Committee members

Ande A. Nesmith, MSW, PhD, LISW (chair)

Annie Gettle, MSW, LGSW

Geoff Riemermann, LADC, CTTS

The Clinical research Project is a graduation requirement for MSW students at St. Catherine University – University of St. Thomas School of Social Work in St. Paul, Minnesota and is conducted within a nine-month time frame to demonstrate facility with basic social research methods, Students must independently conceptualize a research problem, formulate a research design that is approved by a research committee and the university Institutional Review board, implement the project, and publicly present the findings of the study. The project is neither a Master's thesis nor a dissertation.

Abstract

An estimated 50 % of patients on methadone use cocaine concurrently (Holuj et al., 2013). Participants using cocaine were three times more likely to drop out of methadone maintenance treatment (MMT) and are less likely to have cocaine/opiate free urine samples (Kosten et al., 2003). Contingency Management (CM) has been shown to be effective in the reduction of cocaine use for participant on methadone but there isn't a comprehensive evaluation of all of the research completed. This systematic review evaluated the research on the short and long term effectiveness of CM on cocaine use, the effectiveness of the various types of CM, the effect of the magnitude of CM and the timing of CM administration. CM was found to have short and long term success in reducing cocaine use among participants on MMT. CM was most successful when continuously given and the magnitude of the reinforcement was highest. CM was shown to be effective in all forms. Differences in the research studies made it difficult to determine which type of CM was most effective with the exception of one article that showed clear benefits with cash/check CM compared to voucher CM.

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Introduction

This systematic review is intended to analyze research on the amount of use of cocaine while people are involved in Methadone Maintenance (MMT). MMT is a form of ORT (Opiate Replacement Therapy). The intent of ORT is it “supplies illicit drug users with a replacement drug, a prescribed medicine such as methadone or buprenorphine, which is usually administered orally in a supervised clinical setting.” (Kermode et al. April 2011 p. 241). Methadone was invented in early 1900’s (Hanson et al, 1985). Many people believe that methadone was invented as a means to deal with a lack of morphine supply causing intense withdrawal for users in the 1930’s in NAZI Germany (Booth, 1998). In 2015 there were an estimated 4,770 tons of global opium production (World Drug Report, 2016). Recreational use of opiates goes back to prehistoric man; however, the modern day understanding of opiate addiction was not in place until 1910 a few years after the introduction of aspirin as a pain management alternative (Booth, 1998).

Methadone Maintenance Treatment (MMT) has been shown to be effective in increasing employment, improving physical and psychological health, improving social relationships and overall quality of life (Teoh Bing Fei et al, July 2016), MMT has been shown to be superior in retaining patients in treatment and in the suppression of heroin use than detoxification, drug free rehabilitation, placebo medication and waitlist controls (Mattick et al, July 8, 2009). MMT was also found to significantly reduce criminal activity (Bell et al, 1992). MMT is shown to reduce cravings and reduce mortality (Holuj et al. 2013). However, there is also significant evidence showing MMT isn’t as effective when cocaine also used. Cocaine use while in Methadone treatment is “seen in almost 50% of patients” (Holuj et al. 2013 pg 1177). Holuj et al 2013 & Kosten et al, 2003 both state poor prognosis for those using cocaine while on methadone. Kosten

et al, 2003 found MMT participants on cocaine were three times more likely to drop out of treatment. Methadone, if abused, just like other opiates can lead to overdoses especially if used in conjunction with alcohol or benzodiazepines.

Background

Cocaine is defined by the National Institute on Drug Abuse (NIDA) as “a powerfully addictive stimulant drug.” In the early 1900’s, doctors prescribed it for pain, energy and sinus infections. Cocaine is only currently medically used due to its addictive properties as an anesthetic for throat, ear and eye surgeries. It is mainly used illegally. The amount of illegal use has remained stable since 2009. Some effects of cocaine use are increased energy, attentiveness, anxiety, paranoia, impulsiveness and irritability (National Institute of Drug Abuse, 2016).

The following is the background of usage of other mood altering substances while involved in opiate substitution therapy. Opiates have a large enough overdose rate without other drug use. According to the Center for Disease Control (CDC), “Since 2000, the rate of deaths from drug overdoses has increased 137% including 200% increase in the rate of overdose deaths involving opioids” (Rudd, Aleshire, Zibbell, & Gladden, January 1 2016). In 2014, the CDC found 47,055 drug overdose deaths 61% were related to the use of opioids (Rudd et al 2016).

The scope of the use of other drugs on methadone problem is shown in multiple research studies finding usage of other addictive substances on methadone. In one study of 190 people actively receiving MMT, 51% of MMT clients reported heavy alcohol use (Nyamathi, et al., April 2009). Another study found in a study of people who didn’t qualify for having an alcohol use disorder 244 of 359 participants drank alcohol while in MMT programming (Caputo, et al., 2002). Only 19% of people were able to remain abstinent from other addictive drugs while on buprenorphine along with contingency management (CM) or desiprmine (DMI).

CM is a cognitive behavioral treatment where a client receives a voucher/ monetary incentive for each negative urinary analysis (UA) result. DMI on the other hand is a Selective Serotonin Reuptake Inhibitor medication. Only when both CM and DMI were both added to

buprenorphine treatment that 43% of users were to provide a full month of drug free UA results (Kosten, et al., 2003). There were 787 MMT users evaluated in Israel between 1993 and 2012. In studying them, they found that between 25.4 (in 2003) and 61 percent (in 2002) of patients tested positive for benzodiazepines (an abusable prescribed anti-anxiety/ sleep aid). at any time. Goren, Carmel, & Marchevsky, 2014 found benzodiazepine use while in MMT lead to shorter stays in MMT treatment and dying younger than those not using benzodiazepines (Goren, Carmel, & Marchevsky, 2014). In examination of 4 studies on methadone and 3 of buprenorphine, Jones, Mogali and Comer (2012) found between 51 to 70% of patients were using benzodiazepines while in MMT. Jones et al. (2012) also found based on the examination of 3 studies 18 to 54% of MMT new admits were also required to have benzodiazepines detoxification.

This problem is important because for the first time since The Vietnam War the overall mortality rate increased among people from their mid-20's and 50's age group mainly due to opiate related overdoses. The increase in mortality was so high it led to the life expectancy for all Caucasian people to decrease from 78.9 to 78.8 in 2014 despite strong advances in technology that allows Americans to live longer and healthies lives. The mortality rates among minorities continued to decrease, most think due to improving health care technology (National Council on Alcoholism and Drug Dependence, April 26 2016). According the National Institute of Drug Abuse (2015), there was 3.4 times more prescription opioid overdoses, 5 times more benzodiazepines overdoses and 6 times more heroin overdoses in comparing 2001 to 2014.

The potential implications for social work and mental health practice are that it is difficult to regulate mental health symptoms when a person is actively using. It is difficult to differentiate between withdrawal/ use symptoms and mental health symptoms. If performing clinical mental

health practice with a person actively using drugs, it is difficult to know if mental health symptoms are improving or not.

The policy changes/ societal improvement I hope to achieve by doing this study require opiate replacement therapy providers to provide drug testing for all drugs, decrease overdoses risks associated with drug interaction and make additional services available to people who are continuing to struggle.

There has been a lot of research on the topic of usage of other substances while on opiate replacement therapy. However, I haven't been able to find a comprehensive review of all of this research brought together. A systematic review would show the need for changes in opiate replacement therapy to provide an accurate understanding of the benefits and problems of opiate replacement therapy and what the in the rate of positive urinalysis of other substances while on methadone.

Methods

Research Purpose

The purpose of this systematic literature review was to explore the question: What is the effect of contingency management on reducing the use of cocaine in patients in methadone Maintenance Treatment (MMT).

MMT is the most common form of opiate replacement therapy (ORT). ORT is the use of opiates to replace the problematic use of heroin or prescription painkillers. There are several other opiate replacement medications (however, they are less used and less research exists on them). Studies using Subutex, naltrexone, suboxone or other opiate replacements will not be used. I evaluated strictly the use of cocaine use. I chose to evaluate cocaine due to having a larger amount of research on it. Correia et al, 2005, stated he chose to evaluate cocaine use because of numerous studies reporting a high rate of cocaine use, and cocaine dependence among methadone clients as well as poorer clinical outcomes when methadone users also use cocaine. Studies were used from 2000 to present. I used articles from a larger time frame due to the specificity of the subject to gather more research information. Research on this topic can extend further back due to reliable urinalysis in existence for a long time and modern day technology advancements having minimal effect on research.

Review Protocol

Articles were searched and collected in October and Novembers 2016 over a 3-week time span after meeting with committee members to review and approve a systematic review research proposal.

Types of studies

The point of this research is to answer the question about how many and how often participants used cocaine while on methadone. This research will only use quantitative/qualitative studies with no fewer than five research participants.

Search Strategy

The preliminary search of academic journals was done on the PsycINFO search academic search engine. Each of the following terms was searched with the terms “cocaine” in conjunction with the word “methadone”. The search was limited to full text and peer reviewed articles from 2000 to present. There were 42 articles that met these criteria.

Inclusion Criteria

Only articles directly reporting on usage of cocaine while on methadone were included in this research study. Only articles in the English language were used. Only quantitative/qualitative peer reviewed research studies from 2000 or later were included. Articles were only included if the article’s participants were adults ages 18 and older because methadone is rarely administered to children. I used only peer reviewed journals as these articles follow a scientific process that is more accurate and take into account all clinical research. The articles I collected were placed into a diagram reporting results/findings, control group and behavioral interventions used. The research did not use articles related to usage cocaine while not on methadone. Articles that referred only to cocaine usage prior to or after methadone involvement were not included. Studies on methadone that did not report usage of cocaine were not included. Only studies reporting positive and negative urinalysis results were included in the study. Both men and women were included. Articles with fewer than five participants in the study were not included.

Articles where the methadone intake was not medically monitored by a medical professional were not used. Studies referring to illicit use of methadone were not used. After reviewing the 42 discovered articles on Psych Info and reviewing the methods sections these articles only 29 met inclusionary criteria for this review.

Data Abstraction and Analysis

Once I identified my research articles. I used the methods sections of each article and placed the information into the below appendix A grid. I identified patterns in methadone dosage, what other behavioral techniques were included, was there a control group, sample size, gender, frequency of UAs, what drugs were found in UA, and how long the patient had been on methadone. I saw patterns in the data and evaluated the schematic differences of each research article. I compared the effectiveness of the different types of contingency management (CM) and their effect on abstinence while given and up to a year after CM ended, whether the magnitude (amount of money given) affected use, the effect of CM for cocaine on the usage of other drugs

Exclusion Criteria

I excluded El-Bassel et al. (2004) article due to not using contingency management and chemical use being related to domestic violence use and not MMT programming. Sorensen et al (2005) article was excluded due to not all patients being on MMT and no use of contingency management. Proctor & Copland (2014) was excluded due to not all patients being on methadone and contingency management not being used. Weinstock et. al (2010) and Burch et al. (2015) article was excluded due to being a review of other journals that had already been reviewed in journal article Barry et al. (2009). Morgenstern et Al. (2009) article was not included due to no use of contingency management and not all people were on methadone. Marsch et al

(2005) article as not included due to use of other opiate replacement therapies in some members and no CM usage. Ziaee et al. (2016) article wasn't included due to no contingency management and no urinalysis results. After excluding these 8 articles, there were 21 remaining articles.

Findings

The articles enclosed in my systematic review contained of the effectiveness of different types of (CM) Contingency Management. The studies contained several types of CM: the therapeutic workplace, lottery prize, voucher, check, and brief abstinence test procedures. All clients in studies were on methadone maintenance treatment (MMT). The vast majority of clients were involved in outpatient group and or individual behavioral therapy (BT) as well.

The therapeutic workplace (Holtyn et al., 2016) procedure consists of clients being able to work if and only if they provided clean urinalysis (UA) results. The amount they get paid per hour increases with the amount of days of consecutive clean UAs.

The lottery prize procedure (Petry et al, 2012, Barry et al, 2009, Bryne & Petry, 2011) is when clients are given an opportunity to have their name placed in a prize drawing. The more consecutive clean UA's the client provides the more time their name is placed in the prize drawing increasing their chances of winning prizes of various amounts.

The voucher procedure (Dallery et al, 2001, Barry et al, 2009, Bryne & Petry, 2011 Preston et al, 2001) is where the client receives an allotted amount of money that is provided in the form of a voucher. The more consecutive clean UAs the client provides the larger the sum of money they receive is. The client turns in the voucher for everyday items. The check/cash procedure consists of client's receiving an amount of money for each clean UA provided. The monetary value increases with each clean UA.

The brief abstinence test (BAT) procedure (Correia & Sigman et al, 2005, Correia & Dallery et al, 2003, Katz et al. 2002) is a form of CM that typically is administered for a short

period of time to see the reaction of participant towards different amounts of money and different types of reward administration.

When CM was provided, participants were more likely to stay abstinent than when no CM reinforcement at all was provided to the same participants regardless of type of CM provided. (Correia & Sigman et al, 2005, Dallery et al, 2001 Correia & Dallery et al, 2003, Vandrey et al, 2007, Messina et al. 2003, Greenwald, 2006, Katz et al, 2002). When any form of CM was provided there were fewer positive UAs overall and a longer average length of sobriety for patients in CM than patients in the control groups (Barry et al, 2009, Bryne & Petry, 2011, Holtyn et al, 2016, Petry et al, 2012, Ghitza et al, 2007, Silverman et al, 2004, Preston et al, 2001, Stizer & Pierce, 2007, Petry & Carroll, 2013, Epstein et al, 2003, Petry et al 2007). There were fewer positive UAs overall and a longer average length of sobriety for patients in CM than patients in the control groups. In fact, in Epstein et al, 2003 it showed there were fewer positive UA results in CM or CM with Cognitive Behavioral Therapy (CBT) than with CBT alone or in control groups. CBT even appeared to reduce the effect of CM in the early stages of group, however, this changed after seven weeks of CM with CBT programming and the dual group became significantly more effective in reducing the number of positive UAs than the CM with sober support group. One exception to the success of CM was in Silverman et al, 2004 where in the final 13 weeks of the study (despite being effective the first 39 weeks) the reinforcement of receiving a take home methadone dose appeared to no longer have a significant reinforcement effect compared to the control group. In that same study, the voucher reinforcement continued to be effective. The amount of money provided in CM or magnitude of CM reinforcement was found to significantly increase the number of negative UA's in Dallery et al. (2001) and Ghitza et al (2007).

The long-term effects of (BAT) brief abstinence therapy were not taken into consideration in any of the studies in this review. Therefore, it is unknown if BAT had any long-term effect on usage. However, as shown in (Correia & Sigman et al, 2005 and Katz et al, 2002) clients receiving a CM reinforcement one time didn't affect abstinence rates on days when no monetary reinforcement was given regardless of whether the UA test was given at the beginning or end of the study. Interrupted reinforcement seemed to have less of an effect on abstinence than stopping reinforcement (Katz et al, 2002). More long term forms of CM (Barry et al, 2009, Bryne & Petry, 2011, Ghitza et al, 2007, Petry & Carroll, 2013) showed on 3, 6, 9 or 12-month CM follow up UAs, there were significantly more negative UA's in those who had participated in contingency management up a year after the study completed than those in control groups. One study Petry et al 2007, didn't find a significant difference between the control group and the clients in CM at the 9 month follow up.

Studies showed differences in whether the implementation of CM rewarded only for negative cocaine results affected the usage of other drugs that clients was not rewarded for providing a negative UA for. The Epstein et al (2003) study showed a reduction in opiate usage from cocaine based CM but didn't show differences in the use of other drugs. It actually showed a mild increase in use of benzodiazepines. Preston et al (2001) found cocaine based CM had no effect on the usage of other drugs. Correia & Dallery et al (2003) found that when UA results were contingent on both opiates and cocaine that that opiate use decreased compared to when only cocaine abstinence was required to receive a voucher.

Findings Based on reinforcement type

Brief abstinence therapy (BAT). For BAT related studies, Correia & Sigman et al, (2005) found no difference between a shaping condition, where clients are given money for abstinence for 2 clean UA's followed by a third UA payment compared to the terminal condition where client only received money for the third UA to be clean in a BAT. Clients who were in the shaping condition were more likely to have the first two UA's clean (with payment reinforcement) but no difference in the amount of clean UA's the third day when both were reinforced). Correia & Dallery et al, (2003) completed a BAT that showed there was no difference in the rate of cocaine abstinence provided whether monetary reinforcement was provided for just having a clean cocaine UA or if requiring clients to be clean of both cocaine and opiates to receive payment. However, rates of opiate use significantly decreased when both drugs were involved. Katz et al, 2002 found that single BAT (one payment given for the first clean UA) started with the highest abstinence success rate compared to intermittent/no reinforcement/continuous groups but was no longer effective after reinforcement stopped being provided for clean UA's. Continuous BAT (payments given 3 Mon, Wed, and Fri for clean UAs) rates of abstinence decreased after the first UA but stayed higher than the single test and no reinforcement groups. The intermittent group provided reinforcement for the first and third clean UA's had no differences in abstinence rates from the continuous group but was higher than both the no reinforcement and single reinforcement groups. Vandrey et al, (2007) found in a BAT that when cash/check incentives are given a client is significantly more likely to be abstinent compared to when vouchers are given 71% of negative UAs compared to 48% of negative UAs. The study showed both vouchers and cash CM provided more negative UAs than when no CM reinforcement was given.

Voucher. For voucher related studies, Dallery et al, 2001 found that for treatment resistant clients involved in the voucher procedure the magnitude of the reinforcement (more money provided for clean UAs) had a significant effect on the number the percent of clients abstinent for opiates and cocaine with 9% more clean UAs being provided. Barry et al, 2009 who used both voucher or prize procedures found CM was effective regardless of race or procedure type. CM provided longer duration of abstinence and more negative cocaine UA samples than control. Clients positive for cocaine at intake were more likely to be positive for cocaine with or without CM procedures. At the 6 month follow up, CM clients were more likely to be abstinent than the control group. Those positive for cocaine at intake were more likely to be positive for cocaine at 6 month follow up. Bryne & Petry (2011) found that CM treatment lead to longer duration and a greater proportion of negative UA's than clients in control groups. The study found alcohol dependence had no impact on the proportion of clean UAs. Clients with alcohol dependence were significantly more likely to achieve longer periods of cocaine abstinence than those without alcohol dependence. CM made clients significantly more likely to be abstinent of cocaine at the 6 month follow up than the control group. Alcohol Dependent clients were more likely to be abstinent of cocaine at 6 month follow up than those not alcohol dependent. Preston et al (2001) found that a shaping group (group of clients who could receive vouchers for decreased cocaine use) received significantly more vouchers and received longer abstinence than those who only received vouchers for complete abstinence from the start even when expectations were the same for both groups. There were no significant changes in the use of other drugs after CM for cocaine was implemented. Clients were 20% more likely to have a clean UA when the voucher were given based on not using verses them randomly being handed out. Epstein et al (2003) showed their CM or CM with CBT were more likely to produce negative UAs than CBT

alone. The two CM groups also had the longest durations of abstinence. The clients in CBT and CM were significantly less likely to complete the study than other groups had more CBT group abstinences than other groups. Clients self-reported the CBT groups as more helpful than the sober support groups. Silverman et al, (2004) showed a significant difference compared to the control group in the number of positive UAs and length of abstinence when clients were given CM voucher with take home doses. Take home only reinforcement was also an effective reinforcement for continued abstinence but only in the first part of the study,

Therapeutic Workplace. For therapeutic workplace studies, Holtyn et al, (2016) found that employment based abstinence worked well for some keeping some clients abstinent from cocaine but not others. The main factor leading to contributing to clients who couldn't abstain from cocaine appeared to be continued use of opiates. There were significantly more clients able to abstain when work was only provided with a clean UA. However, regardless of whether a clean UA was required to work or not, clients who were able to abstain for at least three weeks in the study earned significantly more money and worked more hours in both groups.

Prize. For prize reward studies, Petry et al, (2012) found that client in the lottery prize procedure remained significantly longer in the study, achieved significantly longer durations of abstinence from cocaine and alcohol, and submitted significantly greater proportions of samples negative for cocaine and alcohol than those assigned to a control group during the study. They were also 20% more likely to be sober 9 months after the CM study completed and CM was no longer provided to any client for 9 months. Stizer & Pierce, (2007) found that 84% of UAs were negative for participant testing negative for stimulants at intake had negative cocaine UAs. Participants positive for stimulants at intake had only 34% negative rate for cocaine. Prize CM caused a significant drop in the number UAs positive for stimulants regardless of whether they

were positive for stimulants at intake compared to the control group. Petry & Carroll, (2013) found that at one, three, six, nine and twelve month follow ups to clients in CM were significantly more likely to have continued sobriety and to attend more outpatient treatment groups than those in the control group. Clients on MMT were significantly less likely to be abstinent of all drugs and attended significantly less outpatient groups than those clients who weren't on MMT regardless of whether they were involved with CM or not. Clients not on MMT were more likely to not attend the 12 month follow up UA than those on MMT. When the people who missed the follow up UA were treated as positive UA samples it reduced the difference being MMT and non-MMT client, however MMT clients were still more likely to provide a positive UA sample. Petry et al (2007), attempted to show the difference between prize and voucher forms of contingency management and compared to standard care. It didn't find any differences between prize and voucher reinforcement types. It did find both CM types in the short term provided longer durations of abstinence and more negative UAs compared to the control group. However, this study did not see a significant difference between the number of clean UAs in the control and either type of CM at the nine month follow up. Ghitza et al, (2007) showed a decrease in cocaine and Opiate use in all forms of CM looked at in the study. However, early in the early stages only the high magnitude reinforcement only appeared to show a significant difference in the short term. At the three and six month follow up, all forms of CM showed decreased positive UA's compared to the control group.

Check/Cash. For check/cash related studies, Greenwald, (2006) found that different methadone dosing cycles didn't significantly affect the amount of drug free samples in methadone receiving client on receiving cash CM. CM and MMT significantly decreased cocaine use verses the baseline from 90% to 50% of positive UAs.

Reinforcement Type Differences

The short term BAT reinforcement typically could get higher rates of nonuse in study. Early on longer term voucher, prize or check forms of CM had a large effect. It seemed the longer a participant is exposed to CM the lower the success rate of the form of CM. There does not appear to be a significant difference between prize and voucher forms of CM. Check or money CM appeared to provide higher rates of Abstinence. The Vandrey et. al (2007) article claims that providing check was significantly more successful than voucher. It also claims that the cash provision didn't lead to additional usage. The one Therapeutic workforce article reported a 68% cocaine abstinence rate which is higher than any non-check or cash reinforcement found.

The average rate of negative UA's in the studies was between 40% and 50%. There was an article that claimed as high as 70% and as low as 19% of clients that provided negative UA's in the study.

Limitations

The limitation of this study is that all patients were on methadone. Almost all of the methadone programs shown in the research were also in group or individual therapy as well. It is difficult to tell what is contributing to success or failure of participants in the study. There was only one article on therapeutic workforce and one on cash/check recipient CM. A literature review would have provided more studies but would create more chance of personal bias affecting the studies. PsycINFO was the only database used to collect studies. The study does not show the additional benefits provided by methadone maintenance. It doesn't show whether or not methadone is beneficial still with cocaine use. The study doesn't show whether implementation

of contingency management is cost-effective. The articles contained in this study report methadone dosage amounts, gender and race differences. This study chose not to evaluate the affect these factors play on the level of success participants had on methadone maintenance.

Discussion

The hypotheses that Contingency Management is effective in improving abstinence rates for people on methadone maintenance is valid. All studies showed it had a significant effectiveness on decreasing cocaine use. All studies included Methadone Maintenance and most included some form of individual or group counseling also.

In studies where there was a control group, the control groups received the similar amounts of methadone and group/individual therapy to clients involved in CM. In fact, in the Epstein et al. (2003) compared participants in CM with participants in CBT and participants in both CM and CBT. It showed significantly longer and more sustained abstinence in the CM groups than in the CBT only groups. The study did find more long term benefits to participants receiving CBT than just in therapy. The Holtyn et al., (2016) Ghitza et al., (2007), Stitzer & Prince et al., (2007) and Greenwald (2006) studies did not report usage of group or individual Therapies but still showed significant effectiveness of CM on cocaine abstinence. The only study where not all participants were on methadone was Petry & Carroll (2013) which found that CM was less effective on methadone maintained participants than completely abstaining opiate participating and participants struggling with the use of non-opiate drugs. There were multiple studies with a two to five week baseline (Katz et Al. (2002), Dallery et al. (2001), Preston et al. (2001), Epstein et al. (2003), Ghitza et al. (2007) and Schroeder et al (2003)) where they eliminated participants from the study who did not provide between two and three positive UA's without CM or any other intervention. These studies intended to find clients who were resistant to regular treatment yet CM was still found be effective. I believe this reduced some of the effectiveness of CM (in those studies) because it only took the worst off participants where methadone maintenance wasn't enough to keep the client abstinent. Surprisingly, the majority of

participants couldn't provide enough negative UA's during the baseline to be excluded from the study. The studies also all eliminated people with severe mental health issues and in prize studies they eliminated participants with a history of gambling problems. In reality, these participants would be involved in MMT as well.

Participants with strong mental health issues would more than likely have more difficulty staying sober than most MMT participants. The fact that even after monetary incentives provided by CM only 40 to 50 percent of clients on average could abstain from cocaine usage which was substantially higher than those who were in MMT programming alone. I believe this shows a large amount of usage while in MMT despite CM involvement. However, the Epstein et al. (2003) article found that at the end of the study only sixteen percent of the participants wanted to quit or reduce heroin use and only seven percent wanted to quit using all drugs. The study found that the withdrawal and discomfort from heroin was the main problem. Considering that many of these people aren't interested in sobriety and many have had minimal separation from their use as they are newer outpatient methadone participants. Methadone reduces the illicit opiate usage however, when a client is used to using both cocaine and heroin at the same time the desire for an upper appears to still be an issue. Multiple studies used medications attempting to reduce cocaine use to and some had mild success and others did not have any (Umbicht et al, 2014 used topirimate) (Sofuoglu et al. 2015 used Carvedilol) and (Winstanley et al., 2011 used fluoxetine). (In parenthesis is the doctor prescribed medication the article used trying to pharmacologically minimize cocaine use). The evidence suggests the needs of participants who have dual drug problems to be involved in additional behavioral program such as CBT or CM or to be placed in a short term residential setting to detoxify from other drugs and to receive relapse prevention

skills to fight off desire for continued use. CM is a successful therapy option but it is also costly especially if clients receive high magnitude prizes or vouchers.

It is questionable whether CM is a cost-effective option for MMT providers. Prize-based CM may be the most cost effective as participants don't necessarily get rewarded but will have the perception they could be rewarded in the future especially if high magnitude prizes are rewarded. The prize reward studies took extra precautions insuring people with gambling addictions weren't in the study whereas in reality that would not be possible. One potential side effect could be creating or exacerbating gambling issues. There are several people with both chemical use and gambling issues. Cash based incentive seem too high risk leaving the possibility the client may use the money for drugs. The state would have to be willing to set policies that encourage contingency management with MMT providers with funding incentives. Federal and state government should require monitoring of urinalysis and provide incentives to facilities that are able to find ways to get a higher percentage of clean UAs.

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*** = articles used in systematic review**

Author	What behavioral therapy is received?	Control group	Results/ Key findings
Correia & Sigman et al. (2005)	Contingency management (CM) BAT Weekly Group/ individual therapy	No Comparative Groups	no differences in shaping and terminal CM group types.
Correia & Dallery et al. (2003)	Contingency management(CM)(BAT Weekly Group/ individual therapy	No Comparative Groups	Opiates and cocaine were used less in the dual group (that tested both drugs) than in the single drug tested group.
Holtyn et al (2016)	Therapeutic Workforce Reinforcement	Yes	Mixed results. Continued use of non-methadone opiates was biggest factor. Work only group continued to test + for cocaine after CM verse work and abstinence significantly decreased + results. Time working in prior to UA's didn't improve likelihood of abstinence in abstinence to work group. abstaining for at least 3 consecutive weeks = more work hours and earnings.
Petry et al. (2012)	Contingency management(CM) Prize Weekly group session, monthly individual session	Yes	Pt in CM condition remained significantly longer in the study, achieved significantly longer durations of abstinence from cocaine and submitted significantly more negative cocaine than control. CM clients provided more negative UA's at 9 month follow up. Having a longer amount of abstinence during the study was significantly associated with longer abstinence at the 9 month follow up.
Katz et Al. (2002)	Contingency Management (4 brief Abstinence tests) Weekly individual and group therapy	No	Pt success didn't change when no reinforcement provided in the in between other vouchers. One time voucher without reinforcement had more positive UA's other days. 70% of participants in study were able to achieve 2 days abstinence.
Dallery et Al. (2001)	Contingency management weekly counseling (individual and group)	No, comparison	There was a significant difference between high and low magnitude vouchers. High providing more negative UA's.
Barry et al. (2009)	Contingency management Weekly group session, monthly individual session	Yes standard care	No difference in the effect of CM based on a client's ethnicity. Clients + for cocaine at intake were more likely to be positive for cocaine in study. At the 6 month follow up, CM clients were more likely to be abstinent than control. Those + for cocaine at intake were more likely to be + for cocaine at 6 month follow up.
Byrne & Petry (2011)	Contingency management Weekly group session, monthly individual session	Yes Standard Care	For all studies reviewed, CM Had a greater proportion of - UA's than SC. Alcohol dependence history was not found to be a factor on abstinence during study. On the 6 month follow up, Alcohol Dependence was associated with a 2.25 times higher likelihood to have a negative cocaine UA. Those in CM had more – UA at follow up.

Preston et al. (2001)	Contingency management Weekly individual sessions,	Yes Standardize d Care	Using a period where complete abstinence wasn't required and instead less use was rewarded at first lead to better results even after abstinence was required.
Greenwald (2006)	Contingency management	No comparison	The way methadone was administered didn't affect the number of + cocaine results.
Stitzer & Peirce et Al. (2007)	Contingency management	No comparison groups	Being Stimulant + during the initial UA at the start of the study significantly increased likelihood of + stimulants during the study. CM benefits led to significantly more - UAs whether they were + for stimulants at intake or not.
Vandrey et al. (2007)	Contingency management BAT daily group and individual therapy	No One group with different incentives	The cash based incentives were significantly more effective than voucher incentives. High magnitude incentives were more effective to the low magnitude.
Petry & Carroll (2013)	Contingency management Prize High Intensity Outpatient Treatment (4 hours 3 days a week) for a month followed by weekly aftercare for a year.	Yes Standard Care	The study found Opiate Maintained clients on MMT attended less group sessions than non-opiate client and opiate clients not on MMT. Clients in CM attended more group sessions than control. Opiate maintained clients showed significantly less sobriety length than non-opiate maintained. Clients in CM had significantly more sobriety than control. MMT clients had less sobriety at 12 month follow up. It wasn't significant when drop outs are included
Epstein et al. (2003)	Contingency management (CM) Individual counseling CBT group therapy sober support meetings.	Yes Standard Care	CBT groups were subject to more frequent absences than social support group but were seen as more helpful. Cocaine – urinalysis was more frequent in the CM only and combination groups than in the CBT-only and control groups. CBT seemed to have an initial – effect on CM. However, over time CBT had a + effect increasing negative UAs.
Petry et al. (2007)	Contingency management (CM) prize and voucher weekly individual and/or group counseling	Yes Standard Care	The prize CM group achieved significantly greater durations of abstinence than control. voucher had greater abstinence but not significant. Voucher and prize CM have some benefits in decreasing cocaine use in MMT.
Ghitza et Al (2007)	Contingency management (CM) Prize	Yes	High magnitude reinforcement had a significant effect on use whereas low magnitude outperformed the noncontingent control group but it wasn't significant.
Silverman et Al. (2004)	patients received weekly individual and group counseling randomized CM groups Voucher	Yes Usual care	Participants in the take-home plus voucher group achieved significantly higher rates of cocaine abstinence compared with control and take home only. the take-home only group
Petry and Martin (2005)	weekly group therapy, and monthly individual counseling Contingency management (CM) Prize for UA and group attendance	Yes Standard Care	Cocaine abstinence was significantly higher on the CM than control for longest sobriety length and number of negative UAs . opiate negative UAs didn't differ between the CM group and control. Participants with higher attendance had higher rates of sobriety. Group attendance between CM and control was no different and 12 month follow up.

Petry, Alessi & Barry et al. (2015)	at least monthly individual counseling; and weekly group counseling Contingency management (CM)	Yes Usual care	The longest duration of abstinence and proportion of samples testing negative were significantly greater in each of the three CM conditions relative to the control . The three CM conditions did not differ from one another. larger magnitude reinforcers weren't more effective than lower magnitude.
Messina Et Al. (2003)	Contingency management (CM) or Cognitive Behavioral Therapy (CBT) or both	Yes MMT only group	No differences in treatment retention among ASBD and non ASBD (anti-social personality Disorder). There were no significant differences between cocaine abstinence use during treatment. ASPD patients outperformed non ASPD patients. Those in the CM condition were significantly more likely to abstain from cocaine use than those in the CBT-only condition. ASPD patients in the CM conditions maintained the highest levels of posttreatment cocaine abstinence. Second, ASPD patients in all three treatment conditions were more likely to abstain from cocaine use during follow-up than control
Schroeder Et Al. (2003)	Contingency management Vouchers	Yes Not contingent control	The contingent group had significantly fewer positive cocaine and opiate UAs than the noncontingent group who was rewarded regardless of UA results.