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**CONTINGENCY MANAGEMENT FOR OPIOID USE DISORDER: EARLY
TREATMENT ADHERENCE AND MOOD**

by

Shelby R. Goodwin

A Thesis

Submitted to the
Department of Psychology
College of Science and Mathematics
In partial fulfillment of the requirement
For the degree of
Master of Arts in Clinical Psychology
at
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Abstract

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CONTINGENCY MANAGEMENT FOR OPIOID USE DISORDER: EARLY
TREATMENT ADHERENCE AND MOOD
2022-2023
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Master of Arts in Clinical Psychology

Opioid use results in potentially devastating consequences, but medications for opioid use disorder, such as buprenorphine, serve as effective ways to curb cravings and withdrawal, helping an individual reduce their use. Unfortunately, around half of patients discontinue buprenorphine treatment within 30 days and co-occurring conditions such as mood symptoms may serve as additional barriers and decrease engagement. This study sought to examine contingency management (CM; incentives for meeting behavioral goals) as a potential intervention to increase early treatment engagement, as well as the role of total depression, anxiety, and stress (mood) severity in the efficacy of contingency management. New patients with opioid use disorder ($n = 47$) were recruited from an outpatient opioid clinic and were randomized to receive either treatment as usual (TAU), which consisted of routine clinic care, or CM, which consisted of routine clinic care with a \$50 incentive for attending their first follow-up visit. The CM group was almost three times as likely to attend their follow-up appointment as the TAU group, and mood symptom severity did not appear to impact CM efficacy. This study supports CM as a potential way to increase early treatment engagement for patients with a range of mood symptom severity, making recovery more likely and improving quality of life.

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Chapter 1

Introduction

Opioid misuse, or the use of opioids in a manner not prescribed, is a pervasive and devastating problem in the United States. In the past year, 9.5 million adults reported misusing opioids, with 2.7 million of them meeting criteria for opioid use disorder (OUD; Center for Behavioral Health Statistics, 2021). The cost of opioid misuse in the United States, including opioid treatment and healthcare, crime, and lost productivity totals around \$1.02 billion dollars annually (Florence et al., 2021). In addition to these financial consequences, opioid use and OUD can result in myriad personal hardships, including malnutrition and other health problems, interpersonal difficulties, occupational functioning deficits, reduced educational attainment, risky behaviors such as driving while intoxicated, and overdose (Chavez & Rigg, 2020; Ellis et al., 2020; Moses et al., 2018). Despite the widespread nature of opioid misuse and the significant impact on both individuals and society, only 21.5% of people with OUD report receiving treatment (Saloner & Karthikeyan, 2015). Therefore, it is essential that access to, and retention in, treatment be improved.

One of the major classes of treatment is medications for opioid use disorder (MOUD), which includes methadone (an opioid agonist), buprenorphine (a partial opioid agonist), and naltrexone (an opioid antagonist). Collectively, these medications reduce withdrawal symptoms and opioid cravings (Hoffman et al., 2019). Methadone and buprenorphine bind to opioid receptors, which prevents other opioids from binding to them (Peddicord & Bush, 2015). Both medications have significant evidence for reducing risk for relapse, acute opioid care, overdose, and death (Larochelle et al., 2018; Tkacz et al., 2012; Wakeman et al., 2020).

Methadone and buprenorphine differ, however, in terms of history, subjective effect, risk, and availability. Methadone has been a treatment option since the 1950s and 60s, and as an opioid agonist, fully activates opioid receptors but does so slower than other opioid agonists (Hoffman et al., 2019; National Institute on Drug Abuse, 2021; Peddicord & Bush, 2015). In comparison, buprenorphine was approved in the United States as a daily tablet in 2000, 6-month subdermal implant in 2016, monthly injection in 2017, and daily sublingual film in 2020 (National Institute on Drug Abuse, 2021). Most commonly, buprenorphine is combined with naloxone in a medication with the brand name Suboxone. Because buprenorphine is a partial agonist and naloxone is an antagonist, the subjective effect is smaller in magnitude and the risk for overdose and intoxication is lower than full agonists, such as methadone. Particularly because of the inclusion of naloxone, buprenorphine has a lower risk of diversion than methadone; that is, it is less likely to be used for purposes other than those prescribed, such as for recreation or for selling to others (Peddicord & Bush, 2015; Shulman et al., 2019).

The safety profile differences between methadone and buprenorphine contribute to how it is administered. Methadone requires a daily visit to a methadone clinic, a specialized facility where the dose is given under supervision (Kampman & Jarvis, 2015; Samet et al., 2018; Tkacz et al., 2012). The high effort required of patients to receive methadone, paired with the insufficient number of methadone clinics to meet demand, impedes treatment access (Samet et al., 2018). In comparison, because buprenorphine when coupled with naloxone has a safer profile, administration does not need to be monitored at a specialized clinic and can instead be prescribed from a wider range of medical settings (Kampman & Jarvis, 2015). Qualified healthcare providers, including

physicians, nurse practitioners, physician assistants, and others had previously been required to apply for an X-Waiver to be able to prescribe buprenorphine to their patients (Stringfellow et al., 2021). However, in February 2023 (partway through data collection for this study), the requirement for an X-Waiver was eliminated, allowing any professional with prescriptive authority to prescribe buprenorphine (Substance Abuse and Mental Health Services Administration, 2023). A patient seeking buprenorphine treatment has more flexibility in location as well as scheduling, as they only need to visit their provider and pharmacy once a week, or up to once a month after stabilization (Tkacz et al., 2012).

Despite greater access to buprenorphine, engagement in treatment remains low and attrition remains high. A nationally representative database of American adults with commercial insurance from 2010 to 2014 found 30-day discontinuation rates ranging from 31% to 58% (sublingual or oral mucosal buprenorphine/naloxone and sublingual buprenorphine, respectively; Morgan et al., 2018). Similar studies found rates of buprenorphine discontinuation around 20% at 60 days, 55% at one year, and 86.3% at three years after initiation (Manhappa et al., 2018; Tkacz et al., 2012). Although the freedom of buprenorphine treatment can increase access, the lack of supervision and structure may decrease adherence (Tkacz et al., 2012). Treatment flexibility appears to be helpful but insufficient to improve treatment outcomes.

One possible way to increase treatment engagement is to add a behavioral intervention to MOUD called contingency management (CM). Informed by the operant conditioning principle of positive reinforcement increasing the likelihood of a behavior, contingency management is an intervention that involves giving individuals incentives

when engaging in certain treatment-related behaviors (Higgins et al., 2007; Skinner, 1938). In opioid treatment, these behaviors can include attendance to treatment sessions or providing substance-free biological samples, positively reinforcing engagement and adherence. Incentives have included vouchers, items (such as bus passes, food, clothing, or electronics; Kidorf et al., 2013; Preston et al., 2008), or cash, can take the form of “fishbowl” draws or guaranteed incentives, and can be delivered in an external setting or within an existing treatment clinic (Jhanjee, 2014).

Contingency management may be particularly helpful in providing external reinforcement before other positive treatment outcomes can take effect. Elements of successful treatment, such as improved relationships, better educational or career attainment, decreased shame, and increased physical and mental health, are not guaranteed, and can usually only occur over extended time (Hooker et al., 2022). Incentives reinforce treatment engagement before improvements in these domains can reward a person who abstains from using opioids. Individuals with opioid use disorder display higher rates of delay discounting than those without the OUD. That is, they devalue rewards more quickly as the delay to those reward increase, when compared to individuals without OUD (Madden et al., 1997; Robles et al., 2011). Because abstinence-induced functional improvement is often delayed, the benefits of treatment are often discounted (Madden et al., 1997; Scholten et al., 2019). In contrast, contingency management provides immediate reinforcement for reaching short-term abstinence or treatment adherence when the natural rewards for these are otherwise delayed. It is able to better compete with the immediate, rewarding effect of substance use, serving to make

the very act of engaging in treatment rewarding from the start (Bickel et al., 2014; Landes et al., 2012).

Contingency management has demonstrated overall efficacy for numerous substances and treatment modalities. These include both in-person and remote, cell phone-based interventions for tobacco abstinence and attendance (Alessi et al., 2017; Businelle et al., 2014; Dallery et al., 2017; Roll & Howard, 2008; Shishani et al., 2018), remote interventions for alcohol abstinence and alcohol-related problems (Alessi & Petry, 2013; Barnett et al., 2017; Dougherty et al., 2015; Koffarnus et al., 2018), in-person cannabis abstinence (Carroll et al., 2012; Kadden et al., 2007; Litt et al., 2008), and in-person stimulant abstinence (Defulio et al., 2009; García-Fernández' et al., 2011; Johnson et al., 2019; McKay et al., 2010; Roll et al., 2013). In fact, contingency management is the only evidence-based intervention for stimulant use disorder (Ronsley et al., 2020). The state of California, having received a waiver from the Department of Health and Human Services to use Medicaid funds, was approved to run a \$58.5 million dollar pilot of contingency management for stimulant use disorder in July 2022 (Bernstein, 2022). Contingency management has mixed evidence with regard to multiple drug use. Some studies have demonstrated efficacy for nonspecific substance use, substance use disorders, and polysubstance use (Bride & Humble, 2008; Ledgerwood et al., 2008; Medenblik et al., 2021), whereas other studies have failed to provide evidence (Hall et al., 2017; McDonnell et al., 2021; Olmstead et al., 2012; Schmitz et al., 2009). There is a significant body of research for contingency management among people stabilized on MOUD treatment for both cocaine (Blanken et al., 2016; Festinger et al., 2014; Kirby et al., 2013; Petry et al., 2012; Silverman et al., 2012) and tobacco treatment (Ainscough et

al., 2021; Dunn et al., 2008, 2010; Sigmon et al., 2016). Additionally, some studies have effectively combined contingency management with other psychosocial treatments such as motivational interviewing for substance use disorders (Hesse et al., 2021), motivational enhancement therapy for cannabis (Kadden et al., 2007), relapse prevention for cocaine (McKay et al., 2010), and cognitive behavioral therapy for tobacco or cocaine (González-Roz et al., 2019; Petitjean et al., 2014).

Contingency management has been examined in relatively few studies for MOUD, particularly with buprenorphine, and the evidence is mixed. Compared to no incentives, contingency management in methadone treatment has resulted in higher proportions of opioid-negative samples, higher treatment retention, fewer missed treatment visits (Brooner et al., 2007; Chen et al., 2013), higher rates of treatment enrollment, lower opioid injection rates, fewer instances of sexually transmitted infection (STI; Kidorf et al., 2009; L. Wang et al., 2014), and lower substance use and substance use disorder symptoms for those who concurrently use opioids and cocaine (Epstein et al., 2009; Ghitza et al., 2007; Panlilio et al., 2020; Preston et al., 2008). However, one study had higher incentivized methadone treatment retention for one recruitment site but not the other (Hser et al., 2011), and two studies found no differences between contingency management and the control group with regard to treatment retention, though both suffered low retention across groups (Jiang et al., 2012; Kidorf et al., 2018). The research on contingency management for buprenorphine is relatively few, with one finding delayed relapse compared to a control (Greenwald, 2008), one showing incentives increasing the likelihood of treatment enrollment (though this study, too, had low adherence across groups; Holtyn et al., 2021), and one study found no differences

between contingency management and control (Ling et al., 2013). Overall, the evidence for MOUD and contingency management is promising but limited, with studies varying by medication (i.e., methadone or buprenorphine) and methodology. More research needs to be conducted to understand the efficacy of contingency management in the context of buprenorphine treatment.

The efficacy of contingency management is perhaps most important for the enrollment in, and beginning stages of, opioid treatment. Even for a highly accessible treatment such as buprenorphine, rates of treatment dropout between intake and treatment initiation can be as high as 60% (Simon et al., 2017). Incentivizing enrollment has been found to increase buprenorphine initiation rates (Holtyn et al., 2021), whereas giving incentives only after initiation has harmed treatment enrollment rates (Jarvis et al., 2019). After initiation, the early stages of treatment may also predict overall treatment success. One study found that among individuals receiving CM for cocaine use, those who were not abstinent during the first month were less likely to be abstinent 6 months later (García-Fernández' et al., 2011). Another study found that individuals receiving CM during methadone treatment who demonstrated some abstinence during the baseline period (where incentives were given regardless of urine sample results) were more likely to be abstinent when undergoing CM (where incentives were only given for abstinent samples; Kirby et al., 2008). Contingency management has similar potential in being beneficial for early buprenorphine treatment engagement but has been understudied in this crucial time period.

Contingency management has good evidence across myriad substances, including the burgeoning evidence for opioids, but one factor that may complicate treatment

success is psychiatric symptoms. According to the National Survey on Drug Use and Health, 64.3% of adults with opioid use disorder also met the criteria for a non-substance psychiatric disorder in the past year (Jones & McCance-Katz, 2019). A recent meta-analysis of individuals with opioid use disorder found that 36.1% also had depression and 29.1% met criteria for an anxiety disorder (Santo et al., 2022). Those with preexisting mental health conditions such as depression and anxiety were more than twice as likely to use opioids nonmedically, and between four and six times more likely to have nonmedical opioid use transition into opioid use disorder. The heightened risk is bidirectional: those with opioid use disorder are between five and six times more likely to develop a depressive or anxiety disorder (Martins et al., 2009). Therefore, it is important to understand interventions for opioid use disorder within the context of psychiatric symptoms.

The interactions between mood and opioid use are numerous: depressive disorders and symptoms are associated with longer opioid use duration, increased non-fatal overdoses, higher likelihood of a transition from non-injection to injection heroin use, and increased use of opioids to regulate negative affect (Bouvier et al., 2019; Cepeda et al., 2012; Rogers et al., 2021). Although less information is available on anxiety disorders and opioid use, state anxiety has been associated with increased likelihood of prescription opioid misuse (Wilsey et al., 2008) and longer heroin use duration was related to higher risk of anxiety disorders (Han et al., 2010). Among those who use heroin, one study found that those who injected heroin had higher depression and anxiety severity (Wang & Liu, 2012), and one study found that those with anxiety disorders were more likely to progress from anxiety to a substance use disorder whereas those with depressive

disorders were more likely to progress from a substance use disorder to depression (Maremmani et al., 2011).

Psychiatric symptoms, specifically depression and anxiety, can also complicate MOUD treatment. Depression and anxiety symptoms are associated with higher perceived barriers to initiating treatment as well as higher risk of relapse during opioid treatment (Cavazos-Rehg et al., 2021; Moradinazar et al., 2020; Rogers et al., 2021). Some studies found that individuals with depressive and anxiety symptoms were more likely to engage in substance use, have greater substance use severity, and had poorer quality of life during methadone and buprenorphine treatment (Craft et al., 2022; Ghabrash et al., 2020; Zhu et al., 2021). However, not all treatment studies found psychiatric symptom-related differences in substance use (Darke et al., 2009; Peckham et al., 2020). Interestingly, some evidence suggests that depressive symptoms may increase opioid use whereas others suggest that depressive symptoms serve as a protective factor and improve treatment success (Benningfield et al., 2012; Ghabrash et al., 2020). Taken together, the relationship between mood and opioid treatment success is complicated and may depend on sample or method-specific factors.

The role of psychiatric symptoms in contingency management for opioid treatment is equally unclear. Few CM studies have included information on psychiatric symptoms across all substances (Hesse et al., 2021; McDonell et al., 2013, 2017; Tidey et al., 2011; Tracy et al., 2007), and fewer still have included depression and anxiety in opioid treatments (González-Roz et al., 2019; Kelly et al., 2014; Kidorf et al., 2013). In theory, CM may be particularly helpful in reinforcing treatment engagement for individuals with psychiatric symptoms, with whom there are greater barriers and a higher

risk for relapse (Cavazos-Rehg et al., 2021; Moradinazar et al., 2020; Rogers et al., 2021). Contingency management may provide the necessary reinforcement to offset these barriers and make the difference in attendance. While CM is likely to be beneficial for everyone, it may bridge the gap between individuals with and without psychiatric concerns.

Psychiatric symptoms during CM for substance use have been examined in three ways: the impact of CM on substance use for a population with existing psychiatric disorders, the effect of CM on psychiatric symptoms, and the impact of CM on both substance use and psychiatric symptoms. First, contingency management has demonstrated efficacy among people with psychiatric and substance use disorders (Tracy et al., 2007), as well as among individuals with serious mental illness and heavy drinking (McDonnell et al., 2017). Second, CM has been linked with a decline in psychiatric symptoms, an effect mediated by drug abstinence (Hesse et al., 2021). Third, CM has been associated with decreased substance use and psychiatric symptoms (McDonnell et al., 2013), increased attendance but no association with substance use or psychiatric symptoms (González-Roz et al., 2019; Kelly et al., 2014; Kidorf et al., 2013), and decreased substance use and no association with psychiatric symptoms (Tidey et al., 2011). These studies examine the impact of contingency management on psychiatric symptoms, but a gap exists in how the presence of psychiatric symptoms may impact the efficacy of contingency management.

Taken together, contingency management appears to have promise for increasing engagement with, and promoting abstinence for, substance use in general and MOUD in particular, with the first stage of treatment serving as a potentially crucial period to study.

More research is needed on the effect of contingency management for buprenorphine interventions. Additionally, although CM appears to have some impact on mood symptoms, less is known about how mood relates to CM efficacy. Therefore, this study aims to evaluate the effect of CM on the first follow-up visit attendance for a Cooper University Hospital outpatient buprenorphine program and the role mood (depression, anxiety, and stress) plays in this relationship.

Chapter 2

Methods

2.1 Participants

Participants were adults diagnosed with opioid use disorder, presenting as new patients for buprenorphine treatment through Cooper University Hospital's outpatient program. Two recruitment sites were used: Cooper's drop-in opioid treatment clinic and the Cooper Center for Healing, both located in Camden, NJ. To be eligible, participants had to be 18 years of age or older and attending their first appointment in the Cooper MOUD program at the time of randomization. Exclusion criteria included a contraindication to Suboxone, being pregnant or breastfeeding, having a DSM-V serious mental illness diagnosis that may interfere with treatment (e.g., schizophrenia), being non-English speaking, having literacy or visual impairments that would prevent survey collection, being a prisoner, and not meeting criteria for opioid use disorder.

2.2 Procedures

To recruit from these sites, research assistants approached potential participants and informed them about the survey and randomization to a behavioral intervention involving incentives to increase treatment engagement. Specifics on the incentives were only given to the group receiving incentives after randomization. If the participant was interested, they were given informed consent, supplied their contact information with their preferred mode of contact, and completed a Qualtrics survey orally conducted by the research assistants. The first four participants were initially given a \$10 gift card for the 45-minute intake, but compensation was increased to \$20 to facilitate study recruitment for the remaining participants. Once participants completed the survey, eligible

individuals were randomized (stratified based on gender) to a control, treatment as usual (no incentives) group or an experimental (contingency management) group. When a research assistant (RA) enrolled a new participant and they finished the intake survey, the RA sent the principal investigator (who was off site and never directly interacted with participants) with the participant's gender for random assignment with stratification.

2.2.1 Treatment as Usual (TAU)

Participants in the treatment as usual group were given their compensation and walked back to the waiting room to continue their treatment procedures through the clinic. No further information was given to them on the procedures for the other study group to prevent any inadvertent effect of not earning incentives on their future appointment attendance. Through the clinic, the treatment as usual group gave a urine sample that was sent for drug testing and had their vital signs measured. A nurse then reviewed an informational packet about starting buprenorphine, instructions for administration, the safety profile of buprenorphine, and policies of the clinic. Participants then met with a provider who gathered health and drug use history before sending a buprenorphine prescription to the participant's pharmacy of choice. At the end of their appointment, the participants were given the option of scheduling their next appointment at the Cooper Center for Healing, around 7 days after their first appointment. If they wished not to schedule an appointment, or were unable to make their scheduled appointment, they had the option of attending the Drop-In Clinic between 1:30 and 4:00pm, Monday through Friday. Participants typically received one-week prescriptions until stabilized, at which time they could receive 14-day, and eventually 30-day, prescriptions. Clinic staff usually called the patients for a reminder one day before their

appointment. Transportation services were offered for interested patients as part of normal, optional clinic procedures.

2.2.2 Contingency Management (CM)

The contingency management group followed the same clinic procedure and had access to the same services as the TAU group. After completing the intake survey, the contingency management group was debriefed and given full information about how they could earn incentives for attending scheduled visits and adhering with treatment recommendations (i.e., taking buprenorphine as prescribed and abstaining from all other opioids). Debriefing typically took around 5 minutes and participants were given the opportunity to ask questions. Participants were also given a paper chart of the incentive schedule to take with them (see Appendix A). Incentives were given for every opioid treatment clinic visit starting at their next appointment (at a maximum of one visit per week) and ending at three months after the initial survey. Participants were given \$50 for attending their first visit, loaded onto a reloadable debit card (CT Payer, Burnsville, MN), independent of their urine drug test results indicating buprenorphine adherence and/or opioid abstinence. Attendance at this visit served as the primary outcome for the current study. Although not directly relevant to the current study, participants could also earn \$25 for subsequent visits with bonuses that escalated with every third consecutive treatment-adherent visit for their first 3-months in treatment (\$10, \$20, then \$30 maximum). Participants were notified by a research assistant of all payments through a phone call or text (depending on their preference) as close to the completed visit as possible. A research assistant called or texted the participant with a reminder of their potential earnings the day before each appointment. Clinic staff also called these participants with

appointment reminders, but the study-related contacts emphasized the participant's potential earnings for attendance. If they missed the appointment, they had 6 days to go to the drop-in clinic to still be considered adherent in attending their first appointment.

2.3 Measures

The Qualtrics survey (see Appendix B) collected demographic variables such as age, race, gender, employment, and household income, as well as the measures listed below. Other information was assessed in the survey that is beyond the scope of this paper. The full survey took approximately 45 minutes to complete and was administered orally by trained research assistants.

2.3.1 Addiction Severity Index (ASI)

The Addiction Severity Index (ASI) is a structured interview that examines substance use history and potential topics that may be impacted by substance use, such as medical status, employment, legal problems, social relationships, and psychiatric problems. The full ASI takes around one hour to administer; thus, a shortened version was used for the purposes of this study. For this study, items on substance use history were included. Participants indicated the number of days in the past 30 days and the number of years of regular use (defined as three or more times a week, bingeing, or irregular use that causes problems) in their lifetime they used the following substances or substance classes: alcohol, heroin, methadone, other opiates/analgesics, barbiturates, other sedatives/hypnotics/tranquilizers, cocaine, amphetamines, cannabis, hallucinogens, and inhalants. Participants also indicated whether they experienced significant depression or significant anxiety in the past 30 days. Severity ratings and scale psychometrics are unavailable for the ASI questions used in this survey (McLellan et al., 1980).

2.3.2 Depression Anxiety Stress Scale 21 (DASS-21)

The Depression Anxiety Stress Scale 21 (DASS-21) is a 21-item measure assessing mood symptom severity over the past week. Each statement is rated on a scale 0-3 to indicate the degree to which the item has applied to the participant (0 = “Did not apply to me at all”, 3 = “Applied to me very much or most of the time”). The DASS-21 is comprised of three subscales, consisting of seven items each: depression (e.g., “I couldn’t seem to experience any positive feeling at all”), anxiety (e.g., “I felt I was close to panic”), and stress (e.g., “I found it hard to wind down”). Subscales are summed and multiplied by two, with cutoffs indicating “normal,” “mild,” “moderate,” “severe,” and “extremely severe” (Lovibond & Lovibond, 1995). The total score is calculated by adding the three subscales together. The DASS-21 demonstrates a good level of internal consistency, ranging between a Cronbach’s alpha of .82 for the anxiety subscale to .93 for the total scale. The total score has a correlation of 0.69 with the negative affect subscale and a correlation of -0.40 with the positive affect subscale of the Positive and Negative Affect Schedule (PANAS), demonstrating adequate convergent and discriminant validity (Henry & Crawford, 2005).

2.4 Data Analysis Plan

First, descriptive statistics were reported to characterize the sample on demographics (age, race, gender, employment, and household income), substance use history, and DASS-21 subscores. Second, differences in DASS-21 subscores and past 30-day opioid use (at the time of enrollment) were examined between the two study groups (contingency management vs. treatment as usual) through t-tests. Third, a logistic regression was conducted to examine the impact of study group assignment (contingency

management vs. treatment as usual) on attendance at the first visit after randomization (attended vs. not attended). Last, exploratory analyses were conducted using logistic regression to examine the moderation effect of DASS-21 total score on the relationship between group assignment and first visit attendance. The logistic regression model with only group assignment as a predictor was then compared to the model with DASS-21 total as a moderator using the AIC, BIC, and Bayes Factor as selection criteria.

2.5 Hypotheses

2.5.1 Hypothesis 1

Individuals in the contingency management group will be more likely to attend their first follow-up appointment than individuals in the treatment as usual group.

2.5.2 Hypothesis 2 (Exploratory)

Examine the influence of depression, anxiety, and stress on the efficacy of contingency management in the likelihood of first follow-up appointment attendance.

Chapter 3

Results

3.1 Participant Characteristics

Of the 47 participants included in analyses, 25 were randomized to the treatment as usual group and 22 were randomized to the contingency management group (see Figure A1, Consort Diagram). The mean age of the participants was 41.28 ($SD \pm 10.57$) and 63.0% were male. Of the participants, 17.0% reported their ethnicity as Spanish, Hispanic, or Latino and 46.8% reported their race as Black. The participants were of largely lower socioeconomic status: 70.2% earned a high school degree or less, 76.6% were unemployed, and 40.4% endorsed an annual household income of less than \$10,000 (see Table A1 for demographics). In the past month, 78.7% said they experienced a significant period of depression and 78.7% also experienced a significant period of anxiety. On the DASS-21, participants scored an average of 15.32 ($SD \pm 13.14$) for depression, 14.04 ($SD \pm 10.77$) for anxiety, and 18.21 ($SD \pm 12.02$) for stress, indicating moderate depression (range: 14-20), moderate anxiety (range: 10-14), and mild stress (range: 15-18; see Table A2 for mental health measures).

Table A3 shows the participants' substance use patterns. Among those who reported past-month non-prescription opioid use (53.2%), participants engaging in an average of 22.16 days of use ($SD \pm 9.95$), and among those who reported past-month prescription opioid use (23.4%), they used on an average of 21.18 days ($SD \pm 10.32$). Overall, the sample reported an average of 9.72 years of lifetime non-prescription opioid use ($SD \pm 10.45$) and 5.94 years of prescription opioid use ($SD \pm 7.59$). Participants largely said they were “considerably” or “extremely” troubled by drug use in the past

month (68.2% of CM group and 48.0% of TAU group), and most said it was extremely important to receive treatment for these problems (86.4% of CM group and 72.0% of TAU group). The contingency management and treatment as usual groups did not significantly differ on DASS-21 subscores (depression, anxiety, stress) or past 30-day prescription and non-prescription opioid use.

3.2 Outcomes

For the primary outcome measure, 72.7% of the contingency management group attended their first follow up visit, compared to 48.0% of the treatment as usual group (see Figure A2). A logistic regression indicated that the participants receiving contingency management were 2.89 times more likely to attend the first follow up visit than treatment as usual (95% CI [-0.16, 2.28]).

A second logistic regression was conducted, adding DASS-21 total scores as a moderator between group membership and first follow up visit attendance. For the contingency management group, a 10-point increase in the DASS-21 total score only increased the odds of first visit attendance by 1.032 (95 CI [-0.01, 0.08]). The model with only group membership was compared with the model including the interaction of DASS-21 total; all three statistics (AIC, BIC, and Bayes Factor) favored the model without the DASS-21 total. Therefore, DASS-21 total was not determined to be a meaningful moderator in the relationship between group membership and first visit attendance.

Lastly, a chi-square test of independence was run to compare rates of first follow-up attendance between contingency management and treatment as usual groups for the degree to which participants were troubled by drug use and for the degree to which

participants felt treatment of drug use was important to them (see Tables A4 and A5). No significant differences were found between groups. However, for those who rated treatment of drug use as “considerably” or “extremely” important, more participants in the contingency management group attended their first follow-up appointment than did not attend (68.2% vs. 27.3%, respectively), compared to an even distribution within the treatment as usual group for those who did and did not attend their follow-up (40.0% vs. 40.0%).

Chapter 4

Discussion

The present study examined the role of contingency management in first follow up buprenorphine visit attendance and found that the group receiving incentives were nearly three times as likely to attend the visit as those receiving treatment as usual. The role of depression, anxiety, and stress (characterized as the DASS-21 total score) was then examined in the relationship between contingency management and first follow-up attendance and was not found to influence the strength of contingency management on attendance. This study supports contingency management as an efficacious intervention for increasing first follow-up attendance, and the exploratory analyses suggest that contingency management may also be able to withstand a range of psychiatric symptoms.

Results of this study aligned with the current literature on low rates of sustained treatment engagement (Morgan et al., 2018). Although 78.7% of the sample said it was extremely important to receive treatment for their drug use, less than half of the treatment as usual sample attended their first follow-up appointment. It is possible that the difficulty in sustained treatment engagement is not related to their desire for treatment, but to external factors. Although barriers to treatment were not formally assessed in this sample, many of the participants reported very low income and high rates of unemployment, which may prevent patients from being able to afford transportation to the clinic (unless they requested it in advance with clinic staff), insurance co-pays, or childcare. Prioritizing opioid treatment for this sample may mean forgoing opportunities for earning income and may make treatment less appealing.

Contingency management is a unique intervention that can simultaneously address motivational deficits in treatment engagement and buffer against practical, monetary barriers. The majority of individuals aware of buprenorphine cite lack of funds as prohibitive in starting and maintaining treatment (Evans et al., 2019). Participant perspectives in other studies of contingency management have been overwhelmingly positive, with most perceiving contingency management as being integral in their recovery progress (Miguel et al., 2018). Participants have explicitly discussed using their incentives for necessities such as food and travel, viewing the money as something they earned to be used in a productive way (Getty et al., 2022). A person will likely prioritize acquiring food to satisfy their immediate needs over attending treatment appointments to achieve distal goals, so incentives earned through contingency management may be used to direct their focus on treatment engagement. This would allow them to meet both food and treatment goals without the two competing against each other. Having monetary incentives for transportation may determine if the patient is physically able to make their appointment where they might otherwise miss it, provided they did not request transportation services through the clinic. Without their next prescription of buprenorphine, the individual's cravings and withdrawal symptoms will likely recur, increasing the risk for returning to illicit opioid use (Peddicord & Bush, 2015).

Regardless of potential barriers to treatment, contingency management improved the likelihood the participants would return to the clinic. Two aspects of contingency management were likely powerful in producing this result: the use of reinforcers and the immediacy of those reinforcers. The use of monetary incentives delivered upon attendance to the first follow up appointment reinforced the behavior and made repetition

of this behavior more likely (Skinner, 1938). Second, the reinforcer was delivered immediately. In typical treatment, an individual is expected to exert great effort in attending visits, taking buprenorphine, and fighting cravings with the hope of decreased opioid use and related impairment. This effort can be difficult to sustain, particularly when treatment gains such as improved relationships, better ability to work, and fewer withdrawal symptoms are not guaranteed and take time to manifest. The increased delay of these positive outcomes is especially devalued in individuals with opioid use disorder compared to individuals without the disorder, further compounding the problem (Madden et al., 1997). For these patients, the immediate effects of opioids, particularly in terms of alleviating withdrawal symptoms, hold greater power than the possibility of functional improvement in the distant future, particularly when perceived at such an early milestone as the first follow-up visit that served as the focus of this study (Hooker et al., 2022).

In this sample, contingency management was equally effective for individuals who exhibited a range of psychiatric symptom severity. Individuals with psychiatric symptoms historically have greater barriers and lower engagement with treatment, but depression, anxiety, and stress did not impact the likelihood of first visit attendance for individuals receiving financial incentives (Cavazos-Rehg et al., 2021; Rogers et al., 2021). It seems that contingency management either served to offset these barriers or the reinforcer was equally salient regardless of psychiatric symptoms. This supports contingency management as an appropriate, efficacious intervention, suitable for individuals with a range of needs and psychiatric symptoms.

Because the contingency management group and treatment as usual group differed in their ratings on the degree to which they were troubled by drug use and the

degree to which treatment of drug use was important, the distributions of these ratings were compared between those who attended their first follow-up visit and those who did not across the two study groups. No significant differences were found, suggesting that these different proportions did not directly translate to follow-up attendance. It should be noted that although these differences were not significant, individuals who regarded treatment as highly important had equal attendance compared to non-attendance in the treatment as usual group, but these participants had a higher rate of attendance compared to non-attendance in the contingency management group, suggesting that the financial incentives contributed to this differential outcome. More research is needed to clarify this relationship, but it may be possible that for highly motivated individuals, contingency management offset barriers to treatment and made follow-up attendance more likely.

Although these results are promising, they should be interpreted in the context of its limitations. The sample size was limited at 47 participants, preventing more fine-grained analyses of depression, anxiety, and stress separately. Thus, the study was underpowered and although meaningful associations were found, statistical significance was not detected in either regression model. It is also possible that the study was underpowered to sufficiently detect the impact of mood on efficacy of contingency management. Additionally, although participants were randomized to study group, the contingency management group did exhibit higher rates of employment, income, and educational attainment than the treatment as usual group (though only educational attainment demonstrated a statistically significant difference). Lastly, only 53.2% of participants reported past-month non-prescription opioid use and only 23.4% reported past-month prescription opioid use. Therefore, a surprising number of participants either

did not engage in past-month opioid use or underreported their opioid use during intake. It is possible that these participants were already engaging in opioid treatment through a different provider or had initiated opioid reduction in the absence of MOUD treatment. Regardless of opioid treatment history, these results still show that CM increased initial engagement in Cooper's treatment program, and the attendance rates for the TAU group are consistent with those found in other buprenorphine engagement studies (Morgan et al., 2018).

Despite these potential limitations, it is important to emphasize the strengths of the current study. Participants were recruited from a real-world opioid clinic and reflected a sample of actual treatment-seekers. Both groups received the same treatment granted to all clinic patients and the treatment as usual group did not interact with the study staff after the intake survey. The contingency management group differed little from the treatment as usual group, with the exception of incentive delivery. Attendance was remotely verified through electronic medical records by study staff and incentives were loaded remotely. Participants were informed of their earnings either through a text message or a phone call, limiting interference with daily clinic procedures. Therefore, results have a high degree of external validity, and the procedures could potentially be adopted within the clinic itself. Contingency management has effectively been incorporated in treatment centers through patient navigators who coordinate care, provide case management, and deliver incentives for meeting treatment goals, as well as incorporated through a digital application called reSET-O (Stitzer et al., 2019; Velez et al., 2021). The sample was diverse in age, ethnicity, and race, and reflected the

demographic makeup of the clinic's patient population, further increasing external validity.

Future directions include separating psychiatric symptoms into more specific domains or disorders. The efficacy of contingency management, and the impact of mood, should be examined over a longer treatment duration to inform how contingency management can affect treatment engagement over time. Additionally, future examinations should explore the original plan for the study before changes had to be made. The original intent of this study was to examine contingency management in an emergency department Bridge Program but was disrupted by the COVID-19 pandemic but had to shift to studying walk-in patients only when Cooper Hospital restricted who could enter the Emergency Department. A Bridge Program requires initiating buprenorphine in the emergency department for those in withdrawal, or providing a dose for home induction, scheduling an appointment with an outpatient treatment facility, and providing sufficient buprenorphine doses until their appointment (D'Onofrio et al., 2015). In this case, contingency management would serve to incentivize attending the scheduled outpatient appointment. Future examinations of contingency management should analyze its utility in raising the rates of bridged outpatient treatment facility engagement.

For every day of continued opioid use, individuals risk death by overdose. Efficacious interventions exist, particularly in buprenorphine, but treatment engagement remains low. Contingency management represents a promising, easy to implement intervention that may increase engagement while limiting interference with everyday treatment clinic operations. Contingency management has demonstrated efficacy for numerous substances, including alcohol, tobacco, and stimulants, but far less information

is available on the effect of contingency management for opioid use disorder buprenorphine treatment. This study adds to the literature by demonstrating the efficacy of contingency management for increasing early buprenorphine treatment engagement, involving patients at an outpatient opioid clinic. It also suggests that contingency management is robust enough for individuals experiencing depression, anxiety, and stress symptoms, which are common in this population. Contingency management may make the difference between the continued struggle with opioid use and an opioid-free, fulfilling life.

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Appendix
Figures and Tables

Figure A1

Consort Diagram

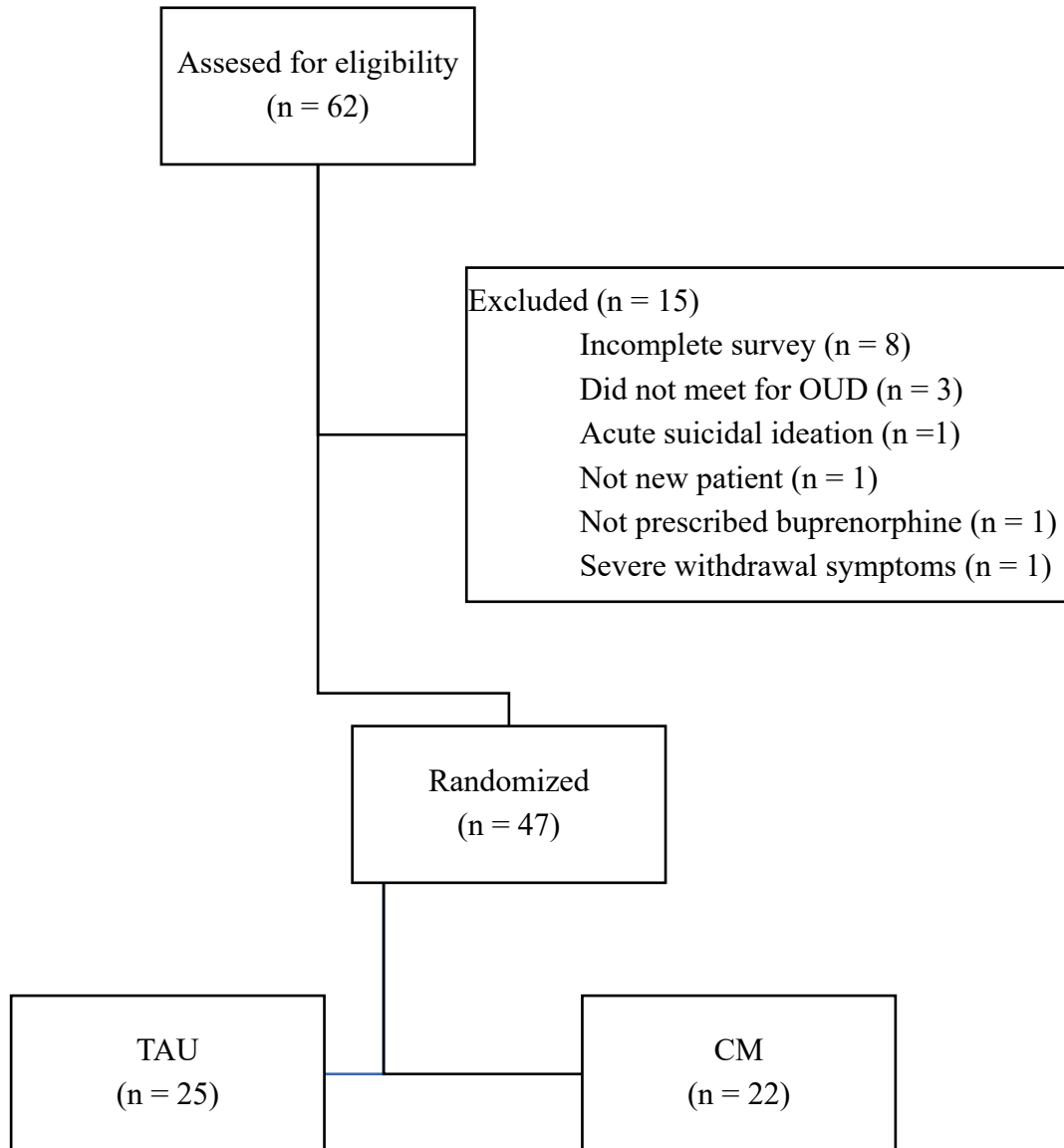


Table A1*Demographics (% or mean(\pm SD))*

		CM (n=22)	TAU (n=25)	Total Sample (n=47)
Age		42.77 (9.64)	39.96 (11.36)	41.28 (10.57)
Gender	Male	57.1%	68.0%	63.0%
	Female	42.9%	32.0%	37.0%
Spanish, Hispanic, or Latino		13.6%	20.0%	17.0%
Race	Black	36.4%	56.0%	46.8%
	White	40.9%	28.0%	34.0%
	Native Hawaiian or Pacific Islander	4.5%	4.0%	4.3%
	Other	18.2%	12.0%	14.9%
	Less than high school degree	13.6%	16.0%	14.9%
Education	High school graduate	36.4%	72.0%	55.3%
	Some college	36.4%	4.0%	19.1%
	Associate degree	4.5%	8.0%	6.4%
	Bachelor degree or above	9.0%	0.0%	4.2%
	Less than \$10,000	36.4%	44.0%	40.4%
Household Income	\$10,000 - \$19,999	13.6%	24.0%	19.1%
	\$20,000 - \$29,000	18.2%	16.0%	17.0%
	\$30,000 or above	31.7%	16.0%	23.4%
	Not working	68.2%	84.0%	76.6%
Employment	Working	31.8%	16.0%	23.4%

Table A2*Mental Health Measures (% or mean(\pm SD))*

	CM (n=22)	TAU (n=25)	Total Sample (n=47)
Past-month depressive symptoms (any)	86.4%	72.0%	78.7%
Past month anxiety symptoms (any)	86.4%	72.0%	78.7%
DASS-21 total ^a	48.00 (28.30)	47.20 (38.40)	47.57 (33.69)
DASS-21 depression ^b	16.00 (11.66)	14.72 (14.52)	15.32 (13.14)
DASS-21 anxiety ^b	14.00 (9.40)	14.08 (12.05)	14.04 (10.77)
DASS-21 stress ^b	18.00 (10.31)	18.40 (13.57)	18.21 (12.02)

^aDASS-21 total represents the past-week severity of depression, anxiety, and stress; it is created by summing the DASS-21 depression, anxiety, and stress subscores.

^bDASS-21 subscores are the past-week severity of depression, anxiety, and stress

Table A3*Substance Use Patterns (% or mean(\pm SD))*

	CM (n=22)	TAU (n=25)	Total Sample (n=47)	
Number of days, past month use (among those who used non-prescription opioids in past month)	22.40 (10.22)	22.00 (10.12)	22.16 (9.95)	
Number of days, past month use (among those who used prescription opioids in past month)	17.75 (11.70)	23.14 (9.84)	21.18 (10.32)	
Years of non-prescription opioid use	8.27 (9.27)	11.00 (11.42)	9.72 (10.45)	
Years of prescription opioid use	5.18 (6.23)	6.60 (8.69)	5.94 (7.59)	
Degree to which troubled by drug use	Not at all	18.2%	28.0%	23.4%
	Slightly	4.5%	4.0%	4.3%
	Moderately	9.1%	20.0%	14.9%
	Considerably	22.7%	20.0%	21.3%
	Extremely	45.5%	28.0%	36.2%
Degree to which treatment of drug use is important	Not at all	4.5%	16.0%	10.6%
	Slightly	0.0%	0.0%	0.0%
	Moderately	0.0%	4.0%	2.1%
	Considerably	9.1%	9.0%	8.5%
	Extremely	86.4%	72.0%	78.7%

Figure A2

First Follow-Up Attendance (%), Primary Outcome

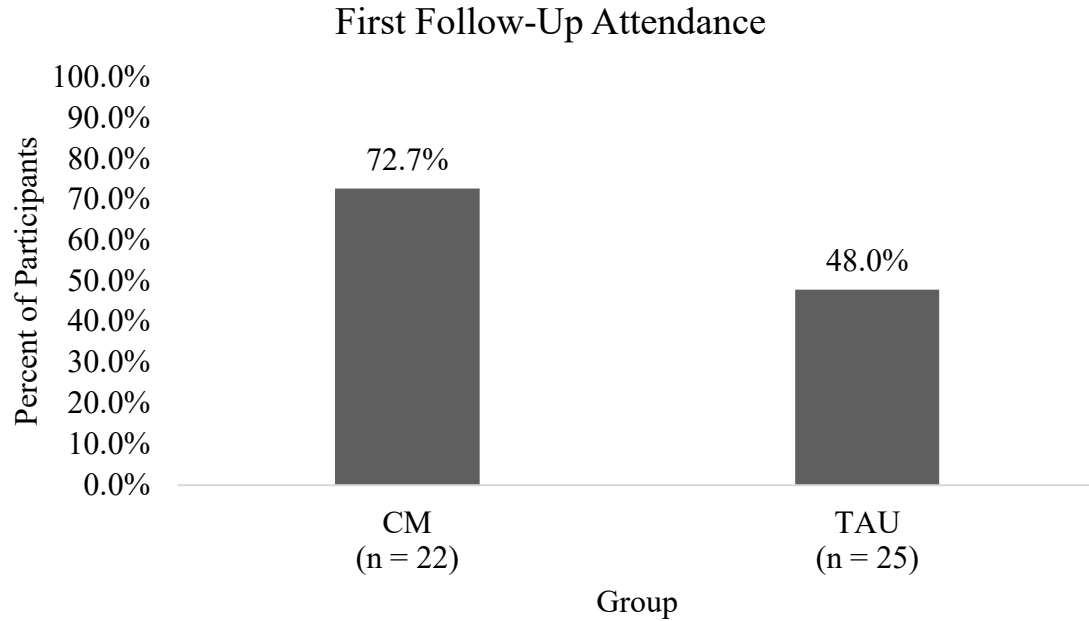


Table A4

Degree to Which Troubled by Drug Use: Group and Follow-Up Attendance (%)

		Group			
		CM (n=22)		TAU (n=25)	
Degree to which troubled by drug use		Attended	Not attended	Attended	Not attended
Not at all, slightly, or moderately		22.7% (n=5)	9.1% (n=2)	28.0% (n=7)	24.0% (n=6)
Considerably or extremely		50.0% (n=11)	18.2% (n=4)	20.0% (n=5)	28.0% (n=7)

Table A5*Degree to Which Treatment of Drug Use is Important: Group and Follow-Up Attendance (%)*

		Group			
		CM (n=22)		TAU (n=25)	
		Attended	Not attended	Attended	Not attended
Degree to which treatment of drug use is important	Not at all, slightly, or moderately	4.5% (n=1)	0.0% (n=0)	8.0% (n=2)	12.0% (n=3)
	Considerably or extremely	68.2% (n=15)	27.3% (n=6)	40.0% (n=10)	40.0% (n=10)