

Table of Contents

01. Abstract	1
02. How Bad Is It?	1
03. What Is Contingency Management?	1
04. Why Is Post-Treatment Recovery Support So Important?	2
05. Does CM Work on Post-treatment Recovery Engagement?	3
06. Why Aren't CM Protocols Already in Use?	4
Acceptability	4
Implementation	5
Cost	5
07. How Can Technology Make CM Easy to Implement?	6
Increased Transportability and Lower Cost	7
Customizable Recovery Goals	7
Optimized Reward Schedules	8
Additional Tools for Clinicians	9
08. How Can We Make a Difference?	9
References	12

Substance Abuse Treatment that Sticks

The Case for Digitized Contingency Management in Post-Treatment Support

01. Abstract

Substance abuse in the US has reached a point of crisis, and the chronic cycle of treatment followed by relapse does little to alleviate the problem.

Contingency Management, an approach which uses incentives to increase healthy behaviors, is one of the most effective treatments for substance use disorders and has demonstrated proven success in reducing relapse rates. Recent technological developments are making Contingency Management more flexible, practical, and cheaper to implement than ever before. By combining research on Contingency Management with new technologies, treatment networks can finally address the growing burden of widespread post-treatment relapse.

02. How Bad Is It?

Substance use disorders (SUDs) in the US caused more than 70,000 deaths in 2017 and have an economic cost of more than \$480 billion annually.²⁻⁴ Of the 19.7 million Americans currently struggling with a SUD, fewer than 1 in 5 will receive any form of treatment.⁵ Even for those who receive treatment, the majority will relapse within

their first year of recovery.⁶⁻⁸ This ongoing cycle of recovery and relapse only exacerbates the heavy toll of SUDs in America. But there is hope: research shows that patients who stay engaged in post-treatment activities that support recovery relapse up to 71% less often than those who do not.⁶ Yet only a small fraction of patients leaving treatment utilize these vital resources.⁶ There has never been a more pressing need to implement effective ways to make treatment stick. By combining recent advances in substance use research with new technologies, emerging solutions rooted in Contingency Management (CM) are poised to deliver post-treatment support that can actually engage and retain people in recovery and reduce relapse rates in the long term. The aim of this paper is to show how CM works to reduce relapse rates, how CM can be combined with technology to make it easy to implement, and how healthcare providers can make the right decisions when it comes to the post-treatment options they provide.

03. What Is Contingency Management?

Contingency Management is an approach to reducing substance use that is based on the long-standing psychological principle that rewarded behaviors are more likely to stick over the long term. In the case of health-promoting behaviors, this approach adds incentive to short-term behaviors that have long-term positive outcomes. For addicts, a focus on short-term incentives is essential because research shows they often have difficulty thinking and planning far into the future.⁹⁻¹¹ For example, one study found that when addicts are told a story about “the future,” they interpret this timeframe to be about 9 days long. In contrast, for non-addicts, “the future” is over 4.5 years long.⁹ Results like these suggest that adding incentives to short-term behaviors that in turn promote long-term health may be particularly important in SUD populations, where focus on long-term positive outcomes may not be a viable approach. Typical CM protocols for SUDs involve providing shopping vouchers or other prizes for submitting drug negative toxicology samples on a regular schedule and are commonly used during early stages of treatment to aid in achieving abstinence.^{1, 2} Recent meta analyses suggest that CM protocols like these are the most efficacious behavioral substance

use treatments currently available,¹² leading to significantly higher abstinence rates than control conditions.¹²⁻¹⁵

When addicts are told a story about “the future,” they interpret this timeframe to be about 9 days long. In contrast, for non-addicts, “the future” is over 4.5 years long.

04. Why Is Post-Treatment Recovery Support So Important?

Individuals transitioning out of intensive substance use treatment face significant challenges upon discharge. Estimates across different substances of abuse suggest that up to 66 percent of people who achieve abstinence while in treatment will relapse in the first year after discharge.⁶⁻⁸ Risk for relapse is highest in the first month post-treatment and remains elevated throughout the first year (Figure 2). Many of those who relapse will be readmitted to expensive, time-intensive active treatment programs. This revolving door of treatment and relapse chips away at the health and well-being of individuals in recovery while racking up a devastating

economic burden. The total economic burden of alcohol and illicit substance misuse is estimated at over \$480 billion annually.²⁻⁴ Due to high costs of substance abuse treatment, even modest improvements to recovery outcomes can have a large economic impact. For example, one week of continued abstinence can save an average of \$789 per patient in associated residential treatment costs.¹⁹

Post-treatment recovery support activities were the best predictor of continued abstinence during the first 5 years of recovery, with those engaging in post-treatment support being 71% less likely to relapse.

If we are truly concerned with long-term solutions to the burden of substance abuse, it is time to turn our attention toward making sure that recovery can be maintained. To combat the shockingly high rates of post-treatment relapse, some form of continued care is highly recommended. Substance abuse is a chronic illness, and as such, requires continued efforts to make sure patients remain healthy over the long term. Many treatment programs provide step-down care for patients exiting treatment or access to outpatient therapy, group therapy, or skills groups. Outside of structured continued care options, research

has identified many other recovery-supporting activities which reduce the risk of relapse, such as peer support groups, mindfulness practices, community and social involvement, and other self-care activities (such as physical exercise).²⁰⁻²³ For example, one study found that post-treatment recovery support activities were the best predictor of continued abstinence during the first 5 years of recovery, with those engaging in post-treatment support being 71% less likely to relapse at any given point compared to those who did no post-treatment support activities.⁶ The results are clear: engagement in post-treatment recovery activities increases recovery success.^{21,24} Yet the actual rate of engagement in post-treatment remains low.^{6,25} Why is it so hard to keep people actively engaged in recovery after treatment? One theory is that there is low inherent motivation to participate in post-treatment support, particularly if someone is currently abstinent and does not perceive themselves to be at risk of relapse. Therefore, if we want to improve long-term recovery outcomes, it is critical to find a way to augment people's motivation to participate in post-treatment recovery support. That's where Contingency Management comes in.

05. Does CM Work on Post-treatment Recovery Engagement?

CM increases health-promoting behaviors by providing short-term rewards. Research suggests that applying CM principles to post-treatment recovery support is an extremely effective approach to increasing engagement and reducing relapse. A number of studies have found evidence that simply rewarding attendance to treatment activities increases engagement while simultaneously improving other recovery outcomes.²⁶⁻²⁹ McKay et al. (2010) found that using CM to enhance participation in their post-treatment program produced significantly higher levels of abstinence at 6 months than either treatment as usual or the non-incentivized program. As this example demonstrates, CM is easily implemented in conjunction with existing treatments to bolster their effectiveness—and has been shown in multiple studies to enhance effects above treatment as usual.³⁰ Despite the overwhelming support for the use of CM in the treatment of SUD, CM protocols remain shockingly underutilized, both in active treatment and to support post-treatment recovery.

Using CM to enhance participation in their post-treatment program produced significantly higher levels of abstinence at 6 months than either treatment as usual or the non-incentivized program.

06. Why Aren't CM Protocols Already in Use?

In a 2011 report by Veteran's Affairs (VA), the low usage of CM was identified as a major barrier to adequately treating SUDs. They identified two primary barriers to more widespread implementation: insufficient training and monetary costs.³¹ Further, stakeholders have often rated CM as having low acceptability (meaning that they perceive it to be less desirable or appropriate than other approaches) which can impede the adoption of CM in community settings.³² These barriers represent issues in the transportability of CM – the ease with which it can be deployed to real-world treatment settings. Another threat to transportability is the overall complexity of CM protocols for clinicians to implement.³³ This section will describe these limitations in more detail.

Acceptability

A systematic review of 81 papers investigating the acceptability of CM approaches concluded that stakeholders often have concerns about the ethics of providing rewards for recovery behaviors.³² Major concerns identified were the perceived potential for coercion and the appropriateness of giving cash or equivalent rewards to substance abusers. However, these studies also provide insight into what types of CM stakeholders find most acceptable and are thus more willing to implement. For example, people find CM protocols most acceptable when they are seen as a 'fair' exchange in which both the provider and the receiver of the incentive are benefitting from the reduction in the target behavior. This balance is optimally achieved in scenarios in which CM incentives are paid for by insurance companies or the government because these sources benefit most directly from the decreased long-term costs of repeated treatment. Stakeholders also find CM protocols more acceptable when they include rewards that are more frequent and closer in time to the target behavior, and they prefer the distribution of shopping vouchers over cash or prizes. Lastly, stakeholders believe that CM should be part of a larger framework of support where change is encouraged and maintained. This requirement aligns well with CM approaches that incentivize a wide

range of recovery promoting behaviors, and that are easily integrated into existing recovery networks. Overall, it's clear that the designers of CM protocols need to be sensitive to the acceptability of CM in order to ensure the highest level of buy-in from all stakeholders.

Implementation

Full implementation of CM protocols in recovery networks consists of multiple steps: training practitioners in CM, active delivery of CM to patients, and ongoing compliance and retraining as necessary. Each step brings its own unique burden to service providers. When the VA took on an initiative to implement CM in over 100 treatment centers, they enrolled 187 treatment providers in 1.5 days of training over 4 weekends – an equivalent of 2,244 clinician hours.³¹ This constitutes a significant upfront investment in personnel to begin integrating CM into existing recovery networks, and it's far from a one-time cost. Research indicates that ongoing supervision and re-training is needed to keep clinician-delivered CM protocols optimally effective over time.^{33–35} Even when adequately trained, the day-to-day work of maintaining CM protocols can be taxing. Traditional clinician-delivered CM protocols require the ongoing monitoring of behaviors, manual tracking of reward schedules, and in-person distribution of rewards – typically

by staff who are already overburdened. Given these challenges in implementing and maintaining clinician-delivered CM protocols, it is not surprising that many treatment settings have decided to eschew CM despite its demonstrated effectiveness.

Cost

Many have suggested that CM protocols may simply be too costly to implement in many clinical settings given the additional cost of the incentives.³⁶ It is unfortunate that the immediate sticker shock of incentives has kept this effective treatment from reaching people who could greatly benefit from it. Let's consider the outcome when cost is not a barrier to implementation by returning to the example of the recent VA rollout of CM. In response to severe underutilization of CM, the VA fully funded CM programs across the nation, and over the course of four years, delivered CM to a total of 2,060 patients.³⁷ Of the urine samples they collected, 91.9% tested negative for substances— an impressive recovery outcome that is comparable to what is achieved in highly controlled studies of CM.³⁷ These results demonstrate that when the financial barrier to CM is removed, it can be effectively implemented in a community treatment setting with high fidelity. Yet, the reality is that most treatment settings do not have the benefit of national funding for such a coordinated

implementation of CM. A sad result of this is that the initial costs associated with CM incentives often overshadow the downstream savings associated with improved substance abuse outcomes. As stated earlier, the average cost of a week of residential substance abuse treatment is \$789. For a full 12-week session of CM, the VA program estimated an average of only \$364 in incentives delivered. Thus, increasing abstinence durations using modest CM incentives, even on the magnitude of days and weeks, has the potential to drastically reduce the cost of future treatment. There are many barriers to implementing CM effectively in real-world settings, particularly with the traditional clinician-delivered protocols that have been most commonly used. But we do not have to give up hope. By integrating treatment research with technology, we can make CM more accessible, flexible, and cost-efficient.

07. How Can Technology Make CM Easy to Implement?

Recently, investigators have begun to test new CM approaches that use technology to address the limitations of traditional CM protocols. CM consists of two main components: monitoring (keeping track of the target behaviors) and delivery (getting the reward to the client). One review of the

use of technology in CM protocols of broad health-promoting behaviors concluded that the most effective approaches automate both the monitoring and the delivery aspects of CM.³⁸ Further, these protocols are just as effective as clinician-administered CM. For example, there have been successful technologies that track physical movement passively through wearables, and deliver electronic vouchers based on activity level. Researchers have begun to look at automating CM for substance use as well; in studies conducted thus far, computerized CM for substance use has performed just as well as traditional CM, while providing solutions to many of the barriers to implementation described earlier.^{39,40}

In response to severe underutilization of CM, the VA fully funded CM programs across the nation, and over the course of four years, delivered CM to a total of 2,060 patients.³⁷ Of the urine samples they collected, 91.9% tested negative for substances.

Increased Transportability and Lower Cost

Traditional CM takes precious clinician time to track behaviors accurately and deliver the appropriate reward, and requires continued supervision and retraining. In contrast, computerized CM can passively monitor and verify behaviors and deliver rewards with near-perfect adherence immediately when the target behaviors are completed – all with very little or no clinician oversight. For example, researchers are developing CM programs which use wearable transdermal alcohol sensors to passively monitor alcohol use and deliver rewards.^{41,42} WEconnect Health Management, which focuses specifically on engagement in post-treatment recovery support, uses GPS verification to track completion of clients' goal activities. In these cases, reward vouchers are delivered automatically through the individual's smartphone in the correct amount. These types of automated CM protocols have the potential to save valuable time and money. In fact, one study found that the clinician time that was saved by computerizing CM was enough to directly offset the cost of the CM incentives,⁴⁰ making it a much more viable option for many treatment centers compared to traditional clinician-delivered CM. Together, these results suggest that computerized CM protocols are poised to eliminate two of the major barriers to

widespread implementation: monetary cost and clinician burden.

Customizable Recovery Goals

Modern perspectives on substance abuse suggest that the road to recovery is highly personalized – and that the behaviors important to one person’s success may be different from another’s. This is in line with research demonstrating that a wide array of post-treatment behaviors, from structured therapy to regular exercise, can have a positive impact on substance use outcomes.^{20–23} Yet CM protocols are often structured so that the rewarded behaviors are highly prescribed and the same from person to person – limiting their ability to be customized to meet different recovery needs. Most computerized CM protocols also stick to strict behavioral targets such as biologically verified abstinence. WEconnect has taken a different approach by allowing clients and clinicians to customize the recovery supporting behaviors that are part of their CM experience. For example, one individual might receive rewards for attending therapy sessions, 12 -step meetings, and exercise classes at their local YMCA, while another receives rewards for meeting with their case manager, visiting their methadone clinic, and going to work. These target behaviors can be set with the help of a clinician and altered over time as someone’s recovery goals change. This

allows more customization for everyone involved—a feature which is likely to improve the acceptability of CM protocols used for post-treatment recovery support.

Computerized CM for substance use has performed just as well as traditional CM, while providing solutions to many of the barriers to implementation described earlier.

Optimized Reward Schedules

Clinician-delivered CM is inherently limited in how complex their reward schedules can be. Because of this, many traditional CM methods deliver the same value of reward every time a target behavior is achieved. Another variation on this is to deliver a reward of random value for each behavior, so that there is a small chance of earning a larger value each time a reward is ‘drawn.’ Both approaches are effective (Benishek et al., 2014; Lussier et al., n.d.), but little variation beyond these two models has been used. One limitation of these is that they aren’t compatible with custom or flexible recovery goals, as they require a larger and larger volume of reward as the number of target behaviors increases. Second, these highly predictable reward

patterns are less engaging than more varied patterns over time. In the development of WEconnect's reward schedule, extant research on CM was combined with psychological principles of reinforcement and developments in gamification to create a schedule designed to keep individuals as engaged as possible over the entire first year of recovery. WEconnect combines custom target behaviors into 'challenges' designed to reward involvement in recovery-supporting activities and continued engagement with the support app. These challenges begin by rewarding clients very frequently for completing smaller tasks as they incrementally build up their recovery routines during the most vulnerable post-treatment period. Once these routines have been established, clients begin to earn larger and larger rewards for maintaining target levels of post-treatment engagement over longer periods of time and for completing increasingly ambitious recovery 'challenges.' The goal of this design is to sustain high levels of motivation over the first year of recovery by keeping interactions with the support app exciting, while also distributing incentives dynamically to optimize engagement and cost. By testing out possible innovations such as these, technologies like WEconnect have the opportunity to hone reward schedules in ways traditional CM simply cannot.

Additional Tools for Clinicians

One of the primary goals of computerized CM is to reduce the time that clinicians waste on administrative tasks related to CM implementation. In addition, computerized CM has a unique opportunity to help clinicians use their time more efficiently to serve their clients. For example, computerized CM collects data on the degree to which users are complying with their target post-treatment behaviors. This information can be used to help prioritize clients who are at high risk of relapse and need more immediate intervention. For example, WEconnect features a clinician dashboard which allows clinicians to monitor their clients' progress toward their recovery goals. Included in this dashboard is a proprietary 'risk score' that is calculated based on post-treatment engagement and other known risk factors for relapse. WEconnect has also begun to implement additional data collection on client well-being to give clinicians further insight into their clients' recovery status. This type of ongoing recovery feedback is priceless for clinicians who struggle to manage large caseloads or have limited face-to-face time with their clients. This is one more example of how computerized protocols can not only reduce the burden of CM, but actually add clinical value.

08. How Can We Make a Difference?

As a nation, we are facing a major epidemic in the form of chronic recurrent substance use disorders—and the high rate of post-treatment relapse is only compounding this state of crisis. To tackle this, we must get serious about post-treatment recovery and leverage technology to increase access and engagement with evidence-based support.

Computerized protocols and support apps like WEconnect are combining the benefits of eHealth technology with the principles of highly effective Contingency Management to deliver science-driven support to those who need it. As more and more treatment providers take the plunge to integrate computerized CM into their treatment networks, we will get closer to significantly decreasing the long-term disease burden of substance abuse.

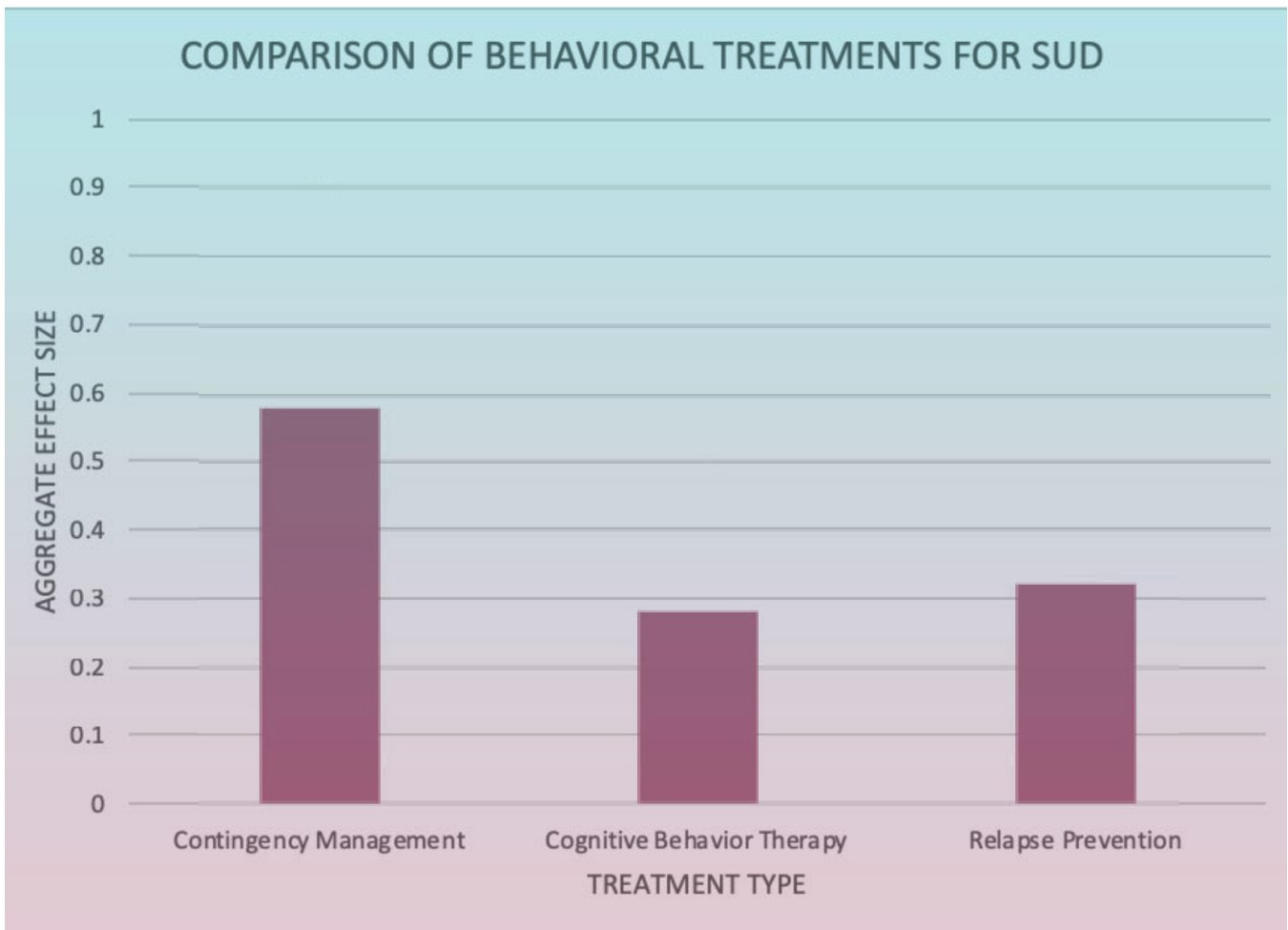


Figure 1 Contingency Management has the highest effect sizes for substance abuse treatment compared to other top behavioral treatments. Adapted from Dutra et al. (2008).

RATE OF POSTTREATMENT RELAPSE

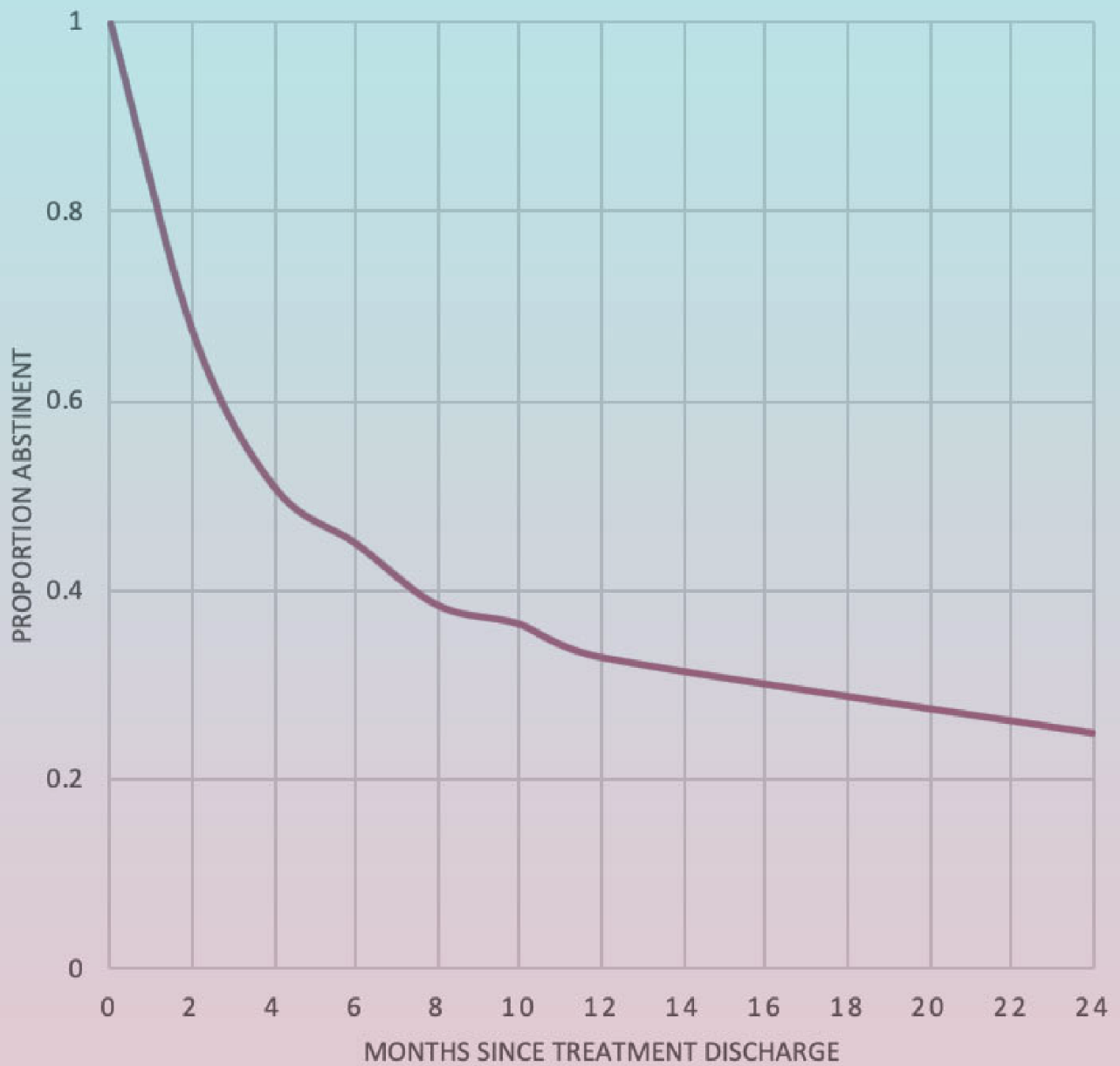


Figure 2 Relapse rates are highest in the first few months post-treatment and remain high throughout the first year. Adapted from Decker et al. (2017) and Brecht & Herbeck (2014).

References

1. Centers for Disease Control and Prevention, National Center for Health Statistics, Multiple Causes of Death 1999-2017 on CDC WONDER Online Database, released December, 2018.
2. Murphy, S. M. et al. Cost-Effectiveness of an Internet-Delivered Treatment for Substance Abuse: Data from a Multi-site Randomized Controlled Trial. *Drug Alcohol Depend.* 161, 119–126 (2016).
3. Sacks, J. J., Gonzales, K. R., Bouchery, E. E., Tomedi, L. E. & Brewer, R. D. 2010 National and State Costs of Excessive Alcohol Consumption. *Am. J. Prev. Med.* 49, e73–e79 (2015).
4. The Economic Impact of Illicit Drug Use on American Society: (618422012-001). (2011). doi:10.1037/e618422012-001
5. 2017 National Survey on Drug Use and Health: Detailed Tables. 2871
6. Brecht, M.-L. & Herbeck, D. Time to relapse following treatment for methamphetamine use: a long-term perspective on patterns and predictors. *Drug Alcohol Depend.* 139, 18–25 (2014).
7. Gossop, M., Stewart, D., Browne, N. & Marsden, J. Factors associated with abstinence, lapse or relapse to heroin use after residential treatment: protective effect of coping responses. *Addiction* 97, 1259–1267 (2002).
8. Gossop, M., Stewart, D. & Marsden, J. Attendance at Narcotics Anonymous and Alcoholics Anonymous meetings, frequency of attendance and substance use outcomes after residential treatment for drug dependence: a 5-year follow-up study. *Addiction* 103, 119–125 (2008).
9. Petry, N. M., Bickel, W. K. & Arnett, M. Shortened time horizons and insensitivity to future consequences in heroin addicts. *Addiction* 93, 729–738 (1998).
10. Amlung, M., Vedelago, L., Acker, J., Balodis, I. & MacKillop, J. Steep delay discounting and addictive behavior: a meta-analysis of continuous associations: Delay discounting and addiction. *Addiction* 112, 51–62 (2017).
11. MacKillop, J. et al. Delayed reward discounting and addictive behavior: a meta-analysis. *Psychopharmacology (Berl.)* 216, 305–321 (2011).
12. Dutra, L. et al. A meta-analytic review of psychosocial interventions for substance use disorders. *Am. J. Psychiatry* 165, 179–187 (2008).
13. Benishek, L. A. et al. Prize-based Contingency Management for the Treatment of Substance Abusers: A Meta-analysis. *Addict. Abingdon Engl.* 109, 1426–1436 (2014).
14. Lussier, J. P., Heil, S. H., Mongeon, J. A., Badger, G. J. & Higgins, S. T. A meta-analysis of voucher-based reinforcement therapy for substance use disorders. *Addiction* 101, 192–203 (2006).
15. Prendergast, M., Podus, D., Finney, J., Greenwell, L. & Roll, J. Contingency management for treatment of substance use disorders: a meta-analysis. *Addiction* 101, 1546–1560 (2006).
16. Barry, D., Sullivan, B. & Petry, N. M. Comparable Efficacy of Contingency Management for Cocaine Dependence Among African American, Hispanic and White Methadone Maintenance Clients. *Psychol. Addict. Behav. J. Soc. Psychol. Addict. Behav.* 23, 168–174 (2009).
17. Secades-Villa, R. et al. Contingency management is effective across cocaine-dependent outpatients with different socioeconomic status. *J. Subst. Abuse Treat.* 44, 349–354 (2013).

18. Rash, C. J., Olmstead, T. A. & Petry, N. M. Income Does Not Affect Response to Contingency Management Treatments Among Community Substance Abuse Treatment-seekers. *Drug Alcohol Depend.* 104, 249–253 (2009).
19. French, M. T., Popovici, I. & Tapsell, L. The Economic Costs of Substance Abuse Treatment: Updated Estimates and Cost Bands for Program Assessment and Reimbursement. *J. Subst. Abuse Treat.* 35, 462–469 (2008).
20. Bowen, S. et al. Relative Efficacy of Mindfulness-Based Relapse Prevention, Standard Relapse Prevention, and Treatment as Usual for Substance Use Disorders: A Randomized Clinical Trial. *JAMA Psychiatry* 71, 547–556 (2014).
21. McKay, J. R. Continuing Care Research: What We've Learned and Where We're Going. *J. Subst. Abuse Treat.* 36, 131–145 (2009).
22. Proctor, S. L., Wainwright, J. L. & Herschman, P. L. Importance of short-term continuing care plan adherence on long-term outcomes among patients discharged from residential substance use treatment. *Am. J. Drug Alcohol Abuse* 43, 734–741 (2017).
23. Weinstock, J., Barry, D. & Petry, N. M. Exercise-related activities are associated with positive outcomes in contingency management treatment for substance use disorders. *Addict. Behav.* 33, 1072–1075 (2008).
24. Proctor, S. L. & Herschman, P. L. The Continuing Care Model of Substance Use Treatment: What Works, and When Is “Enough,” “Enough?” *Psychiatry J.* 2014, 1–16 (2014).
25. Rubinsky, A. D. et al. Outpatient continuing care after residential substance use disorder treatment in the US Veterans Health Administration: Facilitators and challenges. *Subst. Abuse* 39, 322–330 (2018).
26. Ledgerwood, D. M., Alessi, S. M., Hanson, T., Godley, M. D. & Petry, N. M. Contingency Management for Attendance to Group Substance Abuse Treatment Administered by Clinicians in Community Clinics. *J. Appl. Behav. Anal.* 41, 517–526 (2008).
27. Petry, N. M., Alessi, S. M., Rash, C. J., Barry, D. & Carroll, K. M. A randomized trial of contingency management reinforcing attendance at treatment: Do duration and timing of reinforcement matter? *J. Consult. Clin. Psychol.* 86, 799–809 (2018).
28. Walker, R. et al. Disseminating Contingency Management to Increase Attendance in Two Community Substance Abuse Treatment Centers: Lessons Learned. *J. Subst. Abuse Treat.* 39, 202–209 (2010).
29. McKay, J. R. et al. Randomized Trial of Continuing Care Enhancements for Cocaine Dependent Patients Following Initial Engagement. *J. Consult. Clin. Psychol.* 78, 111–120 (2010).
30. Petry, N. M., Alessi, S. M., Olmstead, T. A., Rash, C. J. & Zajac, K. Contingency management treatment for substance use disorders: How far has it come, and where does it need to go? *Psychol. Addict. Behav. J. Soc. Psychol. Addict. Behav.* 31, 897–906 (2017).
31. Petry, N. M., DePhilippis, D., Rash, C. J., Drapkin, M. & McKay, J. R. Nationwide dissemination of contingency management: The Veterans Administration initiative. *Am. J. Addict. Am. Acad. Psychiatr. Alcohol. Addict.* 23, 205–210 (2014).
32. Giles, E. L., Robalino, S., Sniehotta, F. F., Adams, J. & McColl, E. Acceptability of financial incentives for encouraging uptake of healthy behaviours: A critical review using systematic methods. *Prev. Med.* 73, 145–158 (2015).
33. Hartzler, B., Lash, S. & Roll, J. Contingency management in substance abuse treatment: A structured review of the evidence for its transportability. *Drug Alcohol Depend.* 122, 1–10 (2012).