Computerized motivational intervention and contingency management for smoking cessation in methadone-maintained opiate-dependent individuals

Heather E. Durdle
University of Windsor

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COMPUTERIZED MOTIVATIONAL INTERVENTION
AND CONTINGENCY MANAGEMENT FOR SMOKING CESSTATION IN
METHADONE-MAINTAINED OPIATE-DEPENDENT INDIVIDUALS

by

Heather E. Durdle, M.A.
University of Windsor, 2004

A Dissertation
Submitted to the Faculty of Graduate Studies
through Psychology
in Partial Fulfillment of the Requirements for
the Degree of Doctor of Philosophy at the
University of Windsor

Windsor, Ontario, Canada
2008
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ABSTRACT

Approximately 20% of Canadian adults currently smoke, despite widespread knowledge of the significant health problems associated with tobacco use. Of the many smoking cessation interventions developed, contingency management (CM) appears to be among the most efficacious. This type of external motivation has previously been shown to be very efficacious when the contingency is in place, but its effects tend to diminish once the contingency is removed. In contrast, motivational interviewing (MI) is designed to increase an individual’s internal motivation for behaviour change. Studies have shown this type of intervention to produce modest effects for smoking cessation, although follow-up data suggest that the effects of such interventions can be relatively long-lasting.

This study evaluated the combined efficacy of CM and a brief computer-delivered motivational intervention (CDMI) for smoking cessation. This CDMI is based on the principles of MI but is modified from this traditional approach in order to accommodate a computerized delivery of the intervention. The intention was to harness the short-term effectiveness of CM while enhancing or perhaps extending its effects by combining it with CDMI. Using a sample of 48 opiate-dependent persons receiving methadone maintenance therapy, this randomized trial compared rates of smoking cessation for patients receiving CDMI and CM together to those of patients receiving CDMI alone or treatment as usual.

Results indicated that the combination of CDMI and CM was most effective at producing reductions in breath carbon monoxide during the four-week study period, while CDMI only participants endorsed the highest levels of motivation to quit smoking.
At five-week follow-up, CDMI only participants continued to show reductions in number of cigarettes smoked, while CDMI plus CM participants increased their use of cigarettes relative to when the intervention was in place. These results are discussed with respect to the Self-Determination Theory and are used to suggest directions for future research and larger scale studies.
DEDICATION

Throughout my academic career there are many people who have helped to shape me in important ways. I am grateful to Dr. Sherry Stewart, who showed me how exciting and rewarding research can be. Her continued mentorship and example are an inspiration. Drs. G. Ron Frisch and Kevin Gorey, who took a “gamble” on me. And Dr. Steven Ondersma, who went beyond the call of duty and who has proven to be a wonderfully supportive and available mentor.

The following work represents only half of my graduate training. I am also grateful to each clinical supervisor and client that I have been fortunate to work with. You have helped me grow in ways that cannot be written about.

To my family and friends, particularly those whom I met during my time in Windsor. You have given me balance, support, and continued friendships.

Finally, to Matt, who has happily been at every graduation since Grade 9.
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Introduction

Smoking is the most preventable cause of death and disease in the United States and Canada. Each year, tobacco is responsible for over 438,000 (or about one in five) deaths in the United States alone (Centers for Disease Control and Prevention, 2005). Although smoking prevalence rates have dropped over the past two decades, current estimates suggest that 20% of Canadians smoke cigarettes (Health Canada, 2006).

There are a wide variety of interventions designed to reduce tobacco use. Systematic reviews support the efficacy of nicotine replacement therapy (Silagy, Lancaster, Stead, Mant, & Fowler, 2006), individual behavioural counselling (Lancaster & Stead, 2006a), treatment with the antidepressants bupropion and nortriptyline (Hughes, Stead, & Lancaster, 2006a), and especially varenicline (e.g., Jorenby et al., 2006). In each case, these interventions have been found to be 1.5 times more effective relative to no-treatment groups. Less effective but still promising treatments include self-help materials (Lancaster & Stead, 2006b), quit and win contests (Hey & Perera, 2006a), and group therapy (Stead & Lancaster, 2006). There is currently very little evidence to support other interventions such as relapse prevention (Hajek, Stead, West, Jarvis, & Lancaster, 2006), exercise programs (Ussher, 2006), anxiolytics (Hughes, Stead, & Lancaster, 2006b), and acupuncture or laser therapy (White, Rampes, & Campbell, 2006).
Contingency Management

Contingency management (CM) has been shown to have powerful short-term effects on smoking. CM provides an external motivation for behaviour change following the principles of behaviour therapy (itself a product of operant conditioning research). When the target behaviour (e.g., tobacco abstinence) is observed, the individual is reinforced, often with a token or voucher exchangeable for retail goods. When the behaviour is not observed, no reward is provided (Petry & Simcic, 2002). Although decades of research have demonstrated the efficacy of CM in treating substance abuse (Higgins & Silverman, 1999), CM is often criticized because the reinforced behaviours tend to diminish or extinguish when the contingency is removed (Petry, 2000). Reviews of this research confirm that these incentives enhance short-term cessation rates, but the gains tend to dissipate once the rewards are no longer available (Hey & Perera, 2006b; Prendergast, Podus, Finney, Greenwell, & Roll, 2006).

Two recent meta-analyses suggest that CM for substance use produces moderate effect sizes, with one study reporting an average effect size of $r = .32$ (Lussier, Heil, Mongeon, Badger, & Higgins, 2006) and the second reporting an average effect of $d = .42$ (Prendergast et al., 2006). These effects were found to be larger when the delivery of the contingency was immediate, the monetary value of the contingency was high (Lussier et al., 2006), and the treatment duration was relatively brief (Prendergast et al., 2006).

With respect to smoking cessation, CM appears to be remarkably efficacious as an intervention (e.g., Heil, Tidey, Holmes, Badger, & Higgins, 2003; Rand, Stitzer, Bigelow, & Mead, 1989; Stitzer & Bigelow, 1985). However, long-term follow-up data suggest that CM only delays relapse to smoking, and does not reduce smoking levels
relative to baseline (Rand et al., 1989). In general, results for CM are less durable than those for most approaches, as the CM intervention is most effective when the contingency is in place.

Motivational interviewing

Motivational interviewing (MI) has been shown to have more lasting effects on behaviour change. Broadly, MI is a client-centred counselling method designed to enhance an individual’s motivation for behaviour change (Miller & Mount, 2001). This is done through reflective listening and a directive but non-confrontational approach. MI is typically a brief intervention that includes assessment of problem behaviours, personalized feedback, exploration of ambivalence regarding change, and elicitation of the patient’s own reasons for possibly wanting to change (Miller & Rollnick, 1991).

Several meta-analyses support a number of conclusions regarding MI. First, MI is effective at producing change across a wide variety of behaviours, ranging from diet and exercise to substance abuse. Although effect sizes vary, MI tends to produce moderate effects in the range of .35 to .56 relative to no-treatment comparisons (Burke, Dunn, Atkins, & Phelps, 2004). Second, MI often works as well as longer interventions (Burke et al., 2004). For example, in one meta-analysis, MI was found to be as efficacious as alternative treatments, despite being shorter than comparison treatments by an average of 180 minutes (Burke, Arkowitz, & Menchola, 2003). Third, MI appears to be most effective when used as an enhancement to other treatments (Burke et al., 2003; Dunn, Deroo, & Rivara, 2001). Fourth, MI may be most effective with individuals who are more angry/resistant and less ready to change (Burke et al., 2004; Heather, Rollnick, Bell, &
Richmond, 1996; Project MATCH Research Group, 1997), and MI may be contraindicated for individuals who are already committed to behaviour change (Hettema, Steel, & Miller, 2005). There is also some evidence to suggest that the effects of MI are larger for minority samples (Hettema et al., 2005).

With respect to follow-up data, MI appears to produce lasting effects. Dunn et al. (2001) found evidence to suggest that the effects of MI remain the same regardless of the length of time of the follow-up. Similarly, Burke et al. (2003) found that across several studies, the effect sizes at 20 weeks follow-up were not significantly different than effect sizes at 67 weeks follow-up. This is consistent with other meta-analytic reviews that have shown that brief MI for alcohol abuse can lead to reductions in drinking six to 12 months after the intervention (Wilk, Jensen, & Havighurst, 1997).

MI targeting smoking cessation tends to produce smaller effects than MI targeting other substances of abuse. Recent meta-analyses estimate the effect size for such interventions, relative to a no treatment/placebo condition, to range from .11 (Burke et al., 2003; Burke et al., 2004) to .14 (Hettema et al., 2005). However, these small effect sizes are comparable to those for most other smoking cessation interventions (Lancaster & Stead, 2006a), for which statistical significance is often only obtainable in very highly powered studies. The relatively weak effect of MI for smoking cessation may also be a result of the disordinal efficacy of MI noted earlier: MI may in fact be ineffective or even deleterious with many of the more highly motivated individuals who smoke, but quite efficacious with those less motivated. The strong effects of interventions using the 5As approach (Ask about smoking status, Advise to quit smoking, Assess interest in quitting, Assist in quitting, Arrange Follow-up; e.g. Fiore et al., 2000; Pbert et al., 2004), which
presents motivational techniques to those less motivated and problem solving/goal setting to those with more motivation, supports this suggestion.

Computerized interventions

One innovative method of delivering interventions such as MI has been through computerized programs. Computerized interventions offer many advantages over traditional interventions, such as the limited time commitment required from health care providers, the minimal costs associated with their use, the ability of users to maintain their anonymity, and the intervention’s potential accessibility (Copeland & Martin, 2004). Because of this accessibility, these computerized approaches offer the possibility of reaching a large group of people regardless of their age, gender, or socio-economic status. This also includes individuals who may not otherwise receive support for their quit attempt or who may not have been considering reducing their substance use (Ondersma, Chase, Svikis, & Schuster, 2005).

Computer-based interventions using such change strategies as psychoeducation, cognitive restructuring, relapse prevention, and behavioural self-control training have previously been developed. These interventions address a wide variety of mental health problems, such as depression and anxiety disorders (e.g., Carlbring, Westling, Ljungstrand, Ekselius, & Andersson, 2001; Christensen, Griffiths, & Korten, 2002; Lange, van de Ven, Schrieken, & Emmelkamp, 2001) as well as behavioural health problems such as obesity (Tate, Wing, & Winett, 2001). These computerized interventions have also been shown to be effective for reducing alcohol (Hester & Delaney, 1997), drug (Ondersma et al., 2005), and tobacco (Schneider, Walter, &
O'Donnell, 1990) use. One study has shown brief computerized interventions to reduce hazardous drinking at rates similar to practitioner-delivered interventions (Kypri et al., 2004).

**Smoking and methadone maintenance**

Smoking rates are particularly high among substance abusers. Over 90% of individuals in inpatient treatment for alcohol dependence have been found to smoke cigarettes (Bien & Burge, 1990), and rates ranging from 74% to 88% have been reported for individuals in treatment for drug dependence (Kalman, 1998). In particular, opiate users in treatment have among the highest smoking rates in the US population (Stein & Anderson, 2003). Amongst methadone-maintained individuals, smoking prevalence rates of 85% to 100% have been reported (Best et al., 1998; Chait & Griffiths, 1984; Clemmey, Brooner, Chutuape, Kidorf, & Stitzer, 1997; Stark & Campbell, 1993).

The most common and efficacious treatment for opiate dependence is methadone maintenance therapy. Methadone is a medication used for the past 40 years in the treatment of heroin addiction. It acts by occupying the opiate receptor and blocking the "high" that comes from heroin use. Methadone also eliminates withdrawal symptoms and craving for heroin (Zickler, 1999). In Canada, the number of individuals receiving methadone maintenance therapy is growing, with an almost five-fold increase in Ontario alone between 1996 and 2001 (Strike, Urbanoski, Fischer, Marsh, & Millson, 2005). The high rate of smoking prevalence, coupled with the daily dispensing of methadone, presents a unique opportunity for implementing smoking cessation programs with opiate-dependent individuals in treatment.
Given the high rates of tobacco use in methadone-maintained individuals, several authors have suggested that more needs to be done to address smoking in this population (e.g., Olsen, Alford, Horton, & Saitz, 2005; Richter & Ahluwalia, 2000; Richter, Choi, McCool, Harris, & Ahluwalia, 2004). Despite this, relatively few smoking intervention studies have been designed for those in methadone treatment. Although a limited number of approaches have been studied to date, CM or MI have been included as interventions in each of these studies.

Contingency management with methadone-maintained individuals

A number of studies have utilized CM within methadone-maintained samples. In one example of a CM approach, 17 methadone-maintained smokers were followed over a four-week period (Shoptaw, Jarvik, Ling, & Rawson, 1996). As part of the CM, breath carbon monoxide (CO) was assessed three times a week. For each sample that indicated recent abstinence from smoking, participants were given vouchers that could be exchanged for merchandise at the end of the study. These vouchers increased in value for each consecutive day of smoking abstinence. During the CM period, breath CO levels were significantly reduced (indicating less smoking) relative to baseline. Almost one in four participants (23.4%) were able to maintain at least one week of continuous smoking abstinence. Although these results appear promising, all patients had resumed smoking by the end of the study. Breath CO levels did suggest, however, that they had reduced their cigarette smoking relative to baseline.

Researchers have also studied the effects of CM as part of more comprehensive smoking cessation programs. This line of study shows some support for its short-term
effectiveness above and beyond other approaches. Shoptaw et al. (2002) compared the
efficacy of relapse prevention and CM (alone and in combination) for individuals
receiving nicotine replacement therapy. A total of 175 methadone-maintained individuals
were placed into one of four conditions: 1) nicotine replacement therapy only (control
condition); 2) relapse prevention and nicotine replacement therapy; 3) CM and nicotine
replacement therapy; and 4) relapse prevention, CM, and nicotine replacement therapy.
During the 12-week study period, participants provided thrice weekly samples of breath
CO, urine (tested for opiate and cocaine use), and self-reports on the number of cigarettes
smoked. Participants were found to provide more opiate- and cocaine-free urines on the
weeks that they met criteria for smoking abstinence. In terms of the effectiveness of the
intervention on smoking, participants who received CM showed higher rates of smoking
abstinence during the study period. No effect was found for those receiving relapse
prevention alone. However, the gains made by the CM groups were not maintained at six-
and 12- month follow-up.

Therefore, just as with CM interventions for smoking cessation in the general
population, CM with methadone maintained individuals appears to result in significant
but short-lasting reductions in smoking behaviour.

Motivational interviewing with methadone-maintained individuals

Only one smoking intervention study using MI with methadone maintained
individuals has been found. Haug, Svikis, and DiClemente (2004) studied 63 pregnant,
methadone-maintained smokers. All participants received smoking cessation advice from
health practitioners, as well as printed material regarding the harmful effects of smoking
during pregnancy. Half of the women also received four individual sessions of MI. At ten-week follow-up, no difference in smoking (via self-report, urine cotinine, or breath CO) was found between the MI group and the standard care group. However, women who received the MI were more likely to have increased their motivation to change, while the standard care group endorsed less motivation relative to the start of the study period.

Other research suggests that methadone-maintained individuals respond well to motivational strategies when the intervention targets opiate use (Saunders, Wilkinson, & Phillips, 1995). A total of 57 methadone maintained patients received one hour of MI regarding their opiate use. They were compared to a group (N = 65) that received an educational procedure (consisting of a presentation and discussion) on the physical effects of opiate use, brief advice on how to stop, and referral information. At the six-month follow-up, those who received the MI showed greater commitment to opiate abstinence and fewer opiate-related problems. The MI group also remained in methadone treatment longer, and for those who did relapse to opiates, it took them longer to relapse than the educational group. Saunders et al. (1995) found that after just one hour of MI, lasting effects on opiate use could be seen six months later. This supports a recent systematic review that suggests that brief interventions for smoking are just as effective as more intensive counselling methods (Lancaster & Stead, 2006a).

There is therefore some indication that MI with methadone-maintained individuals leads to longer-term gains relative to standard care or educational interventions. These effects may be seen after even very brief interventions.
First research objective: Combined intervention effects

This study intends to build on this previous research in several ways. First, it examines the efficacy of a combined intervention that aims to increase internal motivation (via a brief computer-delivered motivational-based intervention [CDMI]) while also building external motivation (via CM). The intent is to harness CM’s powerful short-term effects while also engaging the potentially longer-term effects of the CDMI.

This CDMI is based on the principles of MI, and is superficially very much like a typical MI session. However, MI by definition is a highly empathic interpersonal process; the CDMI thus cannot be properly understood as MI. It is more accurate to say that it is a motivational intervention.

Theory behind combined interventions

Self-determination theory (SDT; Deci & Ryan, 1985) is helpful in guiding hypotheses for this combined intervention group. SDT is a theory of motivation that addresses the degree to which human behaviours are self-determined and involve free choice. This theory developed in part out of the investigation of the effects of external rewards on internal motivation. In recent years it has been used as a theoretical framework for understanding the efficacy of motivational interventions (i.e., Markland, Ryan, Tobin, & Rollnick, 2005; Vansteenkiste & Sheldon, 2006).

SDT posits that behaviour can be understood in terms of a continuum of autonomy (Ryan & Deci, 2000). At the far left of the continuum is amotivation, which occurs when an individual does not act at all, or acts without intent (e.g., “going through the motions”). Further up the continuum is extrinsically motivated behaviour, which is
thought to have four levels, with the degree of extrinsic motivation decreasing as they progress. The first, *external regulation*, describes actions done in order to satisfy an external demand or receive a reward. *Introjected regulation* describes behaviours designed to avoid guilt or anxiety. Individuals are thought to evidence *identified regulation* when they participate in a behaviour because they value a goal and feel it to be personally important. The last stage of extrinsic motivation is *integrated motivation*. This occurs when one acts in line with their values and needs. In this type of extrinsically motivated behaviour, actions are designed to attain desired outcomes rather than for inherent enjoyment. At the far right of the continuum is *intrinsic regulation*. Behaviours at this end of the continuum are intrinsically motivated and are done because they bring inherent enjoyment or satisfaction. The perceived locus of causality for behaviours along this continuum progresses from impersonal (at the amotivated end), through various levels of external causality (for extrinsically motivated behaviours) to internal causality (for intrinsically motivated behaviours).

The SDT posits that the stability of behaviours is closely related to where they fall on this continuum, such that behaviour based on amotivation or perceived external controls will temporarily be compliant so long as these controls are in place, whereas intrinsically motivated changes will be stable and persistent. Available evidence supports this aspect of SDT. For example, lasting behavioural changes such as long-term weight loss (Williams, Grow, Freedman, Ryan, & Deci, 1996) and diabetes management (Williams, McGregor, Zeldman, Freedman, & Deci, 2004), have both been associated with more autonomous and intrinsically motivated reasons for participating in treatment. A high degree of perceived autonomy and internalized motives for behavioural change
have also been associated with better adherence outcomes in methadone maintenance therapy (Zeldman, Ryan, & Fiscella, 2004). This same study showed that a high degree of external motivation was associated with higher rates of treatment non-compliance.

SDT, then, would predict that CDMI will lead to better outcomes at follow-up relative to control, as motivational interventions are intended to promote autonomous motivation for change. The predicted outcome for the CDMI plus CM group was less clear. In the case of this combined intervention group, studies examining the effect of adding extrinsic rewards (i.e., externally rewarding) to intrinsically motivating (i.e., inherently rewarding) activities were helpful in guiding hypotheses.

Participants in one study completed puzzles that were found to be highly intrinsically motivating. The experimental group received $1 for each puzzle that was completed while the control group received no contingent payments. Results indicated that solving the puzzles for money led to decreases in intrinsic motivation relative to controls (Deci, 1971). A second study paid college newspaper staff 50 cents for each headline written (an intrinsically rewarding activity). Results found, relative to controls who received no additional payments, a decrease in intrinsic motivation that lasted as long as eight weeks after the contingencies were removed (Deci, 1971). These studies indicate that extrinsic rewards can have deleterious effects on intrinsic motivation. This is because these extrinsic rewards (such as money) are thought to change the perceived locus of control from internal to external, resulting in decreased intrinsic motivation (Deci & Ryan, 1985). A meta-analysis of all available experiments such as these has found that tangible rewards contingent upon task performance undermine intrinsic motivation (Deci, Koestner, & Ryan, 1999).
Although smoking cessation is not intrinsically rewarding, these results were used to hypothesize that the combination of CDMI and monetary rewards (i.e., CM) will decrease intrinsic motivation for change and thereby interfere with the processes of CDMI. It is expected that the lack of autonomy support (considered to be a key component of self-determined behaviour; Deci, 1975) in the CM used in this study will also interfere with the process of self-motivation. It is further hypothesized, based on the large body of evidence for the short-term efficacy of CM, that reductions in smoking behaviour will be observed while the contingency phase is in place. However, the work of Deci (1971) suggests that this combined group will evidence higher rates of smoking at follow-up than individuals who received only the CDMI.

*Previous research on combined interventions*

Only two found studies examined the combination of motivational enhancement and contingency management. In both studies, motivation enhancement referred to a relatively brief intervention that used the techniques of MI to promote behaviour change. Budney, Higgins, Radonovich, and Novy (2000) assigned 60 individuals seeking outpatient treatment for marijuana dependence to one of three conditions: 1) motivational enhancement alone (four one-hour sessions); 2) motivational enhancement and behavioural coping skills therapy (14 hour-long sessions); or 3) motivational enhancement and behavioural coping skills therapy plus CM (14 one-hour sessions). Contingencies were provided for marijuana-negative urine drug screens in the amount of $1.50 worth of vouchers for the first negative sample, increasing by $1.50 for each subsequent sample in a row. Budney et al. (2000) found that the motivational
enhancement and behavioural coping skills plus CM group had significantly greater durations of marijuana abstinence than the other two groups, as well as a larger percentage of participants that were marijuana abstinent at the end of the study period. No difference was found between the motivational enhancement alone and motivational enhancement plus behavioural coping skills group.

A second study built on the work of Budney et al. (2000) by adding a control condition and conducting follow-up assessment. In this study, 240 marijuana dependent participants were randomly assigned to one of four study conditions: 1) motivational enhancement plus cognitive behavioural therapy (nine one-hour sessions); 2) CM only; 3) motivational enhancement and cognitive behaviour therapy plus CM (nine one-hour sessions); and 4) control (Kadden, Litt, Kabela-Cormier, & Petry, 2007). In this study, vouchers were provided for marijuana-free urine drug screens that started at $10 for the first negative sample, and totalled $385 if all samples were negative. Follow-up was collected at post-treatment and at three-month intervals for one year. Kadden et al. (2007) found that the two CM groups had the best outcomes, however the CM only group had highest abstinence rates post-treatment, while the CM combined with motivational enhancement and cognitive behaviour therapy had the highest abstinence rates during the follow-up assessments. Despite the findings that MI has been shown to have relatively lasting effects on behaviour change (e.g., Project MATCH Research Group, 1997; Saunders et al., 1995), Kadden et al. (2007) suggest that the cognitive behavioural component of this combined intervention led to the higher rates of abstinence over the follow-up period. However, this remains speculation, as the relative contributions of the three interventions cannot be determined.
While Budney et al. (2000) and Kadden et al. (2007) were able to demonstrate the relative efficacy of a group that received both motivational enhancement and CM, in both studies these were combined with a third intervention. The addition of behavioural skills coping or cognitive behavioural therapy to the motivational enhancement and CM intervention does clearly demonstrate which of these three interventions (or combination of interventions) produced the larger effects.

Therefore, this study aims to extend the earlier research by Budney et al. (2000) and Kadden et al. (2007) by examining the combination of only two interventions: CM and motivational intervention. This is expected to help further dismantle the treatment effects demonstrated by these two studies. The current study also aims to extend this approach to the treatment of nicotine dependence.

Second research objective: Computerized intervention for nicotine dependence

In examining this first research objective, the proposed study develops and utilizes a brief motivational-based computerized intervention targeting nicotine dependence (CDMI). It is therefore a secondary goal to evaluate the efficacy of this novel treatment-delivery approach.

The intervention used in this study is a motivational-based intervention similar to the one developed by Ondersma et al. (2005) in their study of drug-abusing post-partum women. Ondersma et al. (2005) found that relative to baseline, participants endorsed significantly higher levels of motivation to change their drug use following one session of CDMI. A one-month follow-up found an intervention effect of .49 (Cohen's d). The women also rated the intervention as highly satisfactory, easy to use, and respectful. A
larger scale study with 107 drug-abusing post-partum women found an odds ratio of 2.48, indicating that women who received the one session of CDMI were less likely to use illicit drugs at four-month follow-up relative to controls (Ondersma, Svikis, & Schuster, 2007). These findings provide preliminary evidence that a computerized motivational intervention is effective in increasing motivation to change addictive behaviours.

Once computer-based brief interventions such as that utilized in the current study are developed and evaluated, the way is paved for more widespread use. This flexible intervention can easily be modified (at minimal cost) so that it may be implemented in standard outpatient mental health clinics, substance abuse treatment programs, or physician's offices. It could also potentially lead to an internet-based intervention that may be accessed by an even larger number of people world-wide. The development and utilization of such programs may lead to large population effects and may have a significant impact on overall rates of smoking cessation.

Summary

This research therefore aims to examine the efficacy of a combined intervention of CDMI and CM relative to a control group and to CDMI alone. Primary outcomes include changes in smoking behaviour and in motivation to quit smoking. Motivation is a necessary factor in sustaining behaviour change, and CDMI is expected to primarily have an effect on smoking cessation by increasing this motivation to change. A secondary goal of this research is to develop a brief computer-delivered motivational intervention (CDMI) targeting smoking cessation. This approach offers many potential advantages over traditional MI, and previous work by Ondersma et al. (2005) and Ondersma et al.,
(2007) has shown similar computerized interventions to be effective at reducing drug use amongst post-partum women.

Following the stage model of intervention development (Rounsaville, Carroll, & Onken, 2001), this investigation is conceptualized as a Stage Ia/Ib exploratory study. In this model, Stage I studies are designed to develop new intervention approaches, establish feasibility and acceptability, and estimate effect size. Stage I studies provide the basis for Stage II studies in which efficacy is established in an adequately powered clinical trial. Stage I studies are by definition not fully powered trials, but instead focus on the Stage I goals of acceptability, feasibility, and effect-size estimation.

These hypotheses for this study are largely derived from SDT, which posits that behavioural change should be most apparent in the short term for individuals experiencing external motivation to change. Individuals experiencing internal motivation to change should evidence growing levels of motivation but not immediate reductions in smoking behaviour. We therefore predict differences in smoking behaviour and levels of motivation (during the study period and at follow-up) between the CDMI only and CDMI plus CM groups. The four primary hypotheses are: 1) At post-treatment and at five week follow-up, rates of smoking (as measured by breath carbon monoxide, saliva cotinine, and number of self-reported cigarettes smoked) will be lower in the two treatment groups (CDMI and CDMI plus CM) than in the control group; 2) At post-treatment, rates of smoking will be lower in the combined intervention (CDMI plus CM) than in the CDMI alone condition; 3) At follow-up, rates of smoking will be lower in the CDMI alone condition relative to CDMI plus CM; and 4) levels of self-reported motivation will be highest for the CDMI only group at post-study and at follow-up.
Chapter II

METHOD

Participants

All participants in this study were enrolled in methadone maintenance treatment at a clinic in Detroit, Michigan. Consistent with other smoking cessation studies, participants in this study had to report smoking ten or more tobacco cigarettes on an average day (Frosch, Shoptaw, Nahom, & Jarvik, 2000; Schmitz, Rhoades, & Grabowski, 1995; Shoptaw et al., 1996; Stein & Anderson, 2003). Potential participants also had to attend the clinic on Mondays, Wednesdays, and Fridays, as these were the days that samples were taken. Potential participants were excluded from the study if they were currently taking the medication bupropion (Wellbutrin/Zyban), as this is an antidepressant medication that is also an effective smoking cessation aid.

A total of 48 participants (16 in each group) met the above criteria and were enrolled in the study. Completion rates (defined as individuals still providing data at the end of the five week study period) were 87.5% (N=14) in the control group; 68.8% (N=11) in the CDMI only group; and 75% (N=12) in the CDMI plus CM group. Reasons for non-completion were that the participant left the clinic (N=4); the participant failed to meet regularly with the researcher (N=4); or that the participant asked to withdraw from the study (N=3). No significant pattern to non-completion was found across the three groups. Data analysis was conducted only on completers.

Participants tended to be middle-aged (M = 50 years, range = 26 to 66), female (65%), and African American (81%). The modal level of education was General Educational Development (GED; High School equivalent) level, with 14% having
completed less than Grade 10 and 22% having some college or university. With respect to socioeconomic status, 84% of the sample was unemployed and 49% had an income of less than $500 per month.

The average participant had a long history of cigarette use ($M = 30$ years; range = 5 to 50 years). Participants had tried to quit an average of six times in their life, and currently smoked a mean of 15 cigarettes per day. Rates of illicit drug use were also high in this sample, as urine drug screens in the five weeks prior to the study were frequently positive for cocaine and opiates (43% and 34% of the samples, respectively).

**Procedure**

All procedures used in this study were approved by the University of Windsor's Research Ethics Board (Appendix A) and Wayne State University's Human Investigation Committee (Appendix B). Potential participants were approached in the clinic waiting area and asked to complete a brief questionnaire related to their use of tobacco (Appendix C). The investigator explained that by completing this questionnaire, they might be contacted about a research study where they had the opportunity to earn $70 or more in gift cards. Screened individuals earned a $1 gift certificate (see Appendix D for study expenses). McDonald's and Target gift certificates were used throughout this study.

To maintain confidentiality while ensuring the ability to match responses to particular participants, all questionnaires were assigned a unique participant code.
Baseline

Participants provided consent to participate in the study (Appendix E) and were then provided with a list of stop smoking resources (both phone and internet-based; Appendix F). This assured that all participants, including those in the control condition, had support available to them for any quit attempt they chose to make. Participants were then randomly assigned to one of the three study groups using a modified matched-pairs approach to ensure group equivalence on gender and ethnicity. Matching the groups on major demographic criteria allows for a maximal ability to speculate on any differential effects of the interventions. In particular, groups were matched on ethnicity because of previous findings that the effects of MI are larger for minority samples (Hettema et al., 2005).

Following the receipt of informed consent and random assignment to the study condition, the investigator introduced the participant to the computer, which was used to gather all background information and to administer all baseline questionnaires other than the Timeline Followback (a measure used to assess number of cigarettes smoked in the past thirty days), which was completed by hand (see Table 1 for timeline of measures administered throughout the study). Participants were given the choice between using a mouse or touch-screen system. Participants received a $5 gift certificate for completing these initial questionnaires (see Appendix G for the timeline of payments throughout the study).

Across all three groups, the first week of the study was the baseline period. The purpose of this baseline was to record the participants’ level of smoking prior to the
Table 1

**Timeline of measures.**

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<td>Illicit drug use</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

23
intervention, as this afforded the ability to test for within-subject effects. During this baseline, participants were asked to provide a breath CO reading and complete (by hand) the Tobacco Use and Beliefs Measure (used to assess motivation to quit and confidence in ability to quit) and the Brief Tobacco Quantity Assessment (used to assess number of cigarettes smoked in the past several days) on three occasions (Monday, Wednesday, and Friday). Saliva cotinine was also randomly collected on one of these days. During the baseline period, all participants were compensated with $2 in gift certificates each time they provided a breath CO sample and completed the brief measures.

**Intervention**

Following the one-week baseline period, the CDMI only and CDMI plus CM groups underwent the first of two computerized CDMI sessions (Appendix H). Individuals in the control condition interacted with the computer on a non-smoking related task (Appendix I). The fact that all participants interacted with the computer helped control for any computer-related effects.

The intervention lasted approximately 20 minutes and was individually tailored to each participant. It consisted of three main components:

1) Pros and cons of tobacco use, in which the participant chose from a list of options the positive and negative aspects of tobacco use for them (e.g., “Smoking helps me relax and deal with stress”, “Smoking helps me lose weight or maintain my current weight”, “Smoking increases my risk of cancer and other diseases”, “Smoking makes my face and body look older”, see Figure 1).
### Pros and Cons

#### Things I like about smoking

What are some of the things you like about your smoking?

- Smoking feels good
- Smoking helps me relax and deal with stress
- Smoking can be a good way to socialize and bond with other smokers
- Smoking makes things more enjoyable
- Smoking helps me lose weight or maintain my current weight
- I like watching the smoke and the cigarette burn
- Smoking keeps away withdrawals
- I like taking smoke breaks throughout the day
- Something else that is not on this list
- None of these options

---

**Figure 1.** Example of pros and cons of tobacco use.

2) Feedback regarding the specific negative financial and health-related aspects unique to their level of smoking (i.e., the amount of money per year they spend on cigarettes, the percentage of adults who are non-smokers and how this percentage has increased over time, how their negative effects from smoking compare to other smokers, and how much higher their breath CO is than that of a non-smoker, see Figure 2).
3) Optional goal-setting regarding smoking, followed by a questions from the Change Plan Worksheet (Miller & Rollnick, 1991, see Figure 3) to help the participant clarify their goals and plan for obstacles (e.g., their specific reasons for quitting; the steps they plan to take in quitting; and what could interfere with their change plan goal).

Using pre-planned algorithms, participants who were initially willing to set a quit date proceeded directly to the third component. Those initially unwilling to set a quit date engaged in the first and second component. For those participants who reached the end of the second component and were still unwilling to set a quit date, the computer reflected
Figure 3. Example of optional goal setting regarding tobacco use.

their lack of readiness to change at this time and elicited information regarding what signs would tell the participant that he/she did need to change.

Throughout this intervention, an animated and emotionally expressive cartoon character acted as a narrator and guided the participant through the process. The narrator read each item and also reflected back the participant’s answers. This narrator, as well as the touch-screen computer system, ensured that participants with minimal computer literacy or poor reading skills could easily use and understand this computer program.
A second CDMI session was administered at the end of the study period, approximately four weeks after the initial intervention. This was done as an attempt to boost motivation prior to follow-up and engage participants who may have not been initially willing to set a quit date. It was also felt that a second intervention was needed because within the context of brief interventions, more intervention time has been found to be beneficial (Burke et al., 2003). As most relapses occur within a few weeks of quitting, it was felt that a second CDMI within a relatively short time period may help to increase or sustain the motivation of any participants who may have returned to baseline levels of smoking.

The timing of this second intervention was chosen to be at the end of the study period in part because of the nature of the pre-planned algorithms. It was felt that engaging in the same (or very similar) intervention at a short time interval may not be of much benefit or interest to participants. This second intervention also began by assessing the participant’s motivation for quitting and followed the same pre-planned algorithms as the first session. The control group also underwent a second session with the computer on a non-smoking-related task. At the completion of each of the two sessions, participants were compensated with a $10 gift certificate.

Study period

Consistent with other investigations, the study period lasted a total of four weeks (Robles et al., 2005; Shoptaw et al., 1996). During this time, all participants continued to provide thrice weekly breath CO samples and complete the Tobacco Use and Beliefs Measure and Brief Tobacco Quantity Assessment each time they provided a sample.
(Mondays, Wednesdays, and Fridays). Saliva cotinine was also randomly tested once a week during this time. The only difference was in how the groups were compensated:

**CDMI only and control group:** These participants received $2 in gift certificates each time they provided a breath CO sample and completed the brief questionnaires. This compensation was provided regardless of the level of their breath CO. The fact that this payment was non-contingent upon their smoking was stressed to these participants through the study. Participants in these groups earned up to $30 in gift cards for providing these samples, and $75 in gift cards overall.

**CDMI plus CM group:** This group primarily received compensation based on whether or not they provided breath CO samples indicating a recent abstinence from cigarettes. In order to receive this payment, their saliva cotinine also had to test below the cut-off on the random days they were asked to provide this sample.

Participants in this condition earned $4 in gift cards for the first sample they provided that indicated recent smoking abstinence. Consistent with Robles et al. (2005), this amount increased by 50 cents for each consecutive day that they remained abstinent. Participants could therefore earn $4.50 on Day 2, $5 on Day 3, and so on, up to a maximum of $9.50 on Day 12. A sample that tested above the cut-off did not earn the participant any compensation, and the amount they could earn the following day was reset to $4. Budney et al. (2000) also used this incremental earning system in their study of the combined effects of motivational enhancement and CM on marijuana use.

These participants also earned $1 in gift certificates for each time that they provided a breath CO sample and completed the brief questionnaires. This payment was provided even if the sample tested positive for recent tobacco use. This nominal payment
helped ensure that individuals who did not reduce their smoking still had some incentive to continue to provide breath CO samples and information on the number of cigarettes they had smoked.

The amount earned by participants in this group was therefore dependent on how many negative samples they provided. For completing all parts of this study, participants in this group earned $60. A participant that provided negative samples on each of the 12 days of the study would earn an additional $81. This potential payment amount falls within the range of CM reinforcers reported in the literature. For example, reductions in cocaine abuse amongst methadone maintenance clients have been reported with CM payments as high as $3,369 (Dallery, Silverman, Chutuape, Bigelow, & Stitzer, 2001) and as low as $25 per individual (Rowan-Szal, Bartholomew, Chatman, & Simpson, 2005).

Post-study

At the end of the five-week study period, all participants completed the following questionnaires and were compensated with $5 in gift cards:

- Fagerström Test for Nicotine Dependence
- Smoking Self-Efficacy Questionnaire-12
- Readiness to Change Questionnaire
- Stages of Change Algorithm
- Negative Effects of Smoking Questionnaire
- Attributes of Treatment Questionnaire
- Motivation for Change Questionnaire
- Treatment Self-Regulation Questionnaire
Follow-up

Follow-ups were conducted with all participants five weeks after study completion. These follow-ups consisted of a breath CO sample, a saliva cotinine sample, and the following questionnaires:

- Fagerström Test for Nicotine Dependence
- Smoking Self-Efficacy Questionnaire-12
- Readiness to Change Questionnaire
- Stages of Change Algorithm
- Timeline Followback
- Tobacco Use and Beliefs Measure.

Participants were compensated with $15 in gift cards for completing this follow-up. Follow-up rates were 100% for the control group (N = 14); 100% for the MI only group (N = 11); and 91.7% for the MI plus CM group (N = 11). At the end of the follow-up, participants in the control group were offered the motivational intervention.

Measures

Primary Measures

Demographics Questionnaire. This questionnaire records information regarding age, gender, highest level of education obtained, and questions related to socioeconomic status (Appendix J). This questionnaire was computer-administered at baseline.
Smoking Background Questionnaire. This brief questionnaire assesses such variables as age of first use of tobacco, number of years of use, and number of previous quit attempts (Appendix K). This questionnaire was computer administered at baseline.

Breath carbon monoxide (CO). Breath CO readings were taken with the piCO-LO Smokerlyzer Monitor® from Bedfont Scientific Ltd. Readings below 10 ppm place individuals in the non-smoking range. According to the Bedfont website (www.bedfont.com/downloads/Micro+.pdf), this product has a sensitivity of 1 ppm and an accuracy of ± 2%. The breath CO readings were taken three times during the baseline week, three times a week throughout the study period (12 samples total), and during the follow-up assessment.

Saliva cotinine. Cotinine is the principal metabolite of nicotine. The NicAlert© Saliva Nicotine Test was used to assess cotinine levels. This is a semi-quantitative and highly sensitive test that detects levels ranging from 0 ng/ml to 1000+ ng/ml. Test readings range from 0 (0-10 ng/ml) to 6 (1000+ ng/ml). A positive test is considered anything above 10 ng/ml. Research has shown this test to have a specificity of 95% and a sensitivity of 93% (Cooke, Bullen, Whittaker, McRobbie, Chen, & Walker, 2008). This test requires participants to place a sample of oral fluid into a small collection container. This fluid is then placed on a test strip, and results are visibly obtained within minutes. This test was administered once during the baseline period, once a week throughout the four-week study period (the day was chosen at random for each participant), and once at follow-up. Participants were told that saliva samples were collected once per week but
the day was not know to them ahead of time. Saliva cotinine was collected in addition to breath CO, as the 17-hour half-life and a 48 hour window of detection of cotinine (Robles et al., 2005) is much greater than that of breath CO. The cotinine test was only administered once a week throughout the study, as the cost of these tests was prohibitive.

*Timeline Followback* (Sobell & Sobell, 1996). This measure was used to assess the participant’s tobacco use within the past 30 days (Appendix L). It was administered by paper and pencil at baseline and follow-up. It was not necessary to administer this measure at the end of the study period, as the Brief Tobacco Quantity Assessment (see below) captured tobacco use during the 28-day study period. The Timeline Followback makes use of a calendar with important dates and holidays noted. The participant is also encouraged to record any personal markers, such as birthdays or significant life events. Using these dates to enhance their recall, participants provide retrospective estimates for their tobacco use over the specified time period.

The Timeline Followback method has been validated as a measure of tobacco use (e.g., Shiffman, Paty, Kassel, Gnys, & Zettler-Segal, 1994) and is recommended for use in evaluating specific changes in drug or alcohol use before and after treatment (Sobell & Sobell, 1996). Several studies have shown the Timeline Followback to be quite reliable over time, with the majority of test-retest correlations greater than .85 (Sobell & Sobell, 1996). It is considered the gold standard for self-report of tobacco use.

*Brief Tobacco Quantity Assessment.* This brief measure was administered by paper and pencil three times a week throughout the baseline and study period. It asked the
participant to indicate how many cigarettes they have smoked since the last assessment point (Appendix M). This allowed for a daily assessment of tobacco use throughout the entire study period.

_Tobacco Use and Beliefs Measure._ This is a brief measure that has been modified from the contemplation ladder (Biener & Abrams, 1991), a validated measure of smoking cessation change. Using visual analogue scales (VAS), participants were asked to rate: 1) their motivation to quit smoking, and 2) their confidence that they will be able to quit (Appendix N). The VAS is a 10-centimeter line, on which the participant marks a point between two anchors (i.e., 'not at all' and 'extremely'). The response is scored based on how many millimeters from the left anchor the participant's mark is placed. This measure was completed by paper and pencil three times a week throughout the baseline and study period, and during the follow-up assessment.

**Secondary Measures**

_Fagerström Test for Nicotine Dependence_ (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). This is a 6-item questionnaire that assesses one's level of dependence on nicotine (Appendix O). Items include 'How soon after you wake up do you smoke your first cigarette?' and 'Do you find it difficult to refrain from smoking in places where it is forbidden?'. Scores can range from 0 (no to low dependence) to 10 (very high dependence). This measure has been shown to have acceptable internal consistency (Cronbach's alpha of .68; Etter, 2005) and has been found to be significantly correlated with saliva cotinine levels (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994).
This questionnaire was completed on the computer at baseline, study completion, and during the follow-up assessment.

*Smoking Self-Efficacy Questionnaire-12* (Etter, Bergman, Humair, & Perneger, 2000). This 12-item scale assesses the confidence of smokers in their ability to abstain from smoking in high-risk situations (Appendix P). This questionnaire includes both an internal stimuli subscale (e.g., “When I feel depressed”) and an external stimuli subscale (e.g., “When I am with smokers”). Responses are given on a 5-point Likert scale ranging from “Not at all sure” to “Absolutely sure”. This measure has been shown to have acceptable validity, high test-retest reliability (correlation coefficient of .95 for the internal subscale and .94 for the external subscale; Etter et al., 2000), and high internal consistency (Cronbach’s alpha of .95 for the internal subscale and .94 for the external subscale; Etter et al., 2000). This questionnaire was completed on the computer at baseline, study completion, and during the follow-up assessment.

*Readiness to Change Questionnaire* (Rollnick, Heather, Gold, & Hall, 1992). This is a 12-item questionnaire designed to assess an individual’s stage of change (Appendix Q). The original questionnaire was designed to measure readiness to change problem drinking, however for the purposes of this study the items have been modified to assess tobacco use. There are three subscales: Precontemplation (e.g., “I don’t think I smoke too much”); Contemplation (e.g., “Sometimes I think I should cut down on my smoking”); and Action (e.g., “I have just recently cut down on my smoking”). Responses to each item are given on a 5-point Likert scale ranging from −2 (strongly disagree) to +2 (strongly agree).
An individual is said to be in the stage of change with the highest subscale score. This measure has been found to have acceptable internal consistency (Cronbach’s alpha of .73 for the precontemplation subscale, .80 for the contemplation subscale, and .85 for the action subscale; Rollnick et al., 1992) and high test-retest reliability (correlation coefficient of .82 for the precontemplation subscale, .86 for the contemplation subscale, and .78 for the action subscale; Rollnick et al., 1992). This questionnaire was completed on the computer at baseline, study completion, and during the follow-up assessment.

**Stages of Change Algorithm** (DiClemente et al., 1991). This single item measure (“Are you seriously thinking of quitting smoking?”) places individuals in different stages of change based on their response (see Appendix R). There are four stages of change: Precontemplation, Contemplation, Preparation, Action / Maintenance. This questionnaire was administered at baseline, study completion, and at follow-up.

**Negative Effects of Smoking Questionnaire.** This is a 20-item questionnaire with items from the Short Inventory of Problems (Miller, Tonigan, & Longabaugh, 1995) modified to focus on cigarette smoking, as well as author-compiled items (Appendix S). This questionnaire was administered to participants in the two motivational intervention groups (CDMI only and CDMI plus CM) as part of the questionnaire package that they completed at baseline, the end of the study period, and at follow-up. Control participants only received this questionnaire at the end of the study period and at follow-up. It was desired to use this as an outcome measure for all participants, although it was felt that asking participants about the negative effects of their smoking may serve to increase their
motivation for change. To avoid having such a motivational effect on the control group, these individuals did not complete the questionnaire at the beginning of the study period.

*Attributes of Treatment Questionnaire.* This author-compiled 12-item measure assesses how participants feel about the treatment they received in this study (Appendix T). Participants were reminded that this treatment includes any gift cards they received, the time they spent with the computer, and any interactions they had with the researcher. Items include “The treatment I received was respectful”; “The treatment I received was unsupportive”; “The treatment I received made it worthwhile to change for a little bit” and are answered on a 1 (Strongly disagree) to 5 (Strongly agree) Likert Scale. This measure was computer-administered at study completion.

*Motivation for Change Questionnaire.* This author-compiled measure consists of five items assessing internal motivation for change (e.g., “It was a goal I had set for myself”) and five items assessing external motivation for change (e.g., “I got paid for doing it”) (Appendix U). Responses are given on a 1 (Strongly disagree) to 5 (Strongly agree) Likert Scale. This questionnaire was computer-administered at study completion.

*Treatment Self-Regulation Questionnaire* (Williams, Freedman, & Deci, 1998). This 15-item measure assesses motivation for change and includes items assessing autonomous (e.g., “Because I felt I wanted to take responsibility for my own health”), controlled (e.g., “Because it was easier to do what I am told than to think about it), and amotivated (e.g., ‘I really didn’t think about it”) motivation (Appendix V). Responses are
given on a 1 (Not at all true) to 5 (Very true) Likert Scale. This questionnaire was administered at study completion.

*Illicit drug use.* Clinic clients provide frequent urine drug screens as part of their methadone treatment. These drug screens indicate recent use of opiates and cocaine. Participants in this study used other illicit substances too infrequently to be able to statistically analyse any changes over time. The information from these drug screens was valuable to the present study because some studies have found that when individuals quit smoking, there tends to be reductions in overall substance use (e.g., Prochaska, Delucchi, & Hall, 2004). This has also been found in a methadone-maintained sample of individuals. Specifically, participants in a smoking cessation program provided more opiate- and cocaine-free urines in the weeks that they meet criteria for smoking abstinence (Shoptaw et al., 2002). It is thought that this occurs at least in part because cigarette smoking is often a cue for alcohol or drug use.
Chapter III

RESULTS

Data cleaning and evaluation

Missing data

As this was a longitudinal study and involved several time points, addressing missing data was particularly important before data analysis could begin. The average percent of days that participants failed to provide data (i.e., breath CO, self-reported number of cigarettes smoked, and VAS ratings) throughout the study was 16% for participants in the control group; 12% in the CDMI only group; and 19% in the CDMI plus CM group. A one-way ANOVA found no significant difference between the groups on this variable, $F(2,34) = 1.16, p = .33$.

Intention to treat analysis is one method to analyze randomized controlled trials. This method compares participants in the groups to which they were randomly assigned regardless of their subsequent withdrawal or the treatment that they actually received (Hollis & Campbell, 1999). This ensures that clinical effectiveness is not overestimated. Although the application of this method varies widely in the literature, intention to treat analysis is only possible when outcome data is available for all randomized participants (Hollis & Campbell, 1999). Outcome data was not available for all participants who enrolled in this study, and therefore sensitivity analysis was a more appropriate procedure.

To address the issue of missing data, forward replacement was used for participants who failed to provide data on no more than one day in a row and who missed $\leq 20\%$ of the overall study days. Missing data for participants who missed more than two
days in a row or who had missing data for ≥ 20% of the study days were averaged between their day prior to and after the missing days. In order to assess the potential impact of this missing data, we ran a sensitivity analysis on the main outcome measures (breath CO, saliva, number of cigarettes smoked, and self-reported motivation to quit). Participants for whom complete data was available were compared to participants for whom data replacement techniques were used. No significant differences were found.

Differential follow-up rates were not analyzed, as only one participant of those that completed the study was not available for follow-up assessment. As mentioned previously, rates of study completion were not found to significantly differ between the three groups.

Skewness

All variables were evaluated for skewness, and any showing over two standard errors of skewness (Tabachnick & Fidell, 1996) were transformed. For this study ($N = 37$), the critical value was .80. The analyses below are all based on variables that meet the assumptions for ANOVA, although the details of each transformation are not reported.

For the main findings reported below, six of the variables required transformation, with the most frequent being a square root transform.

Approach to data analysis

Current models of intervention development recommend a staged approach, part of which includes an emphasis on appropriate pilot testing (exploring feasibility, acceptability, and effect size estimation) prior to beginning fully powered Stage/Phase III
clinical trials (Rounsaville et al., 2001). As noted above, this study was designed and executed from within this conceptual framework. For this reason, in addition to the small effects typically seen in smoking cessation studies (requiring very large sample sizes in order to obtain significant effects; Lancaster & Stead, 2006a), null-hypothesis significance testing was not the most appropriate means of evaluating these data. Rather than relying solely on the criteria of statistical significance to guide our understanding of the intervention effects, greater weight was given to patterns in the data and to measures of effect size. This allowed for a more exploratory analysis of the findings and allowed us to examine non-linear effects beyond the capacity of ANOVAs.

To conduct these exploratory analyses, a p value cut-off of ≤ .30 was used. Any group main effects or time x group interactions that had a p value under this level were explored further with post-hoc tests and estimates of effect size.

Estimates of effect size were calculated using Cohen's $d$, $d = (\text{mean}_1 - \text{mean}_2) / (SD_1^2 + SD_2^2 / 2)^{0.5}$, in cases where outcomes were continuous. According to Cohen (1992), 0.2 is indicative of a small effect, 0.5 a medium effect, and 0.8 a large effect size. In most cases, $d$ was calculated using change scores (either post-study minus baseline or follow-up minus baseline) in order to control for baseline values.

Change scores could not be calculated for repeated measures analyses. For these analyses, partial eta-squared ($\eta^2_p$), a measure of effect size that is based on proportion of variance accounted for rather than standard deviations, was obtained. This value was then utilized to calculate Cohen's $d$, using the formula $d = (2r / 1 - r^2)^{0.5}$. (Note: since partial eta-squared is most accurate as a measure of effect size when the number of groups is two [$k = 2$], separate repeated measures analyses comparing two groups at a time were run).
The main findings are presented here, although further results may be found in Appendixes W-AC.

Tests of group equivalence

Demographics

The three groups were found to be equivalent on all key demographic variables. As shown in Table 2, analyses of categorical variables through chi-square tests found no difference between the groups on gender, $\chi^2(2) = .50, p = .78$; ethnicity, $\chi^2(4) = .30, p = .99$; level of education, $\chi^2(10) = 9.42, p = .49$; employment status, $\chi^2(4) = 3.02, p = .55$; or monthly income, $\chi^2(8) = 6.03, p = .64$. It was also found that neither age, $F(2,34) = 1.68, p = .20$, or number of days in treatment, $F(2,33) = .44, p = .65$, were significantly different between the groups.

Baseline smoking measures

The three groups were equivalent on all key baseline smoking variables. No significant difference between the groups was found on: age of first cigarette, $F(2,33) = 1.22, p = .31$; age of first regular use of cigarettes, $F(2,34) = .86, p = .43$; number of quit attempts, $F(2,32) = .58, p = .57$; number of total years smoked, $F(2,34) = 2.60, p = .09$; longest time without a cigarette, $F(2,33) = 2.06, p = .14$; money spent each week on cigarettes, $F(2,34) = .40, p = .67$; or number of cigarettes per day, $F(2,34) = .21, p = .81$ (Table 3).
Table 2

Demographic statistics for each study group.

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<tr>
<th></th>
<th>Control</th>
<th>CDMI only</th>
<th>CDMI plus CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (completers)</td>
<td>14</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>46.0 (11.1)</td>
<td>52.3 (9.1)</td>
<td>51.8 (8.4)</td>
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<tr>
<td>Gender (%)</td>
<td></td>
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</tr>
<tr>
<td>Male</td>
<td>28.6</td>
<td>36.4</td>
<td>41.7</td>
</tr>
<tr>
<td>Female</td>
<td>71.4</td>
<td>63.6</td>
<td>58.3</td>
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<td>Ethnicity (%)</td>
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<td>African American</td>
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<td>81.8</td>
<td>83.3</td>
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<td>Caucasian</td>
<td>14.3</td>
<td>9.1</td>
<td>8.3</td>
</tr>
<tr>
<td>Other</td>
<td>7.1</td>
<td>9.1</td>
<td>8.3</td>
</tr>
<tr>
<td>Education (%)</td>
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<tr>
<td>Less than Grade 10</td>
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<tr>
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<td>25.0</td>
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<td>Employment status (%)</td>
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<td>Unemployed</td>
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<td>Employed part-time</td>
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<td>18.2</td>
<td>16.7</td>
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<td>Employed full-time</td>
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<td>8.3</td>
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<td>Monthly income (%)</td>
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<tr>
<td>Less than $500</td>
<td>42.9</td>
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<td>$2001-2500</td>
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<td>More than $2500</td>
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<td>9.1</td>
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<tr>
<td>Mean days in treatment at</td>
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<tr>
<td>beginning of study (SD)</td>
<td>317.2 (575.6)</td>
<td>201.7 (300.8)</td>
<td>173.3 (226.8)</td>
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Table 3

_Baseline smoking statistics for each study group._

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<th>Variable</th>
<th>Control</th>
<th>CDMI only</th>
<th>CDMI plus CM</th>
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<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age of first cigarette</td>
<td>18.2 (7.4)</td>
<td>14.3 (3.0)</td>
<td>16.3 (6.5)</td>
</tr>
<tr>
<td>Age when started smoking regularly</td>
<td>20.3 (9.9)</td>
<td>16.7 (3.6)</td>
<td>20.2 (6.6)</td>
</tr>
<tr>
<td>Number of total years smoked</td>
<td>24.1 (11.8)</td>
<td>34.0 (10.4)</td>
<td>32.1 (12.4)</td>
</tr>
<tr>
<td>Number of times tried to quit</td>
<td>5.6 (6.7)</td>
<td>5.1 (4.6)</td>
<td>7.9 (8.0)</td>
</tr>
<tr>
<td>Longest time without a cigarette (days)</td>
<td>136.0 (221.1)</td>
<td>468.2 (672.2)</td>
<td>215.2 (214.9)</td>
</tr>
<tr>
<td>Number of cigarettes each day</td>
<td>13.1 (5.9)</td>
<td>15.5 (8.0)</td>
<td>15.5 (8.2)</td>
</tr>
<tr>
<td>Amount spent each week on cigarettes ($)</td>
<td>31.5 (20.4)</td>
<td>25.3 (10.6)</td>
<td>30.4 (20.4)</td>
</tr>
<tr>
<td>Have you ever talked to your counsellor at this clinic about quitting smoking? (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>71.4</td>
<td>81.8</td>
<td>91.7</td>
</tr>
<tr>
<td>Yes</td>
<td>28.6</td>
<td>18.2</td>
<td>8.3</td>
</tr>
</tbody>
</table>

_Contingency payments_

The average additional amount earned by participants in the CDMI plus CM group was $16.35 (SD = $20.77, range = $0 to $56.50). The maximum that could be earned was $81.
Breath CO

The overall pattern of breath CO indicates a small increase in breath CO for the control and CDMI only groups (each up approximately 10%) during the 5-week study period, and a small to moderate decrease in breath CO for the CDMI plus CM group (a decrease of approximately 25%; Figure 4).

Breath CO summary

The analyses are consistent in demonstrating the efficacy of the combination of CDMI and CM in producing a during-treatment reduction in breath CO relative to control and CDMI alone. To a lesser degree, there was also an effect for CDMI alone, relative to control. This pattern of results reached the level of statistical significance for analyses of breath CO reductions of 50% relative to baseline. The increased efficacy of the CDMI plus CM group was only evident during treatment, and did not extend to the follow-up period.

During treatment repeated measures

Statistical analysis of these values over the study period was done using a repeated measures ANCOVA on breath CO readings for Week 1, Week 2, Week 3, and Week 4 (12 readings total). The covariate was average breath CO reading for the baseline week. There was a non-significant trend towards a group main effect, $F(2,32) = 2.46, p = .10, \eta^2_p = .13$. No significant main effects were found for time, $F(9,352) = 1.14, p = .34, \eta^2_p = .03$, and there was no time by group interaction, $F(18, 352) = .92, p = .55, \eta^2_p = .06$. 
Given that the \( p \) value for the group effect was well below the cut-off value of .30, further exploration of these data was conducted. Partial eta squared values were calculated for two group comparisons and were converted to Cohen's \( d \). Across the study period, the CDMI plus CM group showed a larger magnitude of reduction in breath CO relative to CDMI alone \((d = .82)\) and control \((d = .97)\). There was a moderate effect size difference between CDMI only and control \((d = .52)\). This suggests that there was a clear advantage for the combination of CDMI and CM in reducing breath CO over the length of the study period.
Baseline versus post-treatment

Change scores were then calculated from baseline to Week 4. The difference in these change scores between the groups approached significance, $F(2,34) = 2.70, p = .08$, $\eta^2_p = .14$. Because this $p$ value was well below the cut-off of .30, more statistical exploration of this data was conducted.

Further analyses (Fisher’s LSD post-hocs) revealed a significant difference between the control and CDMI plus CM group (Mean Difference = 8.14, $p = .04$) and a non-significant trend towards a difference between the CDMI only and CDMI plus CM group (Mean Difference = 6.89, $p = .09$). The CDMI plus CM group decreased their breath CO while the other two groups increased from baseline to Week 4. No significant difference was found between CDMI only and control (Mean Difference = 1.25, $p = .74$).

Change scores revealed a large effect size magnitude for the CDMI and CM group over the CDMI only ($d = .81$) and the control group ($d = 1.17$). The magnitude of the difference on breath CO between the CDMI only and control group was almost zero ($d = .12$). This also suggests that there was a clear advantage for the combination of CDMI and CM on reducing breath CO levels at the end of the study relative to baseline.

Baseline versus follow-up

A statistical analysis of the breath CO follow-up data (controlling for baseline CO levels) found no significant group differences, $F(2,30) = .56, p = .58, \eta^2_p = .04$. Because this $p$ value was above the cut-off of $p<.30$, more statistical analyses were not conducted.
Number of days breath CO was in non-smoking range

The total number of days breath CO was in the non-smoking range was compared across the three groups (Figure 5). Statistical analysis using an ANCOVA (covarying on baseline breath CO) showed a non-significant trend at the $p \leq .30$ level, $F(2,32) = 1.71, p = .20, \eta^2_p = .10$. Two group comparisons were run and partial eta-squared was used to calculate Cohen's $d$. In terms of magnitude of change, the CDMI plus CM group showed more samples in the non-smoker range than the other two groups ($d = .70$ versus CDMI only and $d = .95$ versus control), and the CDMI only group had more non-smoker samples than the control group ($d = .70$).

![Figure 5](image-url)

Figure 5. Total number of days across the study period that breath CO was in the non-smoker range (error bars are standard deviation values).
Breath CO reductions relative to baseline

The number of days across the four weeks of the study that each participant had reduced their breath CO reading by 50% relative to their average reading during the baseline week was calculated (Figure 6). A univariate ANOVA was run on these data, and a significant group difference was found, \( F(2,34) = 5.07, p = .01, \eta^2_p = .23 \). Further analyses (Fisher’s LSD post-hocs) indicated that the control group had significantly fewer days of breath CO reduced by 50% relative to baseline than the CDMI only (Mean Difference = .12, \( p = .03 \)) and the CDMI plus CM (Mean Difference = .16, \( p < .01 \)) groups. There was no significant difference between the CDMI only and CDMI plus CM groups (Mean Difference = .04, \( p = .47 \)).

Estimates of effect size revealed that there was a large effect when the control group was compared to the CDMI only \( (d = 1.10) \) and CDMI plus CM groups \( (d = 1.17) \), with the control group producing fewer samples that met this 50% reduction criterion. When the CDMI only group was compared to the CDMI plus CM group, a moderate effect was found \( (d = .54) \), with the combined intervention group producing the largest number of samples that showed a 50% reduction.

Measure of clinically significant breath CO reductions

A clinically significant reduction in breath CO was defined as a 25% decrease relative to baseline. An ANOVA on follow-up breath CO values indicated no difference between the groups on this value, \( F(2,30) = 1.38, p = .27 \), although nine of the 35 participants provided follow-up samples below this cut-off.
Figure 6. Number of days across the study period that breath CO was reduced 50% relative to baseline (error bars are standard deviation values).

Saliva cotinine

The saliva cotinine readings across all participants decreased slightly between baseline and Week 1 but then slowly increased, such that Week 4 readings were slightly higher than baseline levels. When each of the three groups was examined separately, no clear pattern of results emerged (Figure 7). The average saliva cotinine reading was in the moderate range (modal score of 4 with a possible range = 0-6). At follow-up, all three groups had slightly higher levels of saliva cotinine relative to baseline.
Figure 7. Saliva cotinine values across the study period and follow-up (fixed to zero to account for baseline differences)

Summary of saliva cotinine findings

There were no significant differences in saliva cotinine levels, either during treatment or at follow-up.

Saliva cotinine across the study period

Statistical analysis of Week 1 to Week 4 values (using a repeated measures ANCOVA with baseline saliva cotinine as the covariate) revealed no significant main effects of time, $F(3,99) = .82, p = .49, \eta^2_p = .02$, or group, $F(2,33) = .48, p = .62, \eta^2_p = .03$, and no time by group interaction, $F(6,99) = .49, p = .81, \eta^2_p = .03$. Analysis of change
scores also suggested no treatment effects on saliva cotinine readings at Week 4, $F(2,34) = .18, p = .84, \eta^2_p = .01$.

**Saliva cotinine at follow-up**

Similarly, no significant group differences were found on the change scores at follow-up (controlling for baseline values), $F(2,31) = .18, p = .84, \eta^2_p = .01$.

**Number of self-reported cigarettes**

**Across the study period**

The pattern of results for all participants shows that from baseline to Week 1, participants reduced their smoking from approximately 14 cigarettes per day to 10 cigarettes per day. Looking at the pattern of results for each of the three groups suggests that the control and CDMI plus CM groups showed some degree of reduction each week of the study. The CDMI only group showed reductions from baseline to Week 2, and then increased the number of cigarettes smoked during Weeks 3 and 4 (although not back to baseline levels).

The control and CDMI participants reduced their cigarette use by on average 20 cigarettes a week over the five weeks of the study, while CDMI plus CM participants reduced their smoking by an average of just over 30 cigarettes a week during this time (Figure 8).
Summary of findings for self-reported number of cigarettes

These results suggest that all three groups reduced their levels of self-reported smoking over the study period to a similar degree, and that no clear advantage of one intervention over the others was apparent. At follow-up, all three groups also maintained this reduction relative to baseline levels. However, non-significant trends suggested that the CDMI only group made additional post-treatment changes, whereas the CDMI plus CM group increased use after the removal of treatment. This diverging trend led to an apparent advantage for CDMI only in terms of change from post-treatment to follow-up.

Figure 8. Number of self-reported cigarettes each week of the study period (total value)
During treatment repeated measures

Statistical analysis of the linear pattern of results was done using repeated measures ANCOVA. The within subjects variables were the total number of cigarettes smoked during each of the four weeks of the study and the covariate was total number of cigarettes smoked during the baseline week. This analysis revealed no main effect of time, $F(7, 864) = 1.65, p = .13, \eta^2_p = .05$, or group, $F(13, 864) = .71, p = .75, \eta^2_p = .04$, and no time by group interaction, $F(2,32) = .35, p = .71, \eta^2_p = .02$.

Baseline versus post-treatment

Change scores were calculated for the number of cigarettes smoked during Week 4 minus the number of cigarettes smoked during the baseline week. These differences were not significant across the three groups, $F(2,34) = .31, p = .74, \eta^2_p = .02$. Because the $p$ value was greater than .30, no further analyses were conducted.

Across pre-study, study period, and post-study

Participants overall showed a reduction in number of cigarettes smoked from baseline to post-treatment (from 14 to 10 cigarettes/day, or approximately 6.5 fewer packs of cigarettes a month). This reduction remained almost constant at follow-up (Figure 9). Looking at the three groups separately revealed that the control group followed this same pattern (i.e., sharply reduced the number of cigarettes they smoked relative to pre-study and maintained this level at follow-up). The CDMI only group also drastically reduced their use of cigarettes relative to pre-study and then continued this reduction by approximately a pack per month at follow-up. In contrast, the CDMI plus
Figure 9. Total number of cigarettes smoked pre-study (30 days), during the study period (28 days), and post-study (30 days).

CM group reduced their use of cigarettes to a similar degree during the study period, but then increased their use of cigarettes by approximately one per day at follow-up (still down three cigarettes a day, or almost five packs per month, relative to pre-study).
Pre-study versus study period

Analysis of the number of cigarettes smoked during the study period, minus pre-study levels of smoking showed similar levels of reduction across all three groups, $F(2,34) = .14, p = .87, \eta^2_p = .01$.

Pre-study versus post-study

Change scores were also calculated for the number of cigarettes smoked post-study, minus pre-study. No difference between the groups was found, $F(2,33) = .23, p = .80, \eta^2_p = .01$.

Study period versus post-study

Relative to number of cigarettes used over the study period, self-reported number of cigarettes at post-study held steady for the control group, decreased for the CDMI only group, and increased for the CDMI plus CM participants. A non-significant trend was found at the $p \leq .30$ level, $F(2,33) = 1.30, p = .28, \eta^2 = .07$, so effect sizes were calculated. A small to moderate effect was found when the control group was compared to CDMI only ($d = .35$), with the CDMI only group showing a continued decrease. A small to moderate effect was also found when the control group was compared to CDMI plus CM ($d = .29$), with the CDMI plus CM group showing an increase in number of cigarettes smoked at follow-up. The increase in the use of cigarettes for the CDMI plus CM group and the decrease for the CDMI only group resulted in a large effect when these two groups were compared ($d = .96$).
Relationship between biological and self-report measures

Correlations were run between the biological measures (i.e., breath CO and saliva cotinine) and the self-reported number of cigarettes smoked. Regarding the relationship between saliva cotinine and average breath CO reading, a significant correlation was found for Week 3 ($r = .41, p = .01$), Week 4 ($r = .36, p = .03$), and Follow-up ($r = .41, p = .02$). No significant relationship was found for Baseline through Week 2.

With respect to saliva cotinine levels and number of self-reported cigarettes smoked, only a significant correlation was found for Week 1 ($r = .36, p = .03$). Number of cigarettes smoked was, however, significantly correlated with breath CO at Baseline ($r = .46, p < .01$), Week 1 ($r = .43, p < .01$), and Week 3 ($r = .35, p = .03$). No other significant relationships were found.

These results suggest that the biological and self-report measures were reasonably associated. Average breath CO readings appeared to best correlate with both saliva cotinine levels and number of self-reported cigarettes smoked.

Motivation to quit – VAS ratings

Across all participants, the average motivation ratings were in the moderate range (range = 61.3 – 66.5; possible range 0-100). CDMI only participants showed an increase in motivation that peaked at Week 2 and was still elevated relative to baseline at follow-up (Figure 10). CDMI plus CM participants showed some decreases in motivation, which were lowest at Week 3 but had returned to baseline levels at follow-up. Control participants evidenced relatively constant levels of motivation, with an increase at follow-up.
Figure 10. Average VAS motivation to quit smoking ratings for each week of the study plus follow-up.

Summary of motivation rating findings

Effect sizes suggest that during the study period, CDMI only participants had much higher levels of motivation than CDMI plus CM and control participants (who evidenced the lowest levels of motivation). There were no significant differences between the groups at follow-up.

During treatment repeated measures

Statistical analysis of these values (repeated measures ANCOVA with baseline motivation as the covariate) found a non-significant trend towards a main effect of group,
\[ F(2,33) = 2.99, p = .06, \eta^2_p = .15. \] No main effect of time, \[ F(5,363) = 1.09, p = .37, \eta^2_p = .03, \] or a time by group interaction, \[ F(9, 363) = .75, p = .66, \eta^2_p = .04, \] were found.

Further analyses were conducted due to the group effect \( p \) value being well under the cut-off of \( \leq .30 \). These analyses (Fisher’s LSD post-hoc) on the group main effect found no significant differences: Control and CDMI only (Mean Difference = 12.83, \( p = .11 \)); control and CDMI plus CM (Mean Difference = 3.98, \( p = .60 \)); and CDMI plus CM and CDMI only (Mean Difference = 8.84, \( p = .28 \)).

Two group comparisons were run and Cohen’s \( d \) was calculated from partial eta-squared. Very large effects were found when the CDMI only group was compared to the control (\( d = .90 \)) and CDMI plus CM group (\( d = -1.35 \)), with the CDMI only group endorsing higher ratings than the other groups. A moderate effect was found between the control and CDMI plus CM groups (\( d = .46 \)), with the control group endorsing the lowest ratings of motivation across the study period.

**Baseline versus post-treatment**

Change scores on average motivation ratings during Week 4 (minus baseline ratings) were not significantly different between the groups, \[ F(2,34) = .99, p = .38, \eta^2_p = .39. \]

**Baseline versus follow-up**

Change scores were also calculated for the follow-up motivation ratings, minus ratings at baseline. Statistical analysis revealed no significant group differences, \[ F(2,32) = .66, p = .52, \eta^2_p = .04. \]
Confidence in ability to quit - VAS ratings

Across all participants, the overall confidence in ability to quit smoking ratings were relatively flat across the entire study period. The average rating was in the moderate range for each of the four weeks of the study plus baseline (range = 64.8 – 66.7; possible range = 1-100) and did not show a large degree of variation. This suggests that the average participant had a moderate degree of confidence that they could quit smoking across the study period.

Separate analysis of the three different study groups revealed that the control group showed relatively flat ratings across time while the CDMI only group showed a sharp increase from baseline to Week 2 that leveled off in Weeks 3 and 4 (Figure 11). The CDMI and CM group had similar ratings at baseline and Week 4, although their lowest confidence ratings were in Week 3. At follow-up, the control and CDMI plus CM groups had relatively unchanged confidence ratings compared to baseline. The confidence ratings for the CDMI only group increased slightly from baseline to follow-up, but were down from post-study levels.

Summary of confidence in ability to quit smoking findings

There was a significant group difference in confidence ratings across the study period, with CDMI endorsing the highest levels of confidence and the control group endorsing the lowest. Effect size estimates revealed a similar pattern of results when post-study ratings were compared, relative to baseline. No group differences were found at follow-up.
Figure 11. Average VAS confidence in ability to quit smoking ratings for each week of the study plus follow-up.

During treatment repeated measures

Linear analysis of these patterns (using a repeated measures ANCOVA with baseline confidence as the covariate) revealed a significant main effect of group, $F(2,32) = 3.59, p = .04, \eta^2_p = .18$. No main effect of time, $F(8, 352) = .63, p = .74, \eta^2_p = .02$, or time by group interaction, $F(16, 352) = 1.21, p = .26, \eta^2_p = .07$, were found.

Post-hoc analyses (Fisher’s LSD) on the group main effect found no significant differences: Control and CDMI only (Mean Difference = 1617.56, $p = .12$); Control and CDMI plus CM (Mean Difference = 361.60, $p = .72$); and CDMI plus CM and CDMI only (Mean Difference = 1255.96, $p = .25$).
Two group comparisons were run and partial eta-squared values were used to calculate Cohen’s $d$. Very large effects were found when the CDMI only group was compared to the control ($d = 1.01$) and CDMI plus CM groups ($d = 1.30$), with the CDMI only group endorsing higher levels of confidence across the study period. Only a small to moderate effect was found when the control and CDMI plus CM group was compared ($d = .35$), with the control group showing slightly lower confidence ratings.

*Baseline versus Post-treatment*

To further examine any group differences over the study period, change scores were calculated for Week 4 values minus baseline confidence ratings. A non-significant trend (at the $p \leq .30$ level) was found, $F(2,34) = 1.92, p = .16, \eta^2_p = .10$. Effect size calculations revealed that the control and CDMI plus CM groups had similar small decreases in confidence across the study period ($d = .10$). The increase in confidence shown by the CDMI only group produced a large effect relative to the control ($d = .74$) and CDMI plus CM conditions ($d = .80$).

*Baseline versus follow-up*

Change scores were also calculated from baseline to follow-up for the confidence ratings. A univariate ANOVA was run and no significant difference between the groups was found, $F(2,32) = .57, p = .57, \eta^2_p = .03$. 
Negative Effects of Smoking Questionnaire

The overall ratings on the Negative Effects of Smoking Questionnaire remained relatively steady over time and did not show much variation (range = 25.6 - 27.6; possible range = 0-60). These values indicate that the average participant endorsed a moderate degree of negative effects from their smoking (Figure 12). When each group was examined separately, a divergent pattern of results emerged. At baseline, CDMI only participants endorsed more negative effects of their smoking than the CDMI plus CM group (this measure was not administered to control participants at baseline). At post-study and follow-up, the CDMI only group slightly increased the number of negative effects that they endorsed, while the CDMI plus CM group endorsed fewer negative effects relative to CDMI only and relative to their own baseline. The control group scores fell between the other two groups at post-study and follow-up.

Cronbach’s alpha was run to test for internal consistency of this measure. Alpha levels were .92 at baseline, .90 at post-test, and .90 at follow-up.

Summary of negative effects of smoking results

Significant differences were found between the CDMI only and CDMI plus CM groups, with the CDMI only participants endorsing significantly more negative effects of smoking at post-study and follow-up, relative to baseline.

Baseline versus post-study

Change scores were calculated for the difference between baseline and post-study. This could not be calculated for the control group, as they did not complete this measure.
Figure 12. Total scores on the Negative Effects of Smoking Questionnaire at baseline, post-study, and follow-up.

at baseline. A univariate ANOVA revealed a significant group difference, $F(1,21) = 4.76$, $p = .04$, $\eta^2_p = .19$. Effect size calculations revealed that this was a large effect for the comparison between CDMI plus CM and CDMI only ($d = -.93$), with the CDMI only group showing an increase in their total score over time. The number of negative effects endorsed by the CDMI only group increased over the study period, while they decreased for the CDMI plus CM group.
Baseline versus follow-up

Change scores from baseline to follow-up were also calculated for the CDMI only and CDMI plus CM groups. These change scores were found to be significantly different between the two groups, $F(1,21) = 5.91, p = .02, \eta^2_p = .22$. Effect size calculations indicated that the magnitude of the difference between the groups was large ($d = 1.03$), with the CDMI only group endorsing more negative effects.

Motivation for Change Questionnaire

Internal Motivation Subscale

The Motivation for Change Questionnaire was administered only at post-study. Analysis of the internal motivation subscale showed that the groups were virtually the same on their average score and all showed a relatively high degree of internal motivation ($M = 18.6$; possible range 0-25). This similarity was confirmed with a univariate ANOVA, $F(2,34) = .03, p = .98, \eta^2_p = .00$ (Table 4). Cronbach’s alpha indicated that the internal subscale had an acceptable level of internal consistency, with an alpha level of .79.

Summary of results for the motivation for change subscale

Effect size estimates suggest that the CDMI plus CM group endorsed the highest levels of external motivation, while the CDMI only group endorsed the lowest levels. No difference was found between the three groups on the internal motivation subscale.
Table 4

Motivation for Change Questionnaire subscale scores.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>CDMI only</th>
<th>CDMI plus CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Internal subscale</td>
<td>18.7 (5.1)</td>
<td>18.8 (4.4)</td>
<td>18.4 (3.6)</td>
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<tr>
<td>External subscale</td>
<td>11.6 (3.9)</td>
<td>11.0 (2.0)</td>
<td>13.2 (2.9)</td>
</tr>
</tbody>
</table>

External Motivation Subscale

The external motivation subscale scores were considerably lower across all groups than the internal motivation scores. Across all participants, a moderate degree of external motivation was endorsed (M = 11.9; possible range 0-25). The CDMI only group endorsed the lowest degree of external motivation while the CDMI plus CM group endorsed the highest.

A test of internal consistency indicated that the external subscale had a low Cronbach’s alpha value of .41.

Statistical analysis revealed a non-significant trend (at the p < .30 level) between the groups, $F(2,34) = 1.66, p = .21, \eta^2_p = .09$. Exploratory effect size calculations showed a small to moderate effect size between the control and CDMI only group ($d = -.42$), with the CDMI group scoring lower on external motivation than the control. There was a moderate to large effect size for the comparison between the control and CDMI plus CM group ($d = .72$), with the CDMI plus CM group endorsing more external motivation. This magnitude of effect was largest for the CDMI only and CDMI plus CM group ($d = 1.01$).
Treatment Self-Regulation Questionnaire

Summary of treatment self-regulation questionnaire findings

Effect sizes estimates suggest that the CDMI plus CM group endorsed the highest level of amotivation, while the CDMI only group endorsed the lowest level. No group differences were found on the autonomous or controlled subscales.

Autonomous Subscale

Overall, the participants had relatively high ratings on the autonomous subscale ($M = 5.8$; possible range 1-7), indicating that they felt a large degree of autonomy. No significant differences were found between the groups, $F(2,33) = .08$, $p = .92$, $\eta^2_p = .01$ (Table 5). Cronbach’s alpha was .81 for this subscale, indicating an acceptable level of internal consistency.

Table 5

Treatment Self-Regulation Questionnaire subscale scores

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>CDMI only</th>
<th>CDMI plus CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Autonomous subscale</td>
<td>5.7 (1.3)</td>
<td>5.9 (1.2)</td>
<td>5.9 (1.1)</td>
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<tr>
<td>Controlled subscale</td>
<td>2.8 (1.4)</td>
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<td>3.4 (1.2)</td>
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<td>Amotivated subscale</td>
<td>2.5 (1.0)</td>
<td>2.2 (1.1)</td>
<td>3.3 (1.4)</td>
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</tbody>
</table>
Controlled Subscale

Across all participants, ratings on the controlled subscale were in the moderate range ($M = 3.1$; possible range = 1-7) at post-study, indicating that participants felt a moderate degree of control was being exerted over them. No significant difference between the groups was found on this subscale, $F(2,33) = 0.56, p = .57, \eta^2_p = .03$. There was found to be a large degree of internal consistency for this subscale (Cronbach's alpha of .82).

Amotivated Subscale

At post-study, the average amotivated subscale score across all participants was found to be in the low to moderate range ($M = 2.7$; possible range = 1-7), indicating that the average participant felt a moderate degree of amotivation (i.e., a lack of motivation). Cronbach's alpha was found to be quite low for this subscale (.20). A univariate ANOVA found a non-significant trend towards a difference between the groups on this subscale, $F(2,33) = 2.74, p = .08, \eta^2_p = .14$. Because this trend was well under the $p \leq .30$ cut-off, post-hoc analyses were done. These analyses (Fisher's LSD post-hoc) revealed a significant difference on this variable between the CDMI only and CDMI plus CM group, with the CDMI plus CM group endorsing more amotivation than the CDMI only group ($\text{Mean Difference} = 1.12, p = .03$). Control group amotivation ratings fell between the other two groups but were not significantly different from either.

Effect size estimates showed large effects when the CDMI plus CM group scores were compared to the control ($d = -.84$) and CDMI only groups ($d = -1.00$), with the CDMI plus CM group having the highest amotivation score. A moderate effect was found
when the control and CDMI only groups were compared ($d = .58$), with the control group having the higher amotivation score.

*Attributes of Treatment Questionnaire*

As shown in Table 6, the overall rating of satisfaction with the various interventions across all three study groups was relatively high ($M = 3.94$, $SD = .39$; possible range 1-5). A test of internal consistency revealed a Cronbach's alpha value of .65. An analysis between the groups revealed no significant difference, $F(2,34) = .36$, $p = .70$, $\eta^2_p = .02$.

Table 6

*Attributes of Treatment Questionnaire scores at post-study*

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<th></th>
<th>Control</th>
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<th>CDMI plus CM</th>
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<td>Mean (SD)</td>
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<th>Attributes of Treatment Total Score</th>
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<td>Mean (SD)</td>
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Chapter IV

DISCUSSION

Overview of main findings

This exploratory/developmental study was intended to allow examination of patterns of effects, in order to inform subsequent and more fully powered trials. In such research, the hope is that effects of at least moderate magnitude will be obtained, with statistical significance being a less crucial—but still desirable—secondary goal. Many interesting effects of moderate magnitude and greater were observed, some of which reached statistical significance. This study was therefore highly successful in reaching the above goal.

Overall results suggest that both CDMI only and CDMI plus CM may lead to positive effects with respect to smoking and smoking-related variables. However, there were clear differences in the kinds of outcomes for which each intervention appeared best. Participants in the CDMI plus CM group showed the greatest reductions in breath CO over the course of the study period. These reductions reached statistical significance for some analyses. In contrast, the CDMI only intervention was associated with better outcomes in terms of several motivation-related variables. Therefore, it appears that the combination of an intervention aimed at increasing internal motivation (CDMI) with an intervention that involves a high degree of external motivation (CM) interferes with the internalization of motivation yet exerts a powerful influence on behaviour change, at least in the short term.
Changes in smoking behaviour

With respect to the changes in smoking behaviour, results are mixed. As mentioned above, the breath CO readings for the CDMI plus CM participants were the lowest of the three groups across the study period. That is, the combination of CDMI and CM was most efficacious in producing reductions in smoking behaviour, as measured by breath CO. CDMI alone was more efficacious than control. The analysis of this data closely approached statistical significance and reached the level of significance in one instance. These differential effects were only present while the interventions were in place, as no differences were found at five-week follow-up.

These breath CO findings are inconsistent with the number of cigarettes participants reported smoking, although these two measures were found to be significantly correlated at half of the time points. All three study groups reported equivalent reductions in number of cigarettes smoked during the study period. The fact that even control participants greatly reduced their level of smoking is consistent with other studies of substance abuse interventions, in which participation in baseline assessment is often associated with substantial reductions in use (e.g., Epstein, Drapkin, Yusko, Cook, McCrady, & Jensen, 2005).

The findings at follow-up with respect to number of cigarettes smoked suggest some differential intervention effects. While all three groups maintained their reductions relative to baseline, there was some evidence to suggest that the CDMI only group continued to reduce their levels of smoking relative to the study period. In contrast, the CDMI plus CM group had increased their levels of self-reported cigarette use relative to the study period. This finding is consistent with study hypotheses and previous studies of
CM, which typically find increases in target behaviour when the contingencies are removed (e.g., Hey & Perera, 2006b; Prendergast et al., 2006).

The above findings for breath CO and number of cigarettes smoked are also inconsistent with levels of saliva cotinine. Saliva cotinine was found to be moderately associated with breath CO levels, but poorly related to number of cigarettes smoked. This measure found no difference in cotinine levels across time or between the three study groups. As these cotinine tests have been found to have an excellent level of specificity and sensitivity (Cooke et al., 2008), it must remain a possibility that there were no smoking-related reductions produced by either of the two interventions, relative to control.

The difference in findings between the two biological measures (breath CO and saliva cotinine) merits attention. The primary difference between these measures is that breath CO is under more participant control than saliva cotinine. That is, level of saliva cotinine remains more constant in the body than breath CO, which will begin to decrease soon after a cigarette has been smoked. It is therefore possible that participants learned to alter their smoking habits so that their breath CO was reduced at the time of testing (i.e., refraining from smoking prior to providing a breath CO sample). This explanation is consistent with the finding that although breath CO was lowest for the CDMI plus CM group, the number of cigarettes smoked across the study period was reduced to a similar degree by each of the groups. Saliva cotinine readings (which would be less affected by minor alterations in one’s pattern of smoking) did not show differential changes over the study period. It is therefore possible that CDMI plus CM participants learned to modify
their smoking in an attempt to obtain contingency payments by providing samples below the set cut-offs.

This hypothesis is consistent with anecdotal reports from a CDMI plus CM participant who frequently earned CM payments by providing a breath sample in the non-smoker range. This individual reported to the investigator on several occasions that her reduced breath CO samples were due to the fact that she had reduced her overall smoking levels but had also changed her smoking pattern, such that she did not smoke for the 12 hours prior to testing.

If this explanation is true, it suggests that the reductions in breath CO shown by the CDMI plus CM participants may not reflect true reductions in smoking. The effects seen in the control and CDMI only group should not be affected by this hypothesis, as their level of breath CO had no impact on payments that they received for simply providing a sample. Some CM studies require participants to provide breath CO samples more than once a day, and a more frequent sampling schedule may help address this issue in future research.

The possibility must also be acknowledged that relationship with the researcher, even in the context of a formalized research protocol, may have contributed to the changes observed in the CDMI and CM group. That is, an interpersonal aspect of reinforcement (e.g., acknowledgement by another of smoking-related changes) outside of the CM payments may have accounted for some degree of change in this condition.

While being mindful of the above possible explanations for the results, these findings suggest that CDMI plus CM was most effective in reducing smoking during the
study period (as measured by breath CO), while CDMI only was most effective at reducing smoking at five-week follow-up (as measured by number of cigarettes smoked).

Changes in motivation

Across the study period, participants who received only the CDMI were found to be highest on visual analogue scale measures of motivation to quit smoking. There were no differential effects between the groups on motivation to change at follow-up. This was partly consistent with hypotheses, which predicted a better motivation outcome for CDMI participants at post-study and follow-up. CDMI only participants were also found to endorse the most negative effects related to their smoking. Developing an awareness of positive and negative aspects of behaviour change is a key component of MI and may also be taken as a possible indicator of growing motivation to change smoking behaviour.

There is further indication that the combination of CDMI plus CM impacted motivation relative to CDMI alone. Specifically, the CDMI plus CM group endorsed the highest levels of external motivation and amotivation (i.e., lack of motivation) relative to the other two groups.

Therefore, while CDMI only participants endorsed the most motivation to change, participants who also received the CM appeared to be externally motivated. Although the effects of CDMI and CM cannot be teased apart, it can be hypothesized that the CM overshadowed the CDMI for these participants and interfered with the internalization of motivation to change. However, it is also worth noting that motivation to change is a highly reactive variable that is responsive to changes in the target behaviour (in this case, smoking). For example, someone who has successfully quit may endorse less motivation
or need to change, because he or she has already done so. It is therefore possible that the CDMI plus CM condition appears less motivated to quit smoking simply because they had actually reduced their levels of smoking to the largest degree. This suggestion is supported by the increase in motivation seen in this group from post-treatment to follow-up, during which time their level of smoking appears to have increased.

It is also important to note that while there was a difference between the groups on level of external motivation, there was no difference on level of internal motivation (as measured by the Motivation for Change Questionnaire). This is inconsistent with hypotheses based on the SDT and is in contrast to the visual analogue scale (VAS) ratings of motivation, on which the CDMI only participants rated themselves as most motivated. This VAS was less specific about the source of motivation (i.e., “How motivated are you to quit smoking”). While it can be assumed that this is capturing internal motivation, these results should be interpreted with some caution.

Implications of findings and potential limitations

These findings suggest that low-intensity CM may have positive effects on cigarette smoking (as measured by breath CO) while the contingencies are in place. This has important implications for more widespread use of such an intervention, as the cost of such programs is often a barrier to implementation. In this study participants in the CM group were offered the opportunity to earn $81 to stop smoking (the average actually earned by participants was $16). Even at this low level of potential payment, a significant reduction in breath CO was found over the study period.
While the combination of CDMI and CM produced reduced breath CO over the study period, CDMI alone was the most effective intervention at reducing number of cigarettes smoked at five-week follow-up. This condition also produced the highest level of motivation for change. The combination of CDMI and CM produced reductions in breath CO but was more costly to run and did not show reductions in number of cigarettes smoked at follow-up relative to the control condition. Due to the more lasting effects and low cost to implement, the CDMI on its own offers clear advantages to the combined approach of both CDMI and CM.

These findings also suggest that if harm reduction is a desired outcome of treatment, simple monitoring of cigarette use may be enough to affect some degree of change. Although control participants did not show the same degree of breath CO reductions and motivation to change evidenced by the intervention groups, it appears that frequent monitoring of cigarette use or other study-related factors in the absence of direct intervention led to decreases in self-reported number of cigarettes smoked. These decreases in cigarette use were comparable to those reported by the intervention groups and represent a decrease of approximately three cigarettes per day relative to pre-study. In fact, these overall reductions across all participants were larger than the between-group differences. Furthermore, these reductions were maintained in the control group even at five-week follow-up.

Previous studies would suggest that it is not only the frequency of assessment that leads to changes in the control condition, but any assessment at all. It has been found that even brief baseline assessment is often enough to lead to changes in behaviour. Among the hypothesized reasons for these pre-treatment changes are the provision of
information, natural change as the result of self-observation, and elicitation of personal concerns and reasons for change (Epstein et al., 2005).

In a study of women seeking treatment for alcohol abuse or dependence, Epstein et al. (2005) found that significant reductions in drinking occurred during each stage of the pretreatment assessment. As a result, 44% of participants reported becoming abstinent prior to entering treatment. Kypri, Langley, Saunders, and Cashell-Smith (2007) have also demonstrated an assessment effect with lasting impact. Relative to an information-only group, individuals given information and a ten minute assessment of their alcohol use reported significantly lower consumption and alcohol-related problems at 12-month follow-up.

The impact of this pre-treatment change is that it decreases the chances of finding differential treatment outcomes and must be acknowledged as a potential limitation in the present study. It is possible that limiting the length and frequency of assessment in the control condition may have led to larger effects.

**How does this build on previous research?**

The findings from this study are somewhat consistent with previous studies. Specifically, Budney et al. (2000) found that a group that received motivational intervention, behavioural skills coping, and CM had greatest reductions in marijuana use across the study period. This is consistent with our findings that the combination of motivational intervention and CM produced the greatest reductions in smoking (as measured by breath CO) while the interventions were in place. Kadden et al. (2007) also found that the two groups that received CM had the best outcomes during the study
period. However, the combination of motivational enhancement, cognitive behaviour therapy, and CM produced the greatest degree of marijuana abstinence at follow-up. This suggests that either the cognitive behavioural therapy or motivational enhancement may have had a delayed effect that was not realized until the follow-up period. The results of this study, coupled with SDT, would suggest that the motivational enhancement component may have produced these reductions in marijuana use at follow-up. This is in contrast with a study that targeted cocaine use in methadone maintained individuals (Epstein, Hawkins, Covi, Umbricht, & Preston, 2003). While CM alone produced initial reductions in cocaine use while the contingencies were in place, at 12-month follow-up it was the combination of CM and cognitive behaviour therapy that produced the greatest reductions. Epstein et al. (2003) hypothesized that the late gains in the CM and cognitive behaviour therapy group were the result of a gradual process of learning that took place with the cognitive behavioural component. The exact mechanisms of this delayed effect remain unknown, but it is evident that motivational intervention may result in a similar “sleeper” effect.

With respect to our finding that the combination of motivational intervention and CM may have interfered with the internalization of motivation to change, motivation was not assessed by Kadden et al. (2007). Budney et al. (2000) found that self-reported motivation decreased for all three groups across the study period, and was in fact lowest for the group receiving motivational enhancement.
How do the results fit with the self-determination theory?

The results of this research appear to support the SDT and suggest that the two interventions (CDMI and CM) fall on opposite poles of the continuum of autonomy. That is, the combination of CDMI and CM (which led to high levels of external motivation) effectively reduced breath CO while the intervention was in place but increases in number of cigarettes smoked were evident at follow-up. This is consistent with behaviour towards the amotivated end of the continuum. This was confirmed by the higher ratings of amotivation evidenced in the CDMI plus CM group.

In contrast, the CDMI alone produced more lasting changes. This is more consistent with behaviour at the intrinsic regulation end of the spectrum. Furthermore, the results obtained from the combined intervention group (CDMI plus CM) are consistent with the results of Deci (1971) who found that external rewards interfere with the internalization of motivation. This is evident in the way in which CDMI plus CM participants differentiated themselves from CDMI only participants by showing continued reductions in cigarette use only when the intervention was in place.

Research related to the SDT has found that amotivation is associated with poor treatment outcomes (Senécal, Nouwen, & White, 2000). This is somewhat consistent with the results of this study, in which the CDMI plus CM group endorsed significantly higher levels of amotivation than either CDMI or control. It is possible that participants in this condition acknowledged the shorter term benefits of this treatment (i.e., contingent reinforcement), but did not view it as a method of supporting longer term goals (e.g., quitting smoking).
The results are also consistent with SDT, in that this theory would suggest that behaviour change might occur at different times for the CDMI plus CM and CDMI only groups. That is, according to SDT, CDMI plus CM participants should evidence more immediate changes in behaviour, while behaviour change may occur over a more extended period of time in the CDMI only group, as motivation for change builds. This appears to be the pattern in the present study, in that changes for the CDMI group were slower to appear, but also extended past the intervention period. It may be that longer follow-ups would capture continued decreases in smoking behaviour for this CDMI only group.

What does this tell us about computerized approaches to motivational intervention?

One goal of this research was to assess the efficacy of a brief computerized motivational intervention in affecting smoking-related behaviour change. Affecting change in smoking behaviour is traditionally quite difficult regardless of the intervention used (Lancaster & Stead, 2006a). With respect to traditional motivational interventions, meta-analyses suggest that the effect size for such interventions relative to no treatment/placebo ranges from .11 (Burke et al., 2003; Burke et al., 2004) to .14 (Hettema et al., 2005). Over this five-week study, the key measures found intervention effects for control relative to CDMI of .23 for saliva cotinine, .44 for number of cigarettes smoked, .52 for breath CO, and .90 for motivation to quit. In all cases, CDMI demonstrated more favorable outcomes than control. These results suggest that this computerized intervention (in which changes in smoking behaviour, rather than complete abstinence was assessed) was more efficacious at producing behaviour change over the course of the
study than previous research examining traditional MI for smoking cessation. These effects are on par with the general effects associated with motivation interviewing relative to control across all areas of behaviour change (i.e., .36 to .56; Burke et al., 2004).

While the CDMI was efficacious at producing changes in smoking behaviour and motivation, acceptability must also be considered. Although the ratings of response to treatment received were not significantly higher than the other two groups, participants who received the CDMI rated the intervention in positive ways such as helpful, understanding, supportive, enjoyable, respectful, and as something that made them want to change. They also endorsed the intervention as something they would recommend to others. These positive ratings are consistent with previous studies of similar computerized interventions (Ondersma et al., 2005; Ondersma et al., 2007) that found participants gave high ratings of approval to the intervention.

These results suggest that computerized interventions are well accepted by consumers and may produce smoking-related behaviour change that is more stable in the longer-term, than more expensive and time-consuming traditionally delivered motivational interventions.

**Directions for future research**

The results of this small sample, exploratory study suggest many different areas for future exploration. Based on the promising and intriguing results of this research, it is clear that larger scale studies of this kind are needed. Specific suggestions are discussed below. First, initial studies further exploring the combined efficacy of CM and CDMI
may wish to use larger contingency payments in order to more clearly differentiate treatment effects. While the relatively small payments used in this study (maximum payment of $81) were effective at producing changes in smoking behaviour, research has shown that lower magnitude incentives produce smaller degrees of change than higher magnitude incentives (but more than no incentives at all); (Silverman, Chutuape, Bigelow, & Stitzer, 1999). In order to maximize any differential treatment effects and increase the odds of statistical significance, larger contingency payments may be well-advised. Longer-term research, however, may wish to focus on smaller contingencies, as any level of monetary payment is a significant barrier to implementation in most community or hospital settings. Recent research has pursued such contingencies as the opportunity to win prizes (e.g., Alessi, Hanson, Wieners, & Petry, 2007; Olmstead, Sindelar, & Petry, 2007). This option has shown itself to be both cost-effective and efficacious at producing behaviour change.

An even more intriguing option regarding contingency payments is to examine if there are contingencies that are efficacious at reducing smoking behaviour but will not interfere with the internalization of motivation. Non-monetary rewards such as paid job training (Silverman, Svikis, Robles, Stitzer, & Bigelow, 2001) and access to subsidized housing (Schumacher et al., 1999) have previously been used as effective contingencies in reducing substance abuse. There may also be methods of framing external incentives (e.g., as a participant-chosen means of supporting their own change goals). These possibilities suggest that not all CM may be associated with amotivation, as was found in the present study. By giving individuals a choice of contingencies and input on whether this is the best method to help them reach their goals, it may be possible to foster
autonomy with this approach. The impact of varying types of rewards on motivation should also be more fully explored, as it may be that different types of contingencies are complementary to motivational interventions.

Future researchers may also wish to manipulate the timing of the CDMI and CM in relation to each other. For example, it may be beneficial to expose participants in the combined condition to each intervention but not allow the interventions to overlap. In particular, it may be worth examining whether a CM period followed by a CDMI intervention upon termination may be more effective than applying both interventions at once. These results suggest that the CM will produce reductions in smoking behaviour that may lead to an experience of competence. This sense of competence is felt to be a key condition to enhance autonomous motivation (Deci & Ryan, 1985). Therefore, it may be possible that the later introduction of the CDMI may present an opportunity to build on smoking reductions produced by the CM. This may lead to a greater ability to internalize motivation, and therefore more lasting treatment outcomes. Similarly, it may also be desirable to wean participants off of CM by reducing the incentives over time. This may also allow for participants to build on their smoking reductions from the CM and internalize their motivation to change as the CM incentives are decreased. An additional point to consider is the apparent plateau in motivation level that the CDMI only group evidenced beginning at Week 2. Future research should explore whether a smaller interval of time between CDMI sessions (approximately four weeks in the current study) would be more optimal in fostering continued motivation.

Additional methodological changes worth pursuing include the inclusion of a CM only group. While not feasible in the present study because of budget constraints and a
small sample size, a four group design (i.e., control, CDMI only, CM only, CDMI plus CM) might help to more clearly understand the combined intervention group. It was impossible to tease apart the differential effects of the two interventions in the CDMI and CM group, and a CM only condition might serve as a useful comparison to help further determine any potential benefits of the combined intervention.

Another methodological consideration involves incorporating more follow-up time points. There is some indication from these findings that the effects of the CDMI may be appear more slowly, as there were apparently continued positive effects on number of cigarettes smoked between post-study and five-week follow-up for the CDMI only group. It would be helpful to obtain more information about this. Additionally, at five-week follow-up all three study groups self-reported smoking significantly fewer cigarettes than at baseline. More longer-term follow-up would help determine if and when smoking returns to baseline levels.

The results of this small sample exploratory study are useful in providing preliminary ways of thinking about the effects of an intervention combining both internal and external motives for smoking-related behaviour change. It is likely that these mechanisms of change interact in highly complex ways, and further research is needed to build on and expand these findings.
REFERENCES


APPENDIX A

University of Windsor Research Ethics Board Approval
Today's Date: February 12, 2007
Principal Investigator: Ms. Heather Durdle
Department/School: Psychology
REB Number: 07-008
Research Project Title: Computerized motivational intervention and contingency management for tobacco smoking in methadone-maintained opiate-dependent individuals
Clearance Date: February 12, 2007
Project End Date: December 31, 2007

This is to inform you that the University of Windsor Research Ethics Board (REB), which is organized and operated according to the Tri-Council Policy Statement and the University of Windsor Guidelines for Research Involving Human Subjects, has granted approval to your research project on the date noted above. This approval is valid only until the Project End Date.

A Progress Report or Final Report is due by the date noted above. The REB may ask for monitoring information at some time during the project's approval period.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the REB. Minor change(s) in ongoing studies will be considered when submitted on the Request to Revise form.

Investigators must also report promptly to the REB:
a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

Forms for submissions, notifications, or changes are available on the REB website: www.uwindsor.ca/reb. If your data is going to be used for another project, it is necessary to submit another application to the REB.

We wish you every success in your research.

Maureen Muldoon, Ph.D.
Chair, Research Ethics Board

cc: Dr. G. Ron Frisch, Psychology
    Linda Bunn, Research Ethics Coordinator

This is an official document. Please retain the original in your files.
APPENDIX B

Wayne State University Human Investigation Committee Approval
NOTICE OF FULL BOARD APPROVAL

To: Heather Durdle
Psychiatry
2761 E. Jefferson

From: Ellen Barton, Ph.D.
Chairperson, Behavioral Institutional Review Board (B3)

Date: February 09, 2007

RE: HIC #: 124406B3F
Protocol Title: Computerized Motivational Intervention and Contingency Management for Tobacco Smoking in Methadone-Maintained Opiate-Dependent Individuals
Sponsor: CANADIAN TOBACCO CONTROL RESEARCH INITIATIVE
Coeus #: 0612004381

Expiration Date: December 11, 2007

The above-referenced protocol and items listed below (if applicable) were APPROVED following Full Board Review by the Wayne State University Institutional Review Board (B3) for the period of 02/09/2007 through 12/11/2007. This approval does not replace any departmental or other approvals that may be required.

- Consent Form
- HIPAA Summary Form and HIPAA Authorization Form
- Note to PI: Please submit Windsor IRB approval when received; file as amendment.

- Federal regulations require that all research be reviewed at least annually. You may receive a "Continuation Renewal Reminder" approximately two months prior to the expiration date; however, it is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date. Data collected during a period of lapsed approval is unapproved research and can never be reported or published as research data.
- All changes or amendments to the above-referenced protocol require review and approval by the HIC BEFORE implementation.
- Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the HIC Policy (http://www.hic.wayne.edu/hicpol.html).

NOTE:
1. Upon notification of an impending regulatory site visit, hold notification, and/or external audit the HIC office must be contacted immediately.
2. Forms should be downloaded from the HIC website at each use.
APPENDIX C

Screening Questionnaire

You are being asked to answer some brief smoking-related questions. These questions should take less than five minutes of your time. If you choose to complete this brief questionnaire, you will earn a $1 McDonald's gift certificate.

By answering these questions, you may also qualify for a study that will look at smoking-related behaviour in methadone-maintained individuals.

If you qualify for this later study, you may earn up to $70 in gift cards over the period of several weeks.

If you choose to complete these questions, your questionnaire will only be identified by a unique study number. Your name will not appear anywhere.

You are free to choose whether or not you want to complete this brief questionnaire. You may also complete the questions and later decide that you do not want to participate in the study.

If you do qualify for the study, a researcher will contact you in the next few weeks.

Please take your time to read the questions carefully and answer them as truthfully as you can. If you have any questions, please ask the researcher for assistance.
1. Gender: Male _________ Female _________

2. Age: _________

3. Ethnicity: African American _______ Caucasian _______ Other _________

4. Please circle ALL the days that you currently dose at the clinic:

   MON   TUES   WED   THURS   FRI   SAT

5. Are you currently taking the medications BUPROPION, WELLBUTRIN or ZYBAN?

   Yes _______ No _______

6. How many cigarettes per day do you smoke on average? __________
APPENDIX D

Study Costs

This study was supported by a $10,000 grant from the Canadian Tobacco Control Research Initiative.

Participant Payments:

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<th>Service</th>
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<td>Intervention #1</td>
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<tr>
<td>Breath CO payments (regular)</td>
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<tr>
<td>Breath CO payments (contingencies)</td>
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<td>Post-study questionnaires</td>
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<tr>
<td>Follow-up assessment</td>
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TOTAL: $3505.00

Equipment:

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<td>Saliva cotinine tests</td>
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<td>Smokerlyzer mouthpieces</td>
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TOTAL: $4018.08

Miscellaneous:

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<tbody>
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<td>Supplies, etc.</td>
<td>$131.69</td>
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</tbody>
</table>

TOTAL: $387.79

TOTAL GRANT EXPENSES: $7910.87
At the Jefferson Avenue Research Clinic, which is affiliated with Wayne State University. Please read this form and ask any questions you may have before agreeing to be in the study.

The study is being conducted by Heather Durdle, MA, of the Department of Psychology, University of Windsor and Steven Ondersma, PhD, of Wayne State University. The funding for this study is being provided by the Canadian Tobacco Control Research Initiative.

Study Purpose:

The purpose of the study is to understand how your smoking behavior changes over time. The estimated number of study participants to be enrolled at Wayne State University is about 60.

Study Procedures:

Participants in this study will be divided into three different groups. The general procedure for each of these groups is the same. If you take part in the study, you will be asked to do the following:

You will be asked to complete some initial questionnaires. These will include questions about yourself and questions related to your use of cigarettes. Throughout the study, you are free to choose not to answer any of the questions that are asked of you. These initial questionnaires should take about 20 minutes of your time and will be completed on an easy-to-use talking computer. You do not need to know how to use a computer to do any of the computer tasks in this study.

For the next five weeks, the researcher will meet with you when you come into the clinic on Monday, Wednesday, and Friday. You will be asked to answer a few short questions about your use of cigarettes each time. You will also be asked to provide a sample of your breath carbon monoxide on each of these days. This is
done by blowing into a cardboard mouthpiece attached to a small carbon monoxide detector. On one of these days each week (which will be chosen randomly), you will also be asked to provide a saliva sample. This is done by placing a small amount of oral fluid into a collection container. This breath sample and saliva sample will tell us if you have been smoking recently. Answering these questions and providing these samples should take about five minutes of your time on each visit.

One week from now, we will ask you to complete a computer task. This will involve answering some questions and doing some activities that the computer asks of you. This should take about 20 minutes of your time. Approximately three weeks later, we will ask you to complete the computer task again. This should also take you about 20 minutes.

On your last visit at the end of these five weeks, you will be asked to complete the same questionnaires that you did at the beginning of the study. This should take about 15 minutes of your time.

Once the study has finished, the researcher will return to the clinic five weeks later. If you are still attending the clinic, the researcher will ask you to answer some questions about your use of cigarettes and provide a breath carbon monoxide sample. These visits should take 20 minutes of your time.

At the beginning and end of the study period and at the follow-ups, the researcher will access your online medical records on the clinic database. The researcher will record the results of your urine drug screens that you provide as part of regular clinic procedures. **The results of these urine drug screens will in no way affect your participation in this study.**

**Benefits:**

There may be no direct benefits for you; however, information for this study may benefit other people now or in the future. The possible benefits to you for taking part in this study are that you may decrease the number of cigarettes that you smoke. Additionally, information from this study may help other people now or in the future by helping researchers design ways to help people who want to stop smoking.

**Risks:**

There may be some minimal risks associated with your participation in this study, including potential stress. The study investigator will also know about your recent use of nicotine or illicit substances, which may cause you some embarrassment or loss of privacy.
Alternatives:

There are no alternative treatments to not participating in this study. If you choose not to participate in this research but would like to receive support for quitting smoking, the investigator can provide you with a list of resources. All people who enrol in this study will also receive this list of resources.

Research Related Injuries:

In the unlikely event that this research related activity results in an injury, no reimbursement, compensation or free medical care is offered by Wayne State University.

If you think that you have suffered a research related injury, let the investigator know right away.

Study Costs:

There will be no costs to you for participation in this research study.

Compensation:

The amount and type of compensation that you receive will depend on what group you are randomly assigned to. The investigator will let you know on the first day of the study what group you are in.

Throughout the study, each time you earn less than $5, you will receive McDonald’s gift certificates. If the amount you earn is $5 or more, you will receive Target gift cards.

Everyone participating in the study will be compensated in the following ways.

• For completing the initial questionnaires, you will receive $5 in gift cards.

• When you complete the two computer tasks, you will receive $10 in gift cards each time.

• Once the study period is over, you will receive $5 in gift cards for completing the same questionnaires that you did at the beginning of the study.

• For each follow-up that you participate in, you will receive $15 in gift cards.

For providing breath and saliva samples, Group 1 and Group 2 will be compensated in the following way:
• Over the course of the five-week study, each time that you give us a sample of breath carbon monoxide and/or saliva and complete the brief smoking-related questionnaires, you will receive $2 in gift cards.

For providing breath and saliva samples, **Group 3** will be compensated in the following way:

• For the first week of the study, each time that you give us a sample of breath carbon monoxide and/or saliva and complete the brief smoking-related questionnaires, you will receive $2 in gift cards.

For the last four weeks of the study, each time that give us a sample of breath carbon monoxide and/or saliva and complete the brief smoking-related questionnaires, you will receive $1 in gift cards. You may also earn additional gift cards if the samples you provide indicate that you have not been smoking recently. **Both your breath and saliva samples must show that you have not been smoking in order to earn this payment.**

During these four weeks, the first negative sample that you give us will earn you $4.00. For each time in a row that you give us negative samples, you will earn an extra 50 cents on top of your last payment. If you give us a sample that shows you have recently been smoking, you will not earn anything additional that day and the most you can earn the next day is reset to $4.00.

If each part of the study is completed, **Group 1** and **Group 2** will receive a **MAXIMUM** of $75 in gift cards. If each part of the study is completed and a negative breath and saliva sample is provided on each day of the study, **Group 3** will earn a **MAXIMUM** of $141 in gift cards.

**Confidentiality:**

All information collected about you during the course of this study will be kept confidential to the extent permitted by law. You will be identified in the research records by a code name or number. A master list with your identifying information will be kept in a secured location. Information that identifies you personally will not be released without your written permission. However, the study sponsor, the Human Investigation Committee (HIC) at Wayne State University, the Research Ethics Board (REB) at the University of Windsor or federal agencies with appropriate regulatory oversight (e.g., Food and Drug Administration [FDA], Office for Human Research Protections [OHRP], Office of Civil Rights [OCR], etc.) may review your records.

**Any information that you provide (including the results of your breath or saliva samples) will NOT be shared with your counsellor or any other clinic**
staff. You may, however, choose to tell your counsellor about your involvement in this study.

A secured master list will match your participant identification number to your clinic ID. This is so the investigator can access information on your urine drug screens and other demographic information included in the clinic’s computer system. Because your clinic ID contains your initials and the last four digits of your social security, you will be asked to complete a separate form to authorize the researcher to use this information to access the clinic database. Your name or clinic ID will not be associated with any of the information that you provide.

Personal Health Information (PHI) used and disclosed for the purposes of this study is protected under the federal regulation know as HIPAA (Health Insurance Portability and Accountability Act). Your study investigator will discuss with you your rights under this federal regulation and obtain your authorization to allow the research team to access your PHI.

Voluntary Participation /Withdrawal:

Taking part in this study is voluntary. You may choose not to take part in this study, or if you decide to take part, you can change your mind later and withdraw from the study. You are free to not answer any questions or withdraw at any time. Your decision will not change any present or future relationships with Wayne State University or its affiliates or other services you are entitled to receive.

Your participation in this study is in NO way associated with your methadone treatment. Although you will be asked to provide breath carbon monoxide and saliva samples throughout the course of the study, the results of these samples will not affect your treatment in any way. If you choose to withdraw from this study, this will not affect your enrolment in the clinic.

Subsequent Use of Data:

It is possible that the data from this research may be used in subsequent studies to answer a different research question. Your name or other identifying information will remain confidential. If you do not consent to the further use of your data, please initial here: __________

Questions:

If you have any questions now or in the future, or if you think that you need to report a research related injury, you may contact Dr. Steven Ondersma at (XXX) XXX-XXX or Heather Durdle at (XXX) XXX-XXX. If you have questions or concerns about your rights as a research participant, the Chair of the Human Investigation Committee can be contacted at (XXX) XXX-XXXX.
Consent to Participate in a Research Study:

To voluntarily agree to take part in this study, you must sign on the line below. If you choose to take part in this study, you may withdraw at any time. You are not giving up any of your legal rights by signing this form. Your signature below indicates that you have read or had read to you this entire consent form, including the risks and benefits, and have had all of your questions answered. You will be given a copy of this consent form.

_________________________________________  ______________________
Signature of Participant/Legally Authorized Representative  Date

_________________________________________  _________________
Printed Name of Participant/ Authorized Representative  Time

**Signature of Witness (When applicable)  ______________________
_________________________________________
Printed Name of Witness  Time

_________________________________________  ______________________
Signature of Person Obtaining Consent  Date

_________________________________________  _________________
Printed Name of Person Obtaining Consent  Time
APPENDIX F

Quit Smoking Resources:

The following are free smoking cessation resources that are available to you, should you choose to use them:

**Telephone Numbers:**

National Network of Tobacco Cessation Quitlines:

1-800-QUIT-NOW
1-800-784-8669

American Cancer Society Quitline:

1-800-ACS-2345

American Lung Association:

1-800-LUNG-USA

**Websites:**

American Cancer Society:

www.cancer.org
Click on “Guide to quitting smoking”

American Lung Association:

www.lungusa.org
Click on “Tobacco control”

American Heart Association:

www.amERICANheart.org
Search for “Smoking”
### APPENDIX G
Timeline of Study – Payment Schedule

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APPENDIX H

Details of Brief Computer-Delivered Motivational Intervention

*Introduction*

Hello, my name is Peedy. We will be working together today.

If it's okay with you, I'd like to spend some time getting to know you better.

Specifically, I'd like to learn a little bit more about your smoking and how you feel right now about quitting.

You may know that smoking is bad for your health and that it can cause lung disease, stroke, cancer, and other health problems. Still, many people don't feel that they are ready to quit. We'll spend some time together today to try and understand how you feel about your smoking. I'm giving you no pressure to quit. I just met you. You know best what decision is the right one for you. Sometimes, though, people feel that they are really ready to quit smoking. If you are one of those people, one of the best things that you can do is to set a quit date. This is a day, usually within the next two weeks, that you choose to be the day that you stop smoking. Only you can choose what the best quit date for you may be.

I'd like to check and see if you feel ready to set a quit date. Don't worry if you're not ready. Lots of people aren't. Remember, I don't want to pressure you in any way. I will respect anything that you decide.

Do you feel ready right now to set a quit date?

- □ Yes (on to "Setting a Quit Date")
- □ No (on to "Pros and Cons")
- □ I'm a little unsure (on to "Pros and Cons")

*Setting a Quit Date*

Sounds like you feel that the best thing for you is to set a quit date. There is a calendar next to the computer. Take a minute and choose which quit date you would like. Sometimes the best quit date is one that has a special meaning to you.

What do you choose as your quit date to stop smoking?

(Example)

- □ Monday, July 30th
- □ Tuesday, July 31st
- □ Wednesday, August 1st
(If a quit date is selected, Peedy reflects back the date that was chosen and the participant moves on to “Plan for Change”. If “none of these dates” is selected, then the participant is taken to “Pros and Cons”)

Pros and Cons

It sounds like you plan to keep smoking. At least for a while. I’m sure that you have your reasons for this. I definitely don’t judge you for it and I won’t try to force you to change. I’m just a fat green parrot anyway.

But if it’s OK, I’d like to talk with you just a little bit about what you’re thinking right now. No pressure. I just want to help you think about what, if anything, you might want to change about your smoking.

There can be lots of good and bad things about smoking. Let’s think a bit about what those things are for you.

Here are some positive things about smoking. I know there are lots of options. Take your time. I am only a bird. I don’t have many important places that I need to be.

What are some of the things you like about your smoking?

(Participant chooses all that apply from the list below)

- Smoking feels good
- Smoking helps me relax and deal with stress
- Smoking can be a good way to socialize and bond with other smokers
- Smoking makes things more enjoyable
- Smoking helps me lose weight or maintain my current weight
- I like watching the smoke and the cigarette burn
- Smoking keeps away withdrawals
- I like taking smoke breaks throughout the day
- Something else that is not on this list
Now here are some negative things about smoking. I know I asked you some of these before, but I have a short memory. After all, my brain is only the size of a raisin.

What are some of the things you don't like about your smoking?

- Smoking costs a lot of money
- Smoking affects my health and the functioning of my lungs
- Smoking increases my risk of cancer and other diseases
- I go through mini-withdrawals from nicotine throughout the day
- I am afraid of what smoking is doing to my health or the health of those I love
- Smoking makes my face and body look older
- Not everyone in my family likes that I smoke
- The smell of cigarettes gets in my clothes and hair
- Something else that is not on this list
- None of these options

Sounds like you feel two ways about your smoking. On the one hand, you've told me that the good things about your smoking are that *(Peedy reflects participant's selections)* and maybe other positive things. But on the other hand, you also feel that the things you don't like about your smoking are *(Peedy reflects participant's selections)* and maybe other negative things.

Everyone is different, but talking about the good and bad things about smoking can get people thinking.

Overall, how would you rate the effect of smoking on your life?

- It has no effect at all
- It affects a few things
- It affects a lot of things
- It affects everything in my life

*(Participant moves on to “Feedback”)*

**Feedback**

You told me before that you're not interested in changing, and I respect that.

If you ever do start to think about changing though, there are some important things you might want to know about your smoking.

Most people think this feedback is interesting. I will ask you later what you think of it. But whether you find it helpful or not, it's all just for you to consider. You can take or leave as much of it as you want.
I know I've asked you this before, you'll have to forgive me. There's that bird's memory again.

How many cigarettes did you say that you smoke each day?

- 0-1
- 2-4
- 5-7
- 8-10
- 11-13
- 14-16
- 17-20
- 21-25
- 26-30
- 31-35
- 36-40
- More than 40

Depending on how much you smoke, cigarettes can cost a lot of money.

How much do you think you spend on cigarettes per year?

- Less than $100
- $100-$250
- $250-$500
- $500-$750
- $750-$1000
- $1000-$1500
- $1500-$2000
- $2000 or more

By my estimate, based on the number of cigarettes you smoke each day and the cost of a pack of cigarettes, you actually spend (*calculated amount based on number of cigarettes smoked per day*) each year on cigarettes. Depending on what brand you smoke, it may cost you even more than this.

That would buy me a lot of bird feed.

What else could you do with the money you spend on cigarettes?

- I could go on a vacation
- I could use it to pay my bills
- I could buy things for my children or grandchildren
- I could buy myself some new clothes or other things that make me happy
- I could buy a new car or start to save for one
I could get a new TV or other electronics
I could save it for a rainy day
I could help out someone else financially
Some other reason not listed
None of these options

Here's some trivia for you.

What percent of adults do you think smoke cigarettes?

- Less than 5%
- 5% to 10%
- 10% to 20%
- 20% to 30%
- 30% to 40%
- 40% to 50%
- 50% to 60%
- 60% to 70%
- 70% to 80%
- 80% or more

Based on the latest information that I have available to me, I can tell you that 21% of adult Americans smoke cigarettes. This means that 79% (or 4 out of 5) adults are non-smokers. (Participant is shown a bar graph of number of smokers versus numbers of non-smokers).

As you can see from this chart, the number of smokers has been steadily declining over the past 50 years. (Participant is shown a graph demonstrating a decline in smoking rates over time).

When we first started today, I asked you about some negative effects of your smoking. Let's talk about how your score on this questionnaire compares to others (referring to the Negative Effects of Smoking Questionnaire completed prior to the intervention). Relative to someone who experiences no negative effects from smoking and someone who experiences all the negative effects we talked about and gets the maximum score, this is where your score is. (Peedy demonstrates on a line where the participant's score fell relative to the minimum and maximum score).

Now let's talk about your breath carbon monoxide (CO) reading. I will give you a little background on CO first. This is a poisonous gas that in large amounts can be fatal. Cigarettes produce CO and smokers often breathe in and out this dangerous gas.

What was your breath carbon monoxide reading today?

- 0-1
- 2-3
The average breath carbon monoxide reading for non-smoking adults is around 2. The amount of carbon monoxide in your breath is \((\text{number of multiples higher than a non-smoker, based on selected CO reading})\) that of a non-smoker.

That's a lot of information and numbers that I just threw at you. Let's stop for a minute. I'm curious to know how you're feeling.

What do you make of all that feedback?

- I don't really care what feedback I get, it's not going to change me
- I don't buy it. I know lots of people who smoke more than I do
- I'm not sure I believe it
- I don't smoke that much so it's no big deal
- It's hard for me to have to face this
- I'm shocked. I never knew these things about my smoking
- I'm disappointed in myself
- I'm feeling a way that's not on this list
- I'm not feeling anything

We've just talked a lot about your smoking. I know that you said earlier that you weren't ready to quit, but sometimes people start to feel a little bit differently.

This little parrot is giving you no pressure to change. You can make your own decisions about what's best for you. I did want to check in though and see if you might have changed your mind since the last time I asked you.

Are you thinking now that you'd like to set a quit date to stop smoking?

- No (on to "What would make you decide to quit?")
- Yes (on to "Setting a Quit Date")
- I'm going to keep thinking about it (on to "What would make you decide to quit?")

Plan for Change

Now that you have decided to stop smoking, let's spend a few minutes making a quit plan to ensure that you are as successful as possible.
Before we start, there are some important things to know about change. First, change usually isn't easy. But, second, change can really happen. Most people who commit to change usually succeed. Third, if you decided you want to change, there are lots of ways to do it. You just have to find the one that's right for you. For example, getting help with quitting might be best for some people, but others might prefer to do it on their own. Fourth, many people who do quit slip a few times at first. They always learn from it. As long as you never give up, you never fail.

I want to stop and check in with you. You've just told me that you want to quit smoking. This is a big decision, and it's normal to feel different ways about this.

How are you feeling now that you've decided to quit smoking?

- Scared
- Motivated
- Worried I can't do this
- Excited
- Confused
- Nervous
- Proud of myself
- I'm not really sure yet
- Something else not on this list
- None of these options

At this point, you might be wondering what you've gotten yourself into. You've told me that you want to quit, but let me check in with you and see if this is really what you want to do.

What is the change that you want to make?

- I want to stop smoking cigarettes completely
- I want to cut down on the number of cigarettes I smoke

Let's think about why you want to make this change. Everyone has different reasons, but let's find out what they are for you.

Why do you want to quit smoking?

- To improve my health
- To live longer
- To make my friends and family proud
- Because I deserve to be a non-smoker
- To save money
- So people stop nagging me
- I'm sick and tired of being a smoker
- To stop or reverse what smoking has done to me physically
An important part of making a change is carefully planning out the steps you want to take. Everyone has a different plan for quitting. I will ask you about more possible steps in just a minute.

What are the steps you will take in quitting?

- I will throw out my cigarettes and lighters
- I will distract myself when I have a craving for a cigarette
- I will begin exercising more and drinking lots of water
- I will keep track of each cigarette that I smoke
- I will stay away from people who smoke or places where there is smoking

None of these options

Here are some more steps to consider.

What are the steps you plan to take in changing?

- I will visit my doctor or talk with my counselor about my smoking
- I will write down all the reasons why I want to quit
- I will spend more of my time in places where smoking is not allowed
- I will break my smoking habits, like having a cigarette when I wake up
- I will use a nicotine patch or gum
- I will do whatever comes naturally
- Something else not on this list
- None of these options

Involving other people in your efforts to quit or cut back on smoking can be an important part of ensuring that you are successful.

What are some of the ways that other people can help you quit smoking?

- They can take my cigarettes from me
- They can quit with me
- They can encourage me to quit
- They can ask how I am doing with quitting
- They can support my efforts to quit
- They can stop smoking around me
- They can distract me when I have a craving
- They can tell me how proud they are of me
- Something else not on this list
- None of these options
You've taken the time to make a quit plan that is the best fit for you. An important part of making a plan like this is knowing when your plan is working.

How will you know if your plan to quit smoking is working?

- If I can go a full day or week without smoking
- If I have fewer cravings for cigarettes
- If I can cut the number of cigarettes I smoke in at least half
- If I begin to feel like a non-smoker
- If my breathing and lung functioning improves
- If other people notice the changes I am making
- If I can walk into a corner store and not buy cigarettes
- If I can refuse a cigarette that is offered to me
- Something else not on this list
- None of these options

When you are making a change, it is also important to plan for things that could interfere with your goal to quit smoking.

What are some things that could interfere with your goal to quit?

- Being around people who smoke
- If I am going through a very stressful time
- If I find myself feeling depressed or nervous
- If I talk myself out of quitting
- If people pressure me to smoke
- If I slip-up and have a cigarette
- If I decide it's no longer important to quit
- If I don't follow my change plan
- Something else not on the list
- None of the above

Okay. You've just told me a lot of information about your plan to quit smoking. Birds like me don't have very big brains, so let's see if I've got all this straight. Your quit date is (Peedy reflects back participant's selections). You're feeling (Peedy reflects back participant's selections) and maybe some other feelings. All of these are normal reactions to such a big change. The change goal that you have set for yourself is (Peedy reflects back participant's selections). You've told me that the reasons you want to change are (Peedy reflects back participant's selections) and maybe some other reasons too. The steps you plan to take in changing are (Peedy reflects back participant's selections) or maybe something else that you feel will be helpful to you.

You've also identified ways that people can help you make this change. You feel that others can help you by (Peedy reflects back participant's selections) and maybe by doing something else that you think would be useful to you. You've also shared with me ways that you will know when your plan is working. You will know if your plan to quit or cut
back on smoking is working if (Peedy reflects back participant's selections) or maybe something else. You also took the time to think about what might interfere with your plan to change. You feel that things that could interfere are (Peedy reflects back participant's selections) or maybe there is something else that could interfere with your goal.

Before we finish up, I want to check in again and see how you're feeling. You came up with quite a plan for change, and I want to see what you think of it.

How are you feeling after hearing your plan for change?

- Eager to put my plan into action
- Worried I can't do it
- Excited to try it
- Scared it will be hard
- Doubting I can do this
- It sounds overwhelming
- I think it was helpful to have done this
- Hopeful that this will work for me
- Something else not on this list
- None of these options

(Participant proceeds to “Goodbye”)

What would make you decide to quit?

I hear you telling me that you plan to keep on smoking. That's your decision to make, and I don't judge you for it. Thanks for being so honest with me.

Before we finish, I'd like to find out what you feel might make you think more about quitting in the future.

What would make you think more about quitting?

- If I finally get tired of what smoking is doing to me
- If my doctor tells me I have to
- If someone I know gets sick or dies from smoking
- If someone I care about asks me to quit
- If I think more about the negative aspects of smoking
- If I develop a health problem from smoking
- I might just wake up one morning and decide to quit
- Nothing could make me want to quit
- Something else not on the list
- None of these options

So you might consider quitting smoking (Peedy reflects back participant's selections) or maybe if something else happens in the future. Sounds like you know how important it
can be to keep an eye on your smoking and check in with yourself on whether you may want to quit.

Goodbye

Thank you for sharing your thoughts with me. That’s all for today.

Have a nice day!
APPENDIX I

Details of Control Intervention

Introduction

Hello, my name is Peedy. We will be working together today.

If it's okay with you, I'd like to spend some time today getting to know you better.

Specifically, I will be asking you a little bit about your likes and dislikes when it comes to music and television.

We'll also have the chance to watch some brief music videos and clips from television shows.

I will begin by asking you some questions to learn more about your tastes in music.

Here are some R & B artists. There definitely is a lot of talent amongst these musicians.

Which of these artists do you like to listen to?

- Aretha Franklin
- Ray Charles
- Stevie Wonder
- Little Richard
- The Supremes
- Someone else not on this list
- None of these options

Now here are some rock artists. Some of these bands can really put on a good show.

Which of these artists do you like to listen to?

- U2
- Nickelback
- Aerosmith
- Coldplay
- Red Hot Chili Peppers
- Someone else not on this list
- None of these options

Here are some heavy metal artists. You may or may not have heard of all of them.

Which of these artists do you like to listen to?
Metallica
Iron Maiden
Korn
Led Zeppelin
ACDC
Someone else not on this list
None of these options

Now here are some jazz musicians. I really enjoy listening to some good jazz music.

Which of these artists do you like to listen to?

Diana Krall
Louis Armstrong
Nat King Cole
Miles Davis
Duke Ellington
Someone else not on this list
None of these options

I hear you telling me that you like a lot of different musicians and types of music. So far you have said that you like (Peedy reflects back participant's selections) and maybe some other artists that weren't listed.

Here are some rap artists. I like a lot of these guys but sometimes they use language that a bird like me can't handle.

Which of these artists do you like to listen to?

Eminem
Snoop Dogg
50 Cent
Diddy
Jay Z
Someone else not on this list
None of these options

Now here are some classical musicians.

Which of these artists do you like to listen to?

Beethoven
Mozart
Bach
Schuman
Ernst
Here are some pop musicians or groups. I like to dance to this music sometimes.

Which of these artists do you like to listen to?

- Justin Timberlake
- Britney Spears
- Black Eyed Peas
- Madonna
- Kelly Clarkson
- Someone else not on this list
- None of these options

Here are some country musicians. I like this music, but sometimes the songs are kind of sad.

Which of these artists do you like to listen to?

- Kenny Chesney
- Carrie Underwood
- Johnny Cash
- Tim McGraw
- Garth Brooks
- Someone else not on this list
- None of these options

You have told me that you like a lot of different types of music. You just said that you like (Peedy reflects back participant's selections) and maybe some other artists that weren't on the list of options.

Now here's the fun part. I have some music clips for us to watch.

Which one of these videos would you like to see?

- Ring of Fire (Johnny Cash)
- What a Wonderful World (Louis Armstrong)
- Signed Sealed Delivered (Stevie Wonder and Beyonce)

(Participant selects and watches a 2 minute video clip).

That was good, wasn't it?

Now let's talk about some television shows that you like.
First, I want to ask you a bit about how much television you watch.

On average, how many hours of television do you watch each day?

- I never watch television
- Less than 30 minutes
- 30 minutes - 1 hour
- 1-2 hours
- 2-4 hours
- 4-6 hours
- 6-10 hours
- More than 10 hours

By my calculations, this means that you spend (number of hours based on participant’s selection) hours per week, or (number of hours based on participant’s selection) hours per year watching television.

Do you ever wonder about how the amount of television you watch compares to others?

How many hours a day do you think the average adult watches television?

- Less than 30 minutes
- 30 minutes to 1 hour
- 1-2 hours
- 2-4 hours
- 4-6 hours
- 6-10 hours
- More than 10 hours

According to the latest statistics, the average American adult watches four and a half hours of television a day. This equals sixteen hundred and forty two hours a year, or sixty eight full days.

A few hours can really add up. I'm curious to know how you're feeling about the amount of television that you watch.

Do you think you watch too much television?

- No
- Yes, I should really cut back
- Yes, but I'm going to continue watching it as much as I do

Now let's talk about what television shows you enjoy watching.

Here are some reality television shows.
Which of these shows do you like to watch?

- Survivor
- Big Brother
- America's Next Top Model
- The Real World
- American Idol
- Something else not on the list
- None of these options

Here are some legal or crime shows. There sure are a lot of spin-offs of these shows, aren't there?

Which of these shows do you enjoy watching?

- Law and Order
- Law and Order: SVU
- CSI
- CSI: Miami
- CSI: New York
- Something else not on this list
- None of these options

Now here are some game shows. Did you know that Bob Barker is retiring after hosting the Price is Right for 35 years?

Which of these shows do you like to watch?

- Jeopardy
- Wheel of Fortune
- Price is Right
- Deal or No Deal
- 1 vs. 100
- Something else not on this list
- None of these options

I hear you telling me that you like watching a lot of different shows. So far you have said that you like (Peedy reflects back participant's selections) and maybe something else that was not on the list of options.

Let's find out what other television shows you like.

Here are some medical shows that are on television. Did you know that ER is now in its 13th season?

Which of these shows do you like to watch?
Now here are some talk shows. Did you know that Oprah has signed on to do her show until two thousand and eleven? That will be 25 years on the air.

Which of these shows do you like to watch?

- Oprah
- Tyra Banks
- Maury Povich
- Dr. Phil
- Regis and Kelly
- Something else not on the list
- None of these options

Here are some comedy shows. Some of these really make me laugh.

Which of these shows do you like to watch?

- Seinfeld
- Fresh Prince of Bel-Air
- Friends
- Everybody Hates Chris
- Family Guy
- Something else not on the list
- None of these options

You have told me that you like different types of shows. You have said that you like *(Peedy reflects back participant's selections)* and maybe some other shows that weren't listed.

The fun part again. I have a few clips from television shows that we can watch.

Which one of these clips would you like to see?

- Deal or No Deal
- Seinfeld (Elaine Dancing)
- Fresh Prince of Bel-Air (Carlton Dancing)

*(Participant selects and watches a 2 minute video clip).*
Thank you for sharing your thoughts with me. That’s all for today.

Have a nice day!
APPENDIX J

Demographics Questionnaire

1. Gender: Male __________ Female __________

2. Age: __________

3. Ethnicity: African American _______ Caucasian _______ Other _______

4. What is the highest level of education you have obtained?
   _______ Less than High School (please indicate which grade: _______ )
   _______ GED
   _______ College/University

5. Are you currently employed? Yes _______ (Full time or Part time: _______ )
   No _______

6. Please estimate your average income each month, from all sources:
   _______ Less than $500
   _______ $501 - $1000
   _______ $1001 - $1500
   _______ $1501 - $2000
   _______ $2001 - $2500
   _______ More than $2500
APPENDIX K

Smoking Background Questionnaire

1. How old were you when you smoked your first cigarette? ________

2. How old were you when you started smoking regularly (three times a week or more)? ________

3. How many YEARS in total would you say that you have smoked cigarettes? ________

4. How many times in your life have you tried to quit smoking? ________

5. What is the longest period of time that you have gone without smoking? ________

6. Have you ever talked to your counsellor at the clinic about quitting smoking? ________

7. How much money each WEEK do you generally spend on cigarettes? ________

8. How many cigarettes do you generally smoke each day? ________

9. What ways have you tried to quit smoking? (Check all that apply)
   □ On my own ("cold-turkey")
   □ Nicotine patches
   □ Nicotine gum
   □ Medication prescribed by a doctor (e.g., buproprion / Wellbutrin / Zyban)
   □ Hypnosis or acupuncture
   □ Other: ____________________
APPENDIX L

Timeline Followback

(Sobell & Sobell, 1996)

Instructions:

We would like you to recall what your cigarette use was like in the past month. This is not a difficult task when you use a calendar like the one below. As you can see, this calendar has important holidays marked on it. Take a moment to also write in your own personal holidays and events. These may include birthdays, trips, sporting events, or celebrations.

Now, go through the calendar and write down how many cigarettes you smoked on each of the days. We want you to be as accurate as possible, although we know it is hard for anyone to recall things with 100% accuracy. You may also think about things like whether you tend to smoke more on the weekends, or if there were any days you didn’t have cigarettes, went without them by choice, or if you were feeling sick and didn’t smoke as much on certain days.
(Researcher marks the past 30 days on the calendar)

**JANUARY / FEBRUARY**

<table>
<thead>
<tr>
<th>SUN</th>
<th>MON</th>
<th>TUES</th>
<th>WED</th>
<th>THURS</th>
<th>FRI</th>
<th>SAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
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<td>14</td>
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<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M. Luther</td>
<td>King Jr. Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
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<tr>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
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<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Valentine's Day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>President's Day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX M

Brief Tobacco Quantity Assessment

(Monday version)

How many cigarettes did you smoke yesterday (Sunday)?

How many cigarettes did you smoke the day before yesterday (Saturday)?

How many cigarettes did you smoke three days ago (Friday)?

(Wednesday version)

How many cigarettes did you smoke yesterday (Tuesday)?

How many cigarettes did you smoke the day before yesterday (Monday)?

(Friday version)

How many cigarettes did you smoke yesterday (Thursday)?

How many cigarettes did you smoke the day before yesterday (Wednesday)?
APPENDIX N

Tobacco Use and Beliefs Measure

How **MOTIVATED** are you to quit smoking?

______________________________

Not at all                                          Extremely

How **CONFIDENT** are you that you would be able to quit smoking if you wanted to?

______________________________

Not at all                                          Extremely
APPENDIX O

Fagerström Test for Nicotine Dependence

(Heatherton, Kozlowski, Frecker, & Fagerström, 1991)

1. How soon after you wake up do you smoke your first cigarette?
   - After 60 minutes
   - 31-60 minutes
   - 6-30 minutes
   - Within 5 minutes

2. Do you find it difficult to refrain from smoking in places where it is forbidden?
   - No
   - Yes

3. Which cigarette would you hate most to give up?
   - The first in the morning
   - Any other

4. How many cigarettes per day do you smoke?
   - 10 or less
   - 11-20
   - 21-30
   - 31 or more

5. Do you smoke more frequently during the first hours after awakening than during the rest of the day?
   - No
   - Yes
6. Do you smoke even if you are so ill that you are in bed most of the day?
   □ No
   □ Yes

Scoring:

0-2    Very low dependence
3-4    Low dependence
5      Medium dependence
6-7    High dependence
8-10   Very high dependence
APPENDIX P

Smoking Self-Efficacy Questionnaire-12 (Etter, Bergman, Humair, & Perneger, 2000)

The following are situations in which certain people might be tempted to smoke. Please indicate whether you are sure you could refrain from smoking in each situation.

<table>
<thead>
<tr>
<th>Situation</th>
<th>Not at all sure</th>
<th>Not very sure</th>
<th>More or less sure</th>
<th>Fairly sure</th>
<th>Absolutely sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I feel nervous</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. When I have a drink with friends</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. When I feel depressed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. When celebrating something</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. When I am angry</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. When drinking wine, beer, or other spirits</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. When I feel very anxious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. When I am with smokers</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. When I want to think about a difficult problem</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. After a meal</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. When I feel the urge to smoke</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12. When having coffee or tea</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Subscales:
Odd items: Internal stimuli subscale
Even items: External stimuli subscale
APPENDIX Q
Readiness to Change Questionnaire (Rollnick, Heather, Gold, & Hall, 1992)

Below are a list of ways that people may feel about their smoking. Please circle the response that best suits you for each item.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Unsure</th>
<th>Strongly Agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I don’t think I smoke too much (P)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. I am trying to smoke less than I used to (A)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. I enjoy smoking but sometimes I smoke too much</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. Sometimes I think I should cut down on my smoking (C)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. It’s a waste of time thinking about my smoking (P)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. I have just recently changed my smoking habits (A)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. Anyone can talk about wanting to do something about smoking, but I am actually doing something</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8. I am at the stage where I should think about smoking less (C)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9. My smoking is a problem sometimes (C)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10. There is no need for me to think about changing my smoking (P)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11. I am actually changing my smoking habits right now (A)</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Subscales:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P = Precontemplation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C = Contemplation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A = Action</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12. Smoking less cigarettes would be pointless for me (P)</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
</table>

Subscales:

P = Precontemplation
C = Contemplation
A = Action
APPENDIX R

Stage of Change Algorithm (DiClemente et al., 1991)

Are you seriously thinking of quitting smoking?

- Yes, within the next 30 days
  - If Yes: In the last year, how many times have you quit smoking for at least 24 hours? (PREPARATION STAGE if they have one 24-hour quit attempt in the past year. If no quit attempt then CONTEMPLATION STAGE)

- Yes, within the next 6 months (CONTEMPLATION STAGE)

- No, not thinking of quitting (PRECONTEMPLATION STAGE)

- I have already quit smoking (ACTION / MAINTENANCE)
APPENDIX S

Negative Effects of Smoking Questionnaire

Below are a list of negative effects smoking can have on someone. Please indicate to what extent each of these may have happened to you in the past 30 days.

<table>
<thead>
<tr>
<th>1. I have been unhappy because of my cigarette smoking</th>
<th>Not at all</th>
<th>A little</th>
<th>Somewhat</th>
<th>Very much</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I have felt guilty or ashamed because of my cigarette smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I feel out of breath if I walk up a flight of stairs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. My physical health has been harmed by cigarette smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I often have a cough that I can’t get rid of</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I worry that I am killing myself by smoking cigarettes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I am more at risk of developing lung, throat, or mouth cancer because of my cigarette smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I am more at risk of having a heart attack or stroke because of my cigarette smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I get very anxious, irritable, or moody when I can’t have a cigarette</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I find myself craving a cigarette when I have not had one in awhile</td>
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<td></td>
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<td>---</td>
<td></td>
</tr>
<tr>
<td>11. My clothes, house, or car smell like cigarettes</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>12. My physical appearance has been harmed by my smoking</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>13. My breath often smells from smoking</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14. My fingers, teeth, or skin are yellow from smoking</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>15. My skin is dry and my hair is brittle from smoking</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>16. I am fearful that the ones I love may be negatively affected by my cigarette smoking</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>17. A friendship or close relationship has been damaged by my cigarette smoking</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>18. My partner and I argue about my cigarette smoking</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>19. My smoking has damaged my social life, popularity, or reputation</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>20. I have spent too much money on cigarettes</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Scoring = total on all items
### Attributes of Treatment Measure

Below are a list of ways people might feel about the treatment they received in this study. Please circle the response that best suits you for each item.

<table>
<thead>
<tr>
<th>The treatment that I got...</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Unsure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ...was helpful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. ...focused on things that were relevant to me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. ...was something that I would recommend</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. ...didn’t do much for me (R)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. ...was accepting</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. ...made me want to change</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. ...was understanding</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. ...was respectful of me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. ...was unsupportive (R)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10...was enjoyable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11...was annoying (R)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12...made it worthwhile to change for a little bit (R)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
R = reverse scored items
APPENDIX U

Motivation for Change Questionnaire

Below are a list of reasons that people may give for changing or trying to change their smoking behaviour. Please think about how each reason fits for you during your participation in this study and circle the best response.

<table>
<thead>
<tr>
<th>Reason</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Unsure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I didn't have any choice (E)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. I got paid for doing it (E)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. It is something I was interested in doing (I)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. It is good for my health (I)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I was supposed to do it (E)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. I wanted to do it for myself (I)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. I didn't want to disappoint the researcher (E)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. It made me feel good about myself (I)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. I knew I was being monitored (E)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. It was a goal I had set for myself (I)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

E = External motivation subscale
I = Internal motivation subscale
APPENDIX V

Treatment Self-Regulation Questionnaire (Williams, Freedman, & Deci, 1998)

The following questions relate to the reasons why you might have tried to quit or cut back on smoking over the course of this study. Different people have different reasons for doing that, and we want to know how true each of the following reasons are for you.

The reason I tried to quit or cut back on Smoking is...

<table>
<thead>
<tr>
<th>Reason</th>
<th>Not at all true</th>
<th>Somewhat true</th>
<th>Very true</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Because I felt I wanted to take responsibility for my own health (A)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. Because I felt guilty or ashamed of myself (C)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. Because I personally believed it was the best thing for my health (A)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. Because others would be upset with me if I smoked (C)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5. I really didn’t think about it (AM)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6. Because I thought carefully about it and believe it is very important for many aspects of my health (A)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7. Because I would have felt bad about myself if I had smoked (C)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
The reason I tried to cut or quit back on smoking is...

<table>
<thead>
<tr>
<th>The reason</th>
<th>Not at all true</th>
<th>Somewhat true</th>
<th>Very true</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Because it is an important choice I really wanted to make (A)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9. Because it was easier to do what I am told than to think about it (C)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10. Because I felt pressure from others not to smoke (AM)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>11. Because it was consistent with my life goals (A)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>12. Because I wanted others to approve of (C)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>13. Because it was very important for being healthy as possible (A)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14. Because I wanted others to see that I could do it (C)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15. I don’t really know why (AM)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

A = Autonomous response items
C = Controlled response items
AM = Amotivational response items
APPENDIX W

Additional Analysis of Breath CO Results

Consecutive breath CO samples in non-smoker range

The number of consecutive days breath CO was in the non-smoking range was compared (Figure 13). Statistical analysis of these data (a univariate ANCOVA with number of samples in the non-smoker range during the baseline week as the covariate) revealed a significant difference between the groups, $F(2,33) = 3.94, p = .03, \eta^2_p =.19$. Further analysis (Fisher's LSD post-hocs) indicated that the CDMI plus CM group had significantly more non-smoking days in a row than the control group (Mean Difference = .25, p = .01). The number of consecutive non-smoking days by the CDMI only group did not significantly differ from the control (Mean Difference = .11, p = .20) or the CDMI plus CM group (Mean Difference = -.14, p = .13).

Two group comparisons were run and partial eta-squared was used to calculate Cohen's $d$. These results revealed a large advantage for CDMI only ($d = 1.13$) and CDMI plus CM ($d = 1.10$) over the control group. A moderate effect for the magnitude of the difference between CDMI only and CDMI plus CM was also found ($d = .52$), with the CDMI plus CM group producing more consecutive days in the non-smoking range.

Breath CO reductions of 25% relative to baseline

An analysis was done on the number of breath CO samples reduced 25% relative to baseline (Figure 14). A statistical analysis of these data (a univariate ANOVA) indicated a significant difference between the groups, $F(2,34) = 3.63, p = .04, \eta^2_p =.18$. Further analyses (Fisher's LSD post-hocs) revealed that the CDMI plus CM group had
Figure 13. Number of consecutive breath CO samples in the non-smoker range across the study period.

significantly more days where breath CO was reduced by 25% than the control group (Mean Difference = -3.54, \( p = .01 \)). The difference between the CDMI only and CDMI plus CM group was a non-significant trend (Mean Difference = 1.44, \( p = .07 \)). No significant difference was found between the control and CDMI only group (Mean Difference = .83, \( p = .55 \)).

Effect size estimates revealed a large magnitude of effect when CDMI plus CM was compared to control (\( d = 1.08 \)) and CDMI only (\( d = .89 \)), with the CM group producing more samples that were reduced by 25% relative to baseline. A moderate
Figure 14. Number of days during the study period that breath CO was reduced by 25% relative to baseline.

Effect was found between the control and CDMI only group (d = .54), with the control group producing the fewest number of samples that met this criterion.
APPENDIX X

Results for Fagerström Test for Nicotine Dependence

Overall Fagerström scores for all participants were in the low to moderate range of nicotine dependence. These scores showed some small variations from baseline to post-study. At follow-up, the Fagerström scores had increased to at or above baseline values for the CDMI only and control group (Figure 15). The CDMI plus CM group showed a small decrease relative to both baseline and post-study.

Summary of Fagerström findings

These results suggest that there was no difference in Fagerström scores between the groups, either at post-study or follow-up.

Baseline versus post-treatment

Change scores (post-study minus baseline scores) were essentially the same across the three groups, $F(2,34) = .04, p = .96, \eta^2_p = .00$.

Baseline versus follow-up

Fagerström scores at follow-up were also compared (controlling for baseline scores). No significant difference was found between the groups, $F(2,33) = .77, p = .47, \eta^2_p = .04$. 
Figure 15. Fagerström Test of Nicotine Dependence scores across baseline, post-study and follow-up.
APPENDIX Y

Results for Smoking Self-Efficacy Questionnaire-12

Internal subscale

Across all participants, the internal motivation subscale scores were in the low to moderate possible range of scores for this measure. Overall internal subscale scores for all participants showed a small increase between baseline and post-study. This increase was maintained at follow-up. When the groups were examined separately, only the CDMI only group showed a steady increase in internal self-efficacy across post-study and follow-up (Figure 16). The other two groups were highest at post-study and decreased at follow-up.

Summary of internal subscale findings

These results indicate that there were no significant differences between the groups on the internal subscale scores, either at post-study or follow-up.

Baseline versus post-study

Change scores were calculated for each of the groups on the post-study internal subscale values, taking into account baseline values. No significant differences were found, $F(2,34) = .16, p = .85, \eta^2_p = .01$.

Baseline versus follow-up

Similar scores were calculated for the follow-up values, controlling for baseline scores. No significant group differences were found, $F(2,33) = .73, p = .49, \eta^2_p = .04$. 
Figure 16. Smoking Self-Efficacy Internal Subscale scores across baseline, post-study and follow-up.

External subscale

The external scores were in the low to moderate range and remained relatively constant across time for all three groups across post-study and follow-up (Figure 17).

Summary of external subscale findings

These results indicate that there were no significant differences between the groups on the external subscale scores, either at post-study or follow-up.
Figure 17. Smoking Self-Efficacy External Subscale scores across baseline, post-study and follow-up.

**Baseline versus post-study**

Statistical analysis of the post-study external subscale scores (minus baseline scores) showed that the level of change across the three groups did not differ, $F(2,34) = .05, p = .95, \eta_{p}^2 = .00$.

**Baseline versus follow-up**

Similarly, no difference was found on follow-up scores (controlling for baseline values), $F(2,33) = .05, p = .95, \eta_{p}^2 = .00$. 
APPENDIX Z

Results for Readiness to Change Questionnaire

An analysis of the Readiness to Change stage scores across all participants showed that at baseline, post-study, and follow-up, approximately two thirds of the participants were in the contemplation stage of change (Table 7). This suggests that throughout the study, the majority of participants were considering making a change in their smoking but had not yet progressed to the action stage. The percentage of participants in the preparation stage of change appeared particularly stable for the combined intervention group, CDMI plus CM, while the other two groups showed a slightly larger degree of progression through the stages of change.

There were no statistically significant group differences in stage of change at baseline, $\chi^2(4) = 4.90, p = .30$; post-study, $\chi^2(4) = 1.49, p = .83$; or follow-up, $\chi^2(6) = 6.42, p = .38$. 
Table 7

Percentage of participants in each stage of change (Readiness to Change Questionnaire scores)

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>CDMI only</th>
<th>CDMI plus CM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>0</td>
<td>0</td>
<td>16.7</td>
</tr>
<tr>
<td>Contemplation</td>
<td>85.7</td>
<td>90.9</td>
<td>66.7</td>
</tr>
<tr>
<td>Action</td>
<td>7.1</td>
<td>9.1</td>
<td>16.7</td>
</tr>
<tr>
<td><strong>Post-study</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>7.1</td>
<td>0</td>
<td>8.5</td>
</tr>
<tr>
<td>Contemplation</td>
<td>78.6</td>
<td>72.7</td>
<td>75.0</td>
</tr>
<tr>
<td>Action</td>
<td>14.3</td>
<td>27.3</td>
<td>16.7</td>
</tr>
<tr>
<td><strong>Follow-up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>7.1</td>
<td>18.2</td>
<td>8.3</td>
</tr>
<tr>
<td>Contemplation</td>
<td>64.3</td>
<td>63.6</td>
<td>75.0</td>
</tr>
<tr>
<td>Action</td>
<td>21.4</td>
<td>18.2</td>
<td>16.7</td>
</tr>
</tbody>
</table>
APPENDIX AA

Results for Stages of Change Algorithm

Across all three groups, approximately three quarters of participants were in the contemplation stage at baseline. At post-study and follow-up, approximately half of the participants remained in the contemplation stage, while one third to one quarter had progressed to the preparation stage of change (Table 8).

There were no group differences in stage of change at baseline, $\chi^2(4) = 2.10, p = .72$; post-study, $\chi^2(6) = 6.42, p = .38$; or follow-up, $\chi^2(4) = .97, p = .92$.

Table 8

Percentage of participants in each stage of change (Stages of Change Algorithm)

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>CDMI only</th>
<th>CDMI plus CM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>7.1</td>
<td>9.1</td>
<td>25.0</td>
</tr>
<tr>
<td>Contemplation</td>
<td>85.7</td>
<td>81.8</td>
<td>66.7</td>
</tr>
<tr>
<td>Preparation</td>
<td>7.1</td>
<td>9.1</td>
<td>8.3</td>
</tr>
<tr>
<td>Action/Maintenance</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Post-study</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>14.3</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Contemplation</td>
<td>57.1</td>
<td>54.5</td>
<td>50.0</td>
</tr>
<tr>
<td>Preparation</td>
<td>28.6</td>
<td>45.5</td>
<td>16.7</td>
</tr>
<tr>
<td>Action/Maintenance</td>
<td>0</td>
<td>0</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Follow-up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>21.4</td>
<td>18.2</td>
<td>25.0</td>
</tr>
<tr>
<td>Contemplation</td>
<td>64.3</td>
<td>45.5</td>
<td>33.3</td>
</tr>
<tr>
<td>Preparation</td>
<td>7.1</td>
<td>36.4</td>
<td>33.3</td>
</tr>
<tr>
<td>Action/Maintenance</td>
<td>0</td>
<td>0</td>
<td>8.3</td>
</tr>
</tbody>
</table>
APPENDIX AB

Results for Illicit Drug Use

Urine drug information from each of the participants was recorded for the period five weeks prior to the study (pre-study), the four weeks of the study period plus baseline week (study period), and the five weeks between the end of the study period and follow-up (post-study). These drug screens were provided randomly as part of regular clinic procedures; therefore the number of drug screens was different for each participant. To ensure these comparisons were equivalent, the percentage of positive screens of those provided during each of these time points was calculated for each participant.

Opiates

Across all participants, rates of illicit opiate use were relatively moderate (average of 43.2% pre-study and 32.2% at post-study). This use progressively decreased from pre-study, to study period, to post-study. Looking at each group separately, each of the three groups decreased their opiate use during the study period relative to pre-study (Figure 18). The CDMI and CDMI plus CM groups continued this reduction to post-study, while opiate use increased (although not to baseline levels) for the control group at follow-up.

Summary of findings for opiate use

No differences were found between the groups on opiate use during the study period or at post-study.
Figure 18. Percentage of opiate positive urine drug screens across the 5-weeks pre-study, the 5-week study period, and 5-weeks post-study.

Study period versus pre-study

In order to calculate Cohen’s $d$ as a measure of effect size, change scores were calculated for the percentage of urine drug screens positive for opiates during the study, minus the percentage that were positive prior to the study. These scores were not significant with a univariate ANOVA, $F(2,29) = .33, p = .72, \eta^2_p = .02$.

Post-study versus pre-study

Change scores for opiate use at post-study (minus baseline use), did not show differential reductions between the three groups, $F(2,28) = .18, p = .84, \eta^2_p = .01$. 
Cocaine

Overall rates of cocaine use were relatively moderate (34.8% at pre-study and 26.9% at post-study). The overall rate of cocaine use across the three groups showed a reduction across the three time points. Control participants maintained their rate of use from pre-study through the study period, and then increased their use post-study (Figure 19). The two groups that received the CDMI showed reductions in cocaine use across each of the three time points. This reduction was most apparent for the combined CDMI and CM group, who reduced their cocaine use by more than half from pre-study to post-study.

Summary of results for cocaine use

Effect size estimates suggest that CDMI plus CM was the most efficacious in producing reduced levels of cocaine use post-study, relative to pre-study. No differences between the groups were found during the study period, relative to pre-study.

Study period versus pre-study

Rates of cocaine use during the study period (minus pre-study rates of use) were compared and no significant difference between the groups was found, $F(2,28) = .72, p = .50, \eta^2_p = .05$. 
Post-study versus pre-study

A comparison of the change scores from pre-study to post-study found a non-significant trend ($p \leq .30$) in the difference between the groups, $F(2,27) = 1.89$, $p = .17$, $\eta_p^2 = .12$. Effect sizes revealed that relative to the control group (which increased their rates of cocaine use over this time), the CDMI only group showed a moderate advantage in reducing cocaine use ($d = .53$), while this advantage was large for the CDMI plus CM ($d = .81$). The combined intervention of CDMI plus CM showed a small to moderate magnitude of effect size over CDMI only ($d = .35$).
APPENDIX AC

Notable Participant Characteristics

It was initially desired to examine the effect of ethnicity on study variables, as previous work has found larger effects of MI on minority participants relative to Caucasian samples (Hettema et al., 2005). Due to the low number of Caucasian participants in our study sample (N = 4), these analyses could not be done. Further complicating this was the fact that all four Caucasian participants were female, and all had recently given birth or gave birth during the study period (as this particular clinic was running a program for pregnant women on methadone). One additional African American woman was also a new mother. Research has shown that it is particularly hard to affect substance use-related change in pregnant and post-partum women who continue to use during their pregnancy (e.g., Ondersma et al., 2005; Ondersma et al., 2007). This is primarily due to the fact that women who do not quit smoking or using drugs when they first become pregnant are not likely to quit during the pre- and post-partum period.

While analysis of these factors is beyond the scope of this dissertation, informal comparisons between these Caucasian mothers and African American participants across all three study groups reveals a very interesting pattern of results. While the Caucasian mothers demonstrated higher (and increased over time) levels of breath CO, saliva cotinine, and self-reported number of cigarettes relative to African American participants, their self-reported level of motivation was much higher. Therefore, while their motivation was high, their efficacy to stop smoking was low. Their overall acceptability of the interventions offered to them in this study (as measured by the Attributes of Treatment Measure), while still relatively high, was also significantly lower ($M = 3.45, SD = .39$).
than that of African American participants ($M = 3.99, SD = .36), F(1,32) = 7.51, p = .01, \eta^2_p = .19.

It is not known whether these observed differences are due to effects of ethnicity, pre- and post-natal factors, or even gender. This is an interesting area of investigation, and future research with adequate sample sizes is needed to tease apart these effects.
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