The Role of Self-efficacy in Cocaine Abstinence

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at George Mason University

By

Christine E. Sylvest
Master of Arts
George Mason University, 2004

Director: James E. Maddux, Professor
Department of Psychology

Spring Semester 2009
George Mason University
Fairfax, VA
DEDICATION

This dissertation is dedicated to all the women and men who have participated in substance abuse studies at the Center for Learning and Health at Johns Hopkins University School of Medicine, in gratitude for their participation and in the hope that they achieve freedom from addiction.
I would like to give my warmest thanks to my advisor, Dr. Jim Maddux, and to the members of my committee, Dr. David Anderson, Dr. Linda Chrosniak, and Dr. Ken Silverman, for their support throughout this process and for their thoughtful comments and suggestions. In particular I want to thank Dr. Silverman for generously allowing me to access the data set and for his guidance, kindness, professional support, and most of all, excellent sense of humor over the years. Many thanks go to Paul Nuzzo at the University of Kentucky for his statistical analyses, quick response time and excellent organizational skills. I would like to thank the staff at the Center for Learning and Health at Johns Hopkins School of Medicine for their assistance in gathering and managing the data. I also wish to thank my friends and classmates for their invaluable support and advice, without which I would have completed neither this dissertation nor this program. I am forever grateful for the unconditional love and support of my parents, Rich and Beth, my sisters, Emily and Laura, and my wonderful and talented husband, Benjamin Bulloch, who has been with me through it all. Finally I would like to acknowledge my dogs, Roxy and Bodie, for providing many moments of levity and reminders of what is truly important in life.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Tables</td>
<td>vi</td>
</tr>
<tr>
<td>List of Figures</td>
<td>vii</td>
</tr>
<tr>
<td>Abstract</td>
<td>viii</td>
</tr>
<tr>
<td>1.   Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Definitions of Substance Abuse and Dependence</td>
<td>5</td>
</tr>
<tr>
<td>Treatments for Substance Abuse</td>
<td>8</td>
</tr>
<tr>
<td>Predictors of Treatment Success</td>
<td>20</td>
</tr>
<tr>
<td>Social Cognitive Theory</td>
<td>22</td>
</tr>
<tr>
<td>Defining Self-Efficacy</td>
<td>23</td>
</tr>
<tr>
<td>Self-Efficacy and Addictive Behavior</td>
<td>26</td>
</tr>
<tr>
<td>Stages of Change in Addictive Behaviors</td>
<td>33</td>
</tr>
<tr>
<td>Self-Efficacy and a Model of Relapse Prevention</td>
<td>37</td>
</tr>
<tr>
<td>Self-Efficacy Research and Cocaine Addiction</td>
<td>44</td>
</tr>
<tr>
<td>Current Study Hypotheses</td>
<td>53</td>
</tr>
<tr>
<td>2.   Method</td>
<td>55</td>
</tr>
<tr>
<td>Participants</td>
<td>55</td>
</tr>
<tr>
<td>Measures</td>
<td>58</td>
</tr>
<tr>
<td>Procedure</td>
<td>60</td>
</tr>
<tr>
<td>3.   Results</td>
<td>64</td>
</tr>
<tr>
<td>4.   Discussion</td>
<td>73</td>
</tr>
<tr>
<td>Appendix: Situational Confidence Questionnaire</td>
<td>96</td>
</tr>
<tr>
<td>References</td>
<td>100</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table                                                                                                                               Page
1. Selected Demographic Characteristics of Study Participants.................................57
2. Descriptive Statistics for SCQ Scores and Percent Negative Urine Samples (Missing-Positive Analysis)...............................................................66
3. Inter-correlation Matrix of Study Variables Collapsed Across Group (Missing-Positive Analysis)..................................................................................67
4. Summary of Simultaneous Regression Analysis for Variables Predicting Cocaine Abstinence .............................................................................................68
5. Logistic Regression Predicting Likelihood of Achieving 100% Cocaine Abstinence in Weeks 40 – 52...............................................................72
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Timeline of Study Phases ................................................................</td>
<td>46</td>
</tr>
<tr>
<td>3. History of Recruitment, Assignment and Attrition of Participants in the Study</td>
<td>48</td>
</tr>
<tr>
<td>4. Major Batteries of Assessment Time Points .....................................</td>
<td>50</td>
</tr>
<tr>
<td>5. Cocaine Urinalysis Results Across Consecutive Urine Samples for Individual Participants</td>
<td>62</td>
</tr>
</tbody>
</table>
ABSTRACT

THE ROLE OF SELF-EFFICACY IN COCAINE ABSTINENCE

Christine E. Sylvest, Ph.D.

George Mason University, 2009

Dissertation Director: Dr. James E. Maddux

Coping self-efficacy, defined as confidence in one’s ability to abstain from drug use in difficult situations, has been found to be a predictor of treatment outcome for substance addiction. Cocaine addiction has received less research attention compared to alcohol, nicotine, and opiates. The present study examined archival data from a voucher reinforcement study where 78 opiate- and cocaine-dependent participants were randomized to (1) a control group that received methadone maintenance, (2) a group that earned take-home methadone doses based on abstinence, or (3) a group that earned take-home doses as well as monetary vouchers based on abstinence. The purpose of the present study was to determine if pre-treatment self-efficacy ratings, measured by the Situational Confidence Questionnaire (SCQ), predicted cocaine abstinence outcomes, measured by cocaine-negative urine samples, across 52 weeks of treatment and during the last 13 weeks of treatment. This study also examined whether SCQ scores predicted the period of 100% abstinence that some participants were able to sustain for over 6
months during treatment. Results of the study were mixed dependent upon how missing urinalysis data were treated. When all missing urine samples were considered positive, self-efficacy was not a significant predictor of future abstinence. When analyses were performed without including missing urinalysis data, self-efficacy was predictive of abstinence in the last 13-week block of the treatment period. A third treatment of missing data was applied by filling in all missing urine samples with either a positive or negative value based on the participant’s immediate prior and subsequent levels of abstinence. This method also found that self-efficacy was a significant predictor of abstinence in the last 13-week block of treatment. Both prior abstinence and contingent reinforcement of abstinence were robust predictors of future abstinence, and self-efficacy was significantly related to current drug use. The predictive ability of self-efficacy at various times in the addiction cycle was discussed.
INTRODUCTION

Substance abuse is widely perceived as a serious national health problem, as evidenced by the federal government’s decades-long “War on Drugs” and the numerous public service announcements disseminated by the media describing the dangers of drug use and urging parents to communicate with their children about abstaining from drugs. The use and abuse of chemical substances (illicit drugs, legal drugs such as alcohol and nicotine, and abuse of legal prescription drugs) presents a high cost to society in terms of lives lost or destroyed by the ravages of substance abuse as well as dollars lost to the legitimate economy because they are spent on drugs or in support of drug use (Holder & Blose, 1991; Phibbs, Bateman, & Schwartz, 1991).

The primary source for such statistics and other information about substance use in the United States comes from the annual National Survey on Drug Use and Health (NSDUH), which is sponsored by the federal government’s Substance Abuse and Mental Health Services Administration (SAMHSA). The most recent survey, from the year 2007, reveals that 19.9 million Americans (8% of the population) were current illicit drug users (meaning they had used illicit drugs in the past month). Illicit drugs were defined as any illegal drug (e.g., heroin, cocaine, marijuana), any prescription drug taken for non-medical reasons (e.g., painkillers, sedatives), and inhalants. Marijuana was the most
commonly used illicit drug with 14.4 million people reporting use in the past month (5.8% of the population). 2.1 million people (0.8% of the population) reported using cocaine in the previous month, and 153,000 people (0.06% of the population) reported heroin use in the past month (NSDUH, 2008). The use of illicit drugs is generally not accepted by society.

One can contrast these figures by examining the figures on the prevalence of alcohol and nicotine use, two addictive substances that are legal in our society. Binge drinking of alcohol, defined by the NSDUH as five or more alcohol drinks on one occasion on at least one day in the past month, was reported by 57.8 million Americans (23.3% of the population). Heavy drinking of alcohol, defined by the NSDUH as binge drinking on at least five days in the past month, was reported by 17 million people (6.9% of the population). Finally, 70.9 million Americans (28.6% of the population) reported using some form of tobacco, such as cigarettes, cigars, smokeless tobacco, or tobacco in pipes (NSDUH, 2008).

One of the more interesting statistical analyses of the nation’s substance abuse problem involves the costs to society of drug use. The most recent report currently available, published in 2004 and sponsored by the federal government’s Office of National Drug Control Policy (ONDCP), provides estimates of the costs to society of drug use between 1992, when the report was first published, and 2002. The report includes only the cost of illicit drugs, not alcohol and nicotine. These estimates are calculated according to guidelines created by the U.S. Public Health Service for any cost-of-illness study, and these guidelines have been widely used to study the cost of most
major medical conditions. It must be noted that these figures do not include costs related
to the decreased quality of life commonly associated with heavy drug use. Such costs are
sometimes calculated in economic studies of social maladies; however, they were not
included here.

The overall estimated cost of drug abuse in 2002 is reported as $180.9 billion,
increasing 5.3% annually since 1992. These figures include costs related to productivity
losses, health care costs, and other costs, mostly due to the cost of substance abuse-
related issues in the criminal justice system (e.g., cost of legal defense, cost of local,
state, and federal corrections facilities, etc.) (ONDCP, 2004).

To further understand these costs and to gain some perspective on how
widespread the deleterious effects of substance abuse are, it is important to understand
what factors go into each of the three categories. Productivity losses are due to substance
abuse interfering with a person’s ability to initiate or maintain meaningful productivity
either in or outside of the home. This includes productivity loss due to premature death,
ilness and hospitalization related to drug abuse, incarceration and choosing a career
related to criminal activities instead of a legitimate career, and productivity loss of
victims of drug-related crimes. Health care costs to society cover a wide range, including
money spent on federal, state, and local community-based treatment programs, federal,
state, and local treatment and prevention programs, treatment and prevention research,
medical care costs such as emergency room visits, diseases resulting from drug use (HIV
and AIDS, Hepatitis B and C), the cost of care of infants born already exposed or
addicted to drugs, insurance administration costs, and finally the health care costs of
victims of drug-related crimes. The final category, “other effects,” are related to costs in the criminal justice system, costs of programs and interventions meant to reduce the supply of drugs in the United States, and social welfare costs (ONDCP, 2004).

The estimated productivity loss in 2002 cost $128.6 billion, rising from $69.4 billion in 1992. The estimated health care costs in 2002 were $16 billion, which rose from $10.7 billion in 1992. Criminal justice system and social welfare costs in 2002 were estimated at $36.4 billion, rising from $19.4 billion in 1992 (ONDCP, 2004). These figures, while staggering and difficult to comprehend, cover only the costs of substance abuse to society. They do not include estimates of what Americans actually spend on alcohol and illicit drugs.

The most recent available figures on what American drug users spend on illegal drugs also come from the ONDCP and are available for the year 2000 (ONDCP, 2001). Calculating the estimates of what American drug users spend on illicit drugs is a difficult process. These figures are calculated using a "consumption approach". The researchers use a mathematical model in which they estimate the number of heavy drug users in the United States, analyze Drug Use Forecasting interviews with heavy users who are asked about how much they spend on drugs, multiply the number of users by their typical expenditure, then convert the resulting estimates to dollars for the year 2000. According to the ONDCP, in 2000 Americans spent about $36 billion on cocaine, $11 billion on marijuana, $10 billion on heroin, $5.4 billion on methamphetamine, and $2.4 billion on other substances. These are dollars that would otherwise be contributing to commerce and growth in the legitimate economy, and cocaine is the drug on which by far the most
money is spent. Despite the fact that these figures are only estimates, it is clear that drug use and abuse is a costly burden to American society.

Definitions of Substance Abuse and Dependence

When discussing effective treatments for various substance addictions, it is important to develop an understanding of the phenomenon of substance use, including the terms used to describe it. How is “substance abuse” defined? When and how do mental and physical dependence enter into the substance use cycle? What terms are most appropriate to use? The words “abuse” and “dependence” are often used interchangeably; sometimes both terms are used to indicate an addiction to a drug while at other times “abuse” is used to indicate harmful drug use and “dependence” is used to indicate a physiological and psychological addiction to the drug. However, the terms “abuse,” “dependence,” and “addiction” have discrete meanings and, in the interest of clarity and universal understanding, they should not be used interchangeably.

According to the Fourth Edition of the American Psychiatric Association’s (APA) *Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition, Text Revision (DSM-IV-TR)* (APA, 2000), substance abuse is defined as “a maladaptive pattern of substance use manifested by recurrent and significant adverse consequences related to the repeated use of substances” (p. 198). Substance abuse can be classified as a mental disorder as long as it meets specific criteria during a 12-month period of abuse. The individual must experience clinically significant distress or impairment in functioning along with at least one of the following four criteria: the recurring substance use results in a failure on the part of the individual to fulfill his or her major role obligations (at
home, work, or school), recurrent substance use in situations where it is physically
dangerous (due to physical impairment by the substance), recurrent legal problems due to
the substance use, and persistence in using the substance despite the social or
interpersonal problems caused by its use (arguments with friends and family, physical
altercations, etc.) (APA, 2000).

This definition applies to the formal clinical diagnosis of a substance abuse
disorder. In general usage, the term abuse may refer to any substance use or to using a
legal or prescription drug for non-medical or non-approved purposes. Therefore, the
World Health Organization (WHO) does not include the term “abuse” in the 10th Edition
of the International Classification of Diseases, instead preferring the terms “hazardous
use” and “harmful use.” WHO did, however, offer the following definition of abuse in a
1969 report: “persistent or sporadic excessive drug use inconsistent with or unrelated to
acceptable medical practice” (WHO, 1969).

“Dependence” is more a more specific, psychopharmacological term that is
defined similarly to abuse but adds the criteria of the user experiencing physical tolerance
of and/or withdrawal from the substance. Tolerance is defined by the DSM-IV-TR as “a
need for markedly increased amounts of the substance to achieve intoxication or desired
effect, or markedly diminished effect with continued use of the same amount of the
substance” (APA, 2000, p.197). Withdrawal is defined as “the characteristic withdrawal
syndrome for the substance, or the same (or a closely related) substance is taken to
relieve or avoid withdrawal symptoms” (APA, 2000, p.197). Substance dependence can
also be classified as a mental disorder according to the DSM-IV-TR. Substance
dependence is defined as a maladaptive pattern of substance use within a 12 month period including at least three of the following seven criteria: tolerance for the substance, symptoms of withdrawal from the substance, the substance is taken for longer periods of time or in larger amounts than intended, desire for or unsuccessful efforts towards reducing use, excessive time spent acquiring the substance or recovering from its effects, important life activities (social, occupational, educational) are given up or reduced because of substance use, and substance use is continued despite knowledge that the substance either exacerbates or causes a persistent physical or psychological problem (APA, 2000).

Finally, the following comprehensive definition of “addiction” was proposed by Goodman in 1990:

[Ad]diction may be defined as a process whereby a behavior, that can function both to produce pleasure and to provide relief from internal discomfort, is employed in a pattern characterized by (1) recurrent failure to control the behavior (powerlessness) and (2) continuation of the behavior despite significant negative consequences (unmanageability). (p. 1404)

Drug addiction was defined in a more recent report by the National Institute on Drug Abuse (NIDA) as “a chronic, relapsing brain disease that is characterized by compulsive drug seeking and use, despite harmful consequences” (NIDA, 2007, p. 5). Both definitions identify lack of control over behavior and continued used despite negative consequences as basic tenets of addiction.
For the purposes of this paper, the terms “abuse” and “dependence” will follow the definitions set forth in the *DSM-IV-TR* (2000), and the term “addiction” will follow NIDA’s 2007 definition. The term “substance use” will mean only the use of a substance, without any implications of the user being dependent or addicted.

Treatments for Substance Abuse

Much research has been conducted on the development and effectiveness of treatment strategies for all kinds of substances of abuse – alcohol, nicotine, and illegal drugs such as heroin and cocaine. Before entering into a discussion on treatment modalities, it is important to note that cocaine has received the least attention in terms of substance abuse treatments specifically tailored for the unique characteristics associated with the course and effects of the drug on its abusers (Hubbard, Craddock, Flynn, Anderson, & Etheridge, 1997). Cocaine abuse has typically been investigated as a problematic side note during studies of effective treatments for alcohol and heroin abuse – two drugs with which cocaine use is frequently concurrent.

One study conducted in 1994 examined the growing problem of cocaine use in opioid-dependent patients who receive methadone maintenance treatment (Rawson, McCann, Hasson, & Ling). The authors state that “in a large number of opioid-dependence treatment clinics in the United States, many patients enter methadone maintenance involved with both heroin and cocaine. It is often unclear which is the primary problem” (Rawson et al., 1994, p. 129). Successful treatment of heroin addiction with methadone doses is frequently interrupted by problems related to cocaine addiction, such as destabilization of daily routine and difficulty maintaining gainful employment.
Cocaine use is related to increased drug-injection and high-risk sexual behaviors, which in turn increase risk of contracting HIV or associated diseases. Rawson and colleagues report that methadone patients whose primary addiction is heroin frequently do not view cocaine use, which can be more episodic than the constant craving of heroin addiction, as a problem. The authors conclude that these factors point to the need for drug abuse treatment specifically targeted for cocaine use (1994).

Different modalities of treatment have been investigated in their effectiveness for alcohol and drug abuse. Investigators from one important NIDA-sponsored multi-center study – the Drug Abuse Treatment Outcome Study (DATOS) – collected 1-year follow-up outcomes for 2,966 clients in outpatient methadone (OMT), long-term residential (LTR), outpatient drug-free (ODF), and short-term inpatient (STI) programs from 1991–1993. Hubbard et al. (1997) conducted a meta-review of the various publications that analyzed the data from the DATOS database and concluded that many of the studies stressed the need for further research on effectiveness of treatment specifically for cocaine abusers. Additionally, studies drawn from the DATOS project revealed that treatment modalities typically used with alcohol abusers, particularly short-term inpatient treatment (STI), were admitting increasingly more cocaine-using patients as well without supporting evidence that STI treatment was effective for cocaine users. STI programs are the treatment modalities of choice to guide patients through the first steps of the traditional Alcoholics Anonymous (AA) 12 step recovery process.
Self-help Groups

Narcotics Anonymous (NA) and Cocaine Anonymous (CA) are both 12 step programs that were developed based on the principles of Alcoholics Anonymous. These principles include the perception of addiction as a disease that can be managed but never eliminated: the importance of personal responsibility, maturity, and spiritual growth, the reduction of the self-centeredness that is a hallmark of addiction, and providing help and support to other addicted individuals (Humphreys et al., 2004). Groups are operated by the members and are lead by non-professionals. Although research supports the effectiveness of self-help groups in general, few studies have focused on cocaine-dependent individuals and self-help groups. This is evidenced by a publication produced by a panel of substance abuse experts who convened in Washington, D.C. in 2001 to review the literature on the effectiveness of drug and alcohol self-help groups. Their findings, published in 2004, reveal that most outcome research for self-help groups has focused on Alcoholics Anonymous, and the only randomized-controlled trials of self-help groups in the literature were conducted solely on AA groups (Humphreys et al., 2004).

Psychosocial Treatments

Group and individual psychotherapy. Drug abuse has also been treated with a wide variety of psychological interventions, including psychotherapy of all modalities (eg., psychodynamic therapy, family therapy, cognitive behavioral therapy). Because of the dangerous nature of drug abuse and its potentially life-threatening consequences, it is important that psychological treatments are evidenced-based and shown to be efficacious in reducing or eliminating drug use. In 1990 NIDA, having identified cocaine
dependence as a public health problem requiring the attention of additional research, initiated a randomized, multisite clinical trial to evaluate the efficacy of psychosocial therapies for cocaine dependence. Results from that study were published in 1999 by Crits-Christoph et al. In this study, 487 patients were randomly assigned to one of four manual-guided treatments: individual drug counseling plus group drug counseling (GDC), cognitive therapy plus GDC, supportive-expressive (psychodynamic) therapy plus GDC, or GDC alone. Treatment was intensive, including 36 possible individual sessions and 24 group sessions for six months. Patients were assessed monthly during active treatment and at 9 and 12 months after baseline. Results, as measured by drug use reported on the Addiction Severity Index, indicated that compared with the two psychotherapies and with GDC alone, individual drug counseling plus GDC showed the greatest improvement on the Addiction Severity Index-Drug Use Composite score. The study authors stated that it was unclear specifically why individual drug counseling plus GDC was superior to other modalities; however, they surmised that it was because the treatment was manualized and focused intently on the importance of stopping drug use. They stated that the individual drug counseling was based on the fundamentals of the 12-step program philosophy, and that it was uncertain how this might compare to relapse prevention techniques (discussed later in this paper) and other approaches frequently used in the drug treatment community (Crits-Christoph et al., 1999). Although the data collected in the NIDA study are a promising start to cocaine-specific treatment research, more specific explorations of why psychosocial approaches work and how to effectively apply them are necessary.
Coping skills training. Coping skills training is an approach to substance abuse treatment that has met with some success. Rohsenow, Martin, and Monti (2005) described this training as aimed at helping substance abusers develop abilities to cope with urges to use, to identify their relapse triggers, and to effectively deal with negative thoughts and moods. Communication skills are also targeted for improvement to help users procure social support in their attempts to maintain abstinence. Rohsenow, et al. (2005) reported that many coping skills approaches that are not targeted at cocaine users do not have significant effects (e.g. Hawkins et al., 1989; Wells, 1994); however, those treatments that are specific to cocaine abuse have significant improvements in cocaine use outcomes (e.g., Carroll et al., 1995; Rohsenow et al., 2000). According to Rohsenow’s study, these include skills specific to coping with the urge to use cocaine, including behavioral (finding alternative behaviors, escaping the situation, refusing cocaine, solving the problem, relaxation, seeking social support, or attending a meeting), cognitive (thinking of consequences that would happen as a result of using or of refraining from using, thinking through the chain of behaviors and consequences, thinking about something distracting, generating inner strength messages), and spiritual (praying, relying on God or a higher power).

Despite some initially promising outcomes, Rohsenow et al. (2005) argue that the lack of research leaves the treatment community with “little knowledge…about which coping skills are likely to be most effective in reducing cocaine use or relapse after treatment” (p. 211). In fact, according to the authors’ review of the literature, all published studies on the relationship of coping skills to post-treatment substance use
outcomes have focused on alcoholics (e.g., Wunschel et al., 1993; Monti et al., 1993; Rohsenow et al., 2001). This leaves an obvious gap in the treatment literature regarding how to develop effective coping skills to sustain cocaine abstinence after treatment.

**Behavioral Treatments**

Two promising behavioral treatments for substance abuse are the Community Reinforcement Approach (CRA) and voucher reinforcement techniques. The CRA, originally developed for use with alcoholic patients (Hunt & Azrin, 1973), employs behavioral techniques to help patients identify the antecedents and consequences of cocaine use, explore the nature of the relationships in their lives, obtain meaningful employment, and understand the positive reinforcers inherent in involvement in a new non-drug-related lifestyle, including hobbies, social groups, and other activities (Rawson et al., 1994). Voucher reinforcement techniques provide participants with incentives for maintaining cocaine abstinence by presenting vouchers (exchangeable for retail items) for every cocaine-free urine sample the participant provides. To promote longer periods of abstinence, the value of the voucher increases over time for each cumulative cocaine-free urine sample. These increases can occur with each drug-free urine given or after set intervals of abstinence. Voucher reinforcement has been shown to be effective in increasing cocaine abstinence during treatment. One seminal study by Silverman, et al. (1996) randomized cocaine-dependent methadone maintenance participants into either a group where vouchers were earned contingent upon cocaine abstinence or a group where vouchers were received regardless of cocaine abstinence. Results showed that, during treatment, the group that received contingent vouchers demonstrated significantly higher
levels of cocaine abstinence, although the effect did not last through the post-treatment period.

Further research has explored the efficacy of the CRA plus voucher reinforcement. Two studies demonstrated that this approach was more effective than drug abuse counseling alone in retaining cocaine-abusing adults in an outpatient treatment setting as well as in increasing cocaine abstinence (Higgins et al., 1991, 1993), although no data were collected on post-treatment abstinence. Another study randomly assigned cocaine-dependent participants to either treatment with the CRA alone or to CRA plus vouchers. Participants earned vouchers by providing cocaine-negative urine samples. Results showed a greater retention of participants and higher sustained intervals of cocaine abstinence in the CRA plus voucher group (Higgins et al., 1994). A study published in 2000 (Higgins, Wong, Badger, Ogden, & Dantona) randomized cocaine-dependent participants into two groups. Both groups received CRA-based counseling and vouchers, but one group earned vouchers by providing cocaine-free urine samples, and the other group received vouchers regardless of drug abstinence. Results at the end of treatment and at a one year follow-up showed that participants who received vouchers contingent upon drug abstinence had higher levels of cocaine abstinence than the group who received non-contingent vouchers.

However, follow-up abstinence outcomes are still inconsistent in the research. Another study from this research group compared two randomized groups of patients, one treated with CRA plus vouchers and one treated solely with vouchers for a period of 12 weeks. Results indicated that the group treated with CRA plus vouchers remained in
treatment longer, had lower levels of cocaine use during treatment, and reported drinking to intoxication less frequently than the group treated with vouchers only. Unfortunately, the effects on cocaine use were limited to the treatment period only, as at the 3-month post-treatment assessment interval the CRA plus vouchers participants reported increased levels of cocaine use after treatment ended (Higgins et al., 2003).

These studies demonstrate that behavioral approaches that include contingent voucher reinforcement can be a highly effective means of establishing cocaine abstinence in cocaine-dependent individuals. Because abstinence is typically only maintained during the treatment period, further research needs to be conducted to see how these treatment strategies can contribute to the maintenance of cocaine abstinence after the treatment period has ended.

Pharmacological Treatments

Pharmacological strategies are also important methods of treating substance abuse problems, and most of the understanding of their mechanisms of action comes from animal studies. Medications for substance abuse work to interfere with the reward system in the brain that is activated by the use of the drug. This may happen in a variety of ways: medications may cause noxious physical symptoms when the substance of abuse is ingested, or they may cause either an attenuation of the euphoric high experienced with drug use or act to reverse the neurochemical changes brought about by sustained drug use (i.e., medications may replenish neurotransmitters that have been depleted by the drug of abuse, thus negating unpleasant withdrawal effects and reducing the likelihood of continued drug-seeking behavior to avoid withdrawal). Medications can
also help reduce cravings for the drug (Pettinati et al., 2008; Vocci, Acri, & Elkashef, 2005).

While some drugs of abuse, such as alcohol and heroin, have long had pharmacological treatments, researchers have only recently begun to investigate pharmacotherapies in the treatment of cocaine addiction. Currently there are no medications approved by the Federal Drug Administration (FDA) for the treatment of cocaine dependence (Vocci, Acri, & Elkashef, 2005).

The drug that has garnered the most attention in treating cocaine addiction is disulfiram, which has been in use for over 50 years for the treatment of alcohol abuse (Vocci & Elkashef, 2005). Disulfiram is an important candidate for cocaine treatment because alcohol and cocaine are frequently used together – one study reports that 88% of cocaine users entering treatment reported co-abuse of alcohol (Wiseman & McMillan, 1996); another case series reported that 61% of cocaine-dependent individuals had a history of alcohol dependence (Heil, Badger, & Higgins, 2001). Alcohol and cocaine may have a high concurrent use for several reasons. First, alcohol may be used to dampen the negative effects of cocaine’s stimulant properties. Alcohol’s disinhibiting properties and its impairment of the user’s judgment may also increase the chances of cocaine use after alcohol ingestion. Additionally, co-ingestion of alcohol and cocaine produces the metabolite cocaethylene, which functions to increase and prolong the cocaine high (McCance-Katz, Kosten, & Jatlow, 1998). Therefore, if alcohol ingestion is reduced by using disulfiram, then cocaine use may be reduced as well.
In alcohol use, disulfiram works by blocking the enzyme aldehyde dehydrogenase, which breaks down alcohol in the body. The inability of the enzyme to perform its function when alcohol is ingested causes an accumulation of another enzyme, acetaldehyde. The resulting high levels of acetaldehyde after the consumption of alcohol in patients taking disulfiram cause highly unpleasant physical symptoms such as nausea, severe vomiting, throbbing headache, and respiratory difficulty. These symptoms discourage alcohol use (George et al., 2000).

Some studies have shown that disulfiram can also generate aversive experiences when cocaine is ingested. One study found that disulfiram, when administered prior to a dose of intranasal cocaine, produced anxiety, paranoia, and dysphoria in participants (Hameedi et al., 1995). Another study had cocaine-dependent participants rate their experience of the cocaine “high” after being administered an intravenous dose of cocaine while on either disulfiram treatment or placebo. Participants on disulfiram therapy rated their cocaine “high” and “rush” as significantly diminished compared to the placebo group (Baker, Jatlow, & McCance-Katz, 2007). Disulfiram is thought to work in cocaine-using patients by inhibiting the enzyme dopamine-β-hydroxylase, which converts dopamine into norepinephrine in the brain. The resulting excessive amounts of dopamine release following cocaine use may be associated with increased anxiety and dysphoria rather than pleasurable and rewarding effects. This may lead to reduced cocaine use in the presence of disulfiram (George et al., 2000).

Studies conducted on the use of disulfiram in cocaine-dependent participants have been initially promising. One study randomized 20 cocaine- and opiate-dependent
participants into two groups, a treatment group that received daily doses of disulfiram and
a control group that received a placebo (George et al., 2000). All patients were being
treated for opiate dependence with buprenorphine, a drug that is used as an alternative to
methadone maintenance treatment. Participants in the disulfiram group achieved a
significantly higher total number of weeks of cocaine abstinence, had a higher number of
cocaine-negative urine samples overall, and reached a period of sustained abstinence
faster than did participants in the placebo group. Another study evaluated the use of
disulfiram concurrently with both cognitive behavioral therapy (CBT) and interpersonal
psychotherapy (IPT) by randomly assigning 121 cocaine-dependent participants to one of
four groups: disulfiram plus CBT, disulfiram plus IPT, placebo plus CBT, and placebo
plus IPT (Carroll et al., 2004). Both therapies were manual-guided and lasted for 12
weeks. Patients in both disulfiram groups reduced their cocaine use significantly
compared to the placebo groups, and patients in the disulfiram plus CBT group reduced
cocaine use significantly compared to the disulfiram plus IPT group. These results are
particularly important as they also demonstrate that CBT is a more effective
psychotherapy treatment for cocaine dependence than is IPT.

No other drug has received the amount of research attention that disulfiram has in
the treatment of cocaine addiction. However, as more information is discovered about
the neurological effects of cocaine use, drugs acting on neurochemicals other than
dopamine are being examined. Recent investigations of other drugs have concentrated on
those that increase the neurotransmitter glutamate as animal studies have shown that
cocaine interrupts the reward-related glutamate pathways in the brain and depletes
extracellular glutamate levels (Kalivas et al., 2003). The dysregulation of these pathways is thought to underlie aspects of cocaine dependence such as experience of the euphoric high, craving for the drug, and withdrawal symptoms (which include increased sleep, depressed mood, psychomotor retardation, overeating, decreased concentration, and lack of energy) (Dackis & O’Brien, 2003). Because the intense unpleasantness of withdrawal symptoms can cause a user to seek out the drug to eliminate withdrawal, it is useful to investigate drugs that would address withdrawal symptoms.

One such glutamate-enacting drug is modafinil, which is currently FDA-approved to treat narcolepsy. Modafinil’s effects are opposite those of cocaine withdrawal and include increased energy and wakefulness, decreased appetite, elevated mood and improved concentration and attention. One study tested modafinil’s efficacy by randomizing 62 cocaine-dependent outpatient participants into two groups – one receiving a daily dose of modafinil and one receiving placebo (Dackis, Kampman, Lynch, Pettinati, & O’Brien, 2005). Both groups also participated in a manualized cognitive behavioral therapy twice a week for eight weeks. Patients taking modafinil provided significantly more cocaine-free urine samples than the placebo group and were more likely to achieve significantly longer periods of sustained abstinence (greater than three weeks) than the placebo group (Dackis et al., 2005). More studies are required to replicate these results and provide evidence for the use of modafinil in treating cocaine dependence.

In reviewing the treatment literature for cocaine abuse, one common theme emerges: promising psychosocial, behavioral, and pharmacological treatment
methodologies exist, but more research needs to be conducted on how these approaches are specific to cocaine-dependent users. Additionally, it is important to provide evidence for treatments that will effectively aid users in maintaining abstinence after the end of treatment. As more information emerges from the complex neuroscience literature on the effects of cocaine on the brain’s neurochemical environment, it appears to be increasingly more likely that the most effective treatments for cocaine addiction will be a combination of cognitive, behavioral, and pharmacological approaches.

Predictors of Treatment Success

When someone who is dependent upon and abusing a substance seeks treatment, certain factors are more predictive of success in remaining abstinent from use than others. Of the studies that have shown significant results in post-treatment cocaine abstinence, several have identified cocaine abstinence achieved during treatment as the best predictor of cocaine abstinence at follow-up (Carroll et al., 1994; Higgins et al., 2000; Kosten et al., 1992; Higgins, Badger, & Budney, 2000). Additionally, pre-treatment abstinence predicts abstinence during treatment (Alterman et al., 1997; Budney, Higgins, Wong, & Bickel, 1996; Preston et al., 1998). Another general predictor of drug abstinence during and after treatment is the number of previous treatments, which means the individual has experienced more periods of abstinence and therefore the benefits of being abstinent (Means et al., 1989; Wong et al., 2004).

Different predictors emerge as significant for different populations according to the substance of abuse. One study examined gender differences in predictors of positive treatment outcome for substance abusers (including alcohol, heroin, cocaine,
amphetamine, and marijuana). Hser, Huang, Teruya and Anglin (2003) reported that positive predictors of drug abstinence for women include longer time in treatment and a greater readiness for treatment prior to starting it. Participants’ readiness for treatment was evaluated using a measure developed from Prochaska and DiClemente’s Stages of Change model (1992). The measure focuses on the participant’s degree of commitment to changing his or her addictive behavior in a treatment program by having the participant self-report (on a scale of zero to five) on three different factors: problem recognition, desire for help, and treatment readiness. The mean ratings for all participants in the study on all three scales were 4.0 or above, indicating a significant self-reported commitment to change. For men, longer treatment retention was also a positive predictor of abstinence; additionally, they experienced a better treatment outcome by being in residential treatment programs instead of outpatient programs. For both men and women, participation in 12-step self-help groups was positively related to maintaining abstinence after treatment (Hser et al., 2003).

Coping self-efficacy, defined as confidence in one’s ability to abstain from drug use in difficult situations, is another predictor of treatment outcome that has generality across substances, including cocaine. Several reports on cocaine-dependent patients have noted that coping self-efficacy measured at intake and at the end of treatment predicts abstinence during post-treatment follow-up measures (Coon, Pena, & Illich, 1998; Rounds-Bryant, Flynn, & Craighead, 1997). The more a person believes that he or she has the ability to cope successfully with the urge to use drugs, the more likely he or she is to maintain longer periods of abstinence. Greater coping self-efficacy also indicates a
greater ability to quickly recover from a relapse and to view the relapse as a minor setback instead of a full-fledged return to drug use (Coon et al., 1998).

McKay et al. (2005) examined predictors of outcome variables in treatment-seeking alcohol and cocaine abusers over a three-year period. They targeted eight predictors – general social support, social support specific to substance use, quality of living situation, perceived seriousness of alcohol or drug problem, self-efficacy levels, self-help group attendance, psychiatric severity, and employment status. For the cocaine abusers, only self-efficacy consistently predicted cocaine abstinence in the follow-up periods (at 6 months, 12 months, 30 months, and 36 months). There were some strong relationships between cocaine abstinence and general social support, self-help group attendance, and employment; however, these relationships were not statistically significant (McKay et al., 2005).

Because self-efficacy appears to be a promising predictor of drug abstinence, particularly for cocaine-dependent individuals, it is important to understand the concept of self-efficacy and how it applies to addictive behavior.

Social Cognitive Theory

Understanding what self-efficacy beliefs are and how they develop requires understanding its theoretical foundation. Self-efficacy is best understood in the context of social cognitive theory – an approach to understanding human cognition, action, motivation, and emotion that assumes that people actively shape their environments, rather than simply reacting to them (Bandura, 1986, 1997, 2001; Barone, Maddux, & Snyder, 1997). Social cognitive theory has at least four basic premises.
First, people have powerful cognitive or symbolizing capabilities that allow them to create internal models of experience. Because of this capacity, people can observe and evaluate their own thoughts, behavior, and emotions. They also can develop new plans of action, make predictions about outcomes, test and evaluate their predictions, and communicate complex ideas and experiences to others.

Second, environmental events, inner personal factors (cognition, emotion, and biological events), and behaviors are reciprocal influences. People respond cognitively, emotionally, and behaviorally to environmental events. Also, through cognition, people can exercise control over their own behavior, which then influences not only the environment but also their cognitive, emotional, and biological states.

Third, self and identity are socially embedded. They are perceptions (accurate or not) of one’s own and others’ patterns of social cognition, emotion, and action as they occur in patterns of situations. Because they are socially embedded, self and identity are not simply what people bring to their interactions with others; they are created in these interactions, and they change through these interactions. Fourth, the self-reflective capacities noted above set the stage for self-regulation. People choose goals and regulate their behavior in the pursuit of these goals. At the heart of self-regulation is the ability to anticipate or develop expectancies – to use past knowledge and experience to form beliefs about future events or states, one’s abilities, and one’s behavior.

Defining Self-Efficacy

Self-efficacy is generally defined as one’s set of beliefs concerning what one is capable of doing or accomplishing. An individual’s level of self-efficacy for different
activities and domains will vary according to the task; for example, one person might consider herself very capable as a writer (i.e., she has high self-efficacy in this area and believes she is capable of producing high-quality written work) but a poor cook (i.e., she has low self-efficacy and does not believe she can even boil an egg without it exploding). However, there are many more nuanced levels to this definition that help to shape our understanding of self-efficacy. Maddux and Gosselin (2001) set forth a discussion of the definition of self-efficacy that describes what it is as well as what it is not.

First, self-efficacy is made up of a series of beliefs about our abilities within a certain domain – whether or not those beliefs are founded in reality is not a criterion for inclusion into the concept of “self-efficacy.” Self-efficacy concerns beliefs about the ability to perform complicated activities in specific and circumscribed situations, and they are concerned not with what people believe they will do, but what they are capable of doing under those circumstances. Self-efficacy beliefs do not concern intentions or expected outcomes of a certain situation. For example, an athlete about to compete in an Olympic track and field event holds certain self-efficacy beliefs: that due to extensive athletic training and talent, she is physically and psychologically capable of completing the track event within a certain amount of time. The desire to win a medal is not part of her self-efficacy belief system. Her self-efficacy beliefs center around her ability to accomplish something, not on whether or not she will actually win the medal. An average psychologist, for example, placed in the same Olympic track and field event, is much less likely to hold the same self-efficacy beliefs about his ability to physically complete the event as the Olympic athlete has about her abilities. As mentioned before,
However, self-efficacy is concerned with beliefs about one’s abilities, not with actual or expected outcomes. So it is entirely possible that the psychologist believes himself to be capable of completing the event successfully, regardless of the actual probability of this occurrence. Maddux and Gosselin (2001) state: “as people contemplate a goal and approach a task, they consider what behaviors and strategies are necessary to produce the outcome they want, and they evaluate to what extent they can perform those behaviors and implement those strategies” (p. 5). These evaluations are what make up self-efficacy beliefs. Self-efficacy is not the same thing as the level of control that a person perceives that he or she has over a situation; rather, one’s beliefs about one’s capabilities can contribute to that perceived level of control.

Another important point in understanding self-efficacy is distinguishing it from self-esteem. Teasing these two concepts apart can at times be very difficult, as they are interwoven together. As Maddux and Gosselin (2001) state:

Self-concept is what people believe about themselves, and self-esteem is how people feel about what they believe about themselves. Self-efficacy beliefs are an important aspect of self-concept (e.g., Deci & Ryan, 1995), but self-concept includes many other beliefs about the self that are unrelated to self-efficacy, such as beliefs about physical attributes and personality traits. Self-efficacy beliefs in a given domain will contribute to self-esteem only in direct proportion to the importance one places on that domain (p. 6).
Therefore, referring back to the previous examples, if one does not place much importance on being a good cook or on being able to complete an Olympic event, then one’s self-esteem would not be negatively impacted by being unable to perform a task in these domains.

Self-Efficacy and Addictive Behavior

Self-efficacy beliefs play a major role in addictive behaviors, including substance abuse. Self-efficacy beliefs may influence the initiation of an addiction (if one perceives that there are advantages to substance use, then they begin to develop self-efficacy beliefs about their ability to initiate substance use), the change process involved in stopping substance use, and the ability to maintain abstinence from the substance. In fact, self-efficacy has been integrated into a general theory of behavioral change (Prochaska & DiClemente, 1992) that is often applied to treatment models for substance abuse to ascertain at what stage of readiness for change patients are and how that will affect their treatment adherence and effectiveness.

DiClemente and colleagues originally categorized self-efficacy according to each of the five target behaviors in addiction treatment (DiClemente, Fairhurst, & Piotrowski, 1995). The first category in their taxonomy is coping self-efficacy, which focuses on the individual’s belief that he or she will be able to replace the detrimental coping method (i.e., substance use) with a more positive coping method during times of emotional distress. The second is treatment behavior self-efficacy, which involves the individual’s belief in his or her ability to engage in behaviors that are required by their treatment plan. Third is recovery self-efficacy, or the ability to regain abstinence after a relapse. The
fourth is control self-efficacy, which involves the individual’s belief that he or she can control and modulate his or her addictive behavior in situations where the temptation to overindulge in the behavior is present. The final category is abstinence self-efficacy, the individual’s confidence in his or her ability to abstain from substance use in various environments or situations that typically trigger substance use (DiClemente et al., 1995).

Marlatt, Baer, and Quigley (1995), however, comment that DiClemente’s taxonomy of self-efficacy appraisals suffers from some significant limitations, such as the fact that the categories involve treatment and relapse prevention but exclude self-efficacy as a factor in initiation of the addictive behavior. For example, an individual’s self-efficacy beliefs regarding his ability to properly inject himself with a needle will play a role in whether or not he chooses to begin taking drugs intravenously. Additionally, the categories overlap each other in that treatment behavior self-efficacy would subsume other types since treatment often includes developing coping skills, strategies to recover from relapse, and methods for dealing with desires to use the substance. Marlatt et al. further state that the “last two categories, control and abstinence self-efficacy, reflect different treatment goals – whether to seek abstinence or use the substance in controlled moderation” (1995, p. 291).

Marlatt and colleagues offer another taxonomy that builds upon DiClemente’s proposal. Their typology includes five self-efficacy categories for two stages: initiation and subsequent change of addictive behaviors. It begins with two types of self-efficacy in the initiation phase. The first is resistance self-efficacy, beliefs about an individual’s ability to resist using prior to first use of a substance, and the second type is harm-
reduction self-efficacy, beliefs about one’s ability to reduce the risks of using after the initial use. The last three types of self-efficacy are in the behavior change stages. Action self-efficacy is belief in one’s ability to achieve the desired goal of abstinence (or, for alcohol or food, controlled use). Fourth is coping self-efficacy, belief in the ability to cope positively with relapse crises, and finally there is recovery self-efficacy, involving the ability to use positive coping skills after relapse episodes (Marlatt et al., 1995).

Most of the research on self-efficacy’s role in addictive behavior and treatment has focused on cigarette smoking and alcohol use. One smoking cessation study assessed 630 smokers who identified themselves as being ready to quit smoking immediately (Gulliver, Hughes, Solomon, & Dey, 1995). The individuals participated in a baseline intake interview, which included a self-efficacy measure, and all participants quit smoking within 2 to 10 days after the interview. Participant follow-up included further measures of self-efficacy and smoking behavior at 7, 14, and 30 days after the initial interview. Data on smoking behavior was collected from participants regularly until 180 days after the intake. Although different variables predicted relapse at different time-points, self-efficacy was the only variable to consistently predict relapse across time.

However, another smoking cessation study produced different results on the ability of self-efficacy to predict later abstinence. Baer, Holt, and Lichtenstein (1986) examined 146 smokers who were participating in six weekly, two-hour group sessions teaching cognitive behavioral strategies with the goal of quitting smoking by the fourth session. Self-efficacy ratings were measured by administering the Confidence Questionnaire, where participants are asked to rate the probability (on a percentage scale
of 1 – 100) that they would be able to resist the urge to smoke in the future in 46 specific situations. A confidence score was then derived by taking the average of the item responses. These ratings were taken one week before treatment and at the end of the treatment program. Follow-up self-efficacy ratings were taken at one, two, three, and six months after the end of treatment, but only from participants who reached abstinence or near-abstinence (defined as no more than one cigarette per day). At these time points, self-efficacy was rated by having participants rate their confidence in four situations, selected from the original questionnaire, that were found to represent common relapse situations. The researchers averaged the responses to the four situations to achieve an overall self-efficacy score. Results indicated that post-treatment self-efficacy ratings for ability to resist smoking predicted future abstinence, until the researchers controlled for the effects of prior abstinence, after which self-efficacy was no longer a significant predictor. However, the authors did find that self-efficacy, measured during and after treatment, predicted future smoking rate (i.e., how much smoking increased from abstinence levels) even when it could not predict whether or not a person would remain abstinent from smoking in the future.

One major study of treatment for alcohol addiction that examined self-efficacy as a predictor of abstinence is Project Matching Alcohol Treatments to Client Heterogeneity (Project MATCH). Project MATCH was a large, multisite investigation designed to test 16 empirically-based hypotheses that matched one or more pretreatment client attributes interacting with treatment assignment (cognitive behavioral therapy, motivational enhancement therapy, or 12-step facilitation) in the prediction of post-treatment
abstinence. The original analysis of MATCH data indicated that all three treatments were equally effective in the treatment of alcoholism, but only one of the 16 hypotheses was supported. Because Project MATCH was, at the time, “the largest, statistically most powerful, psychotherapy trial ever conducted” (Project MATCH Research Group, 1997, p. 25) with carefully formulated, empirically-based hypotheses, it was an immense disappointment to the research community that almost no empirical evidence emerged in support of those hypotheses. After publishing the initial results and hearing the response from others in the field, the Project MATCH Research Group (1999) stated: “[I]f only we had examined the data in another way, the results might have been different” (p. 69).

In response to that call, Witkiewitz, van der Maas, Hufford and Marlatt (2007) re-examined the original Project MATCH matching hypothesis that clients with lower baseline self-efficacy would have better outcomes if they received cognitive-behavior therapy (CBT) as compared with those who received motivation enhancement therapy (MET). Individuals higher in self-efficacy were hypothesized to have good outcomes, regardless of the treatment received. In the original study (Project MATCH Research Group, 1997), the results supported the significant relationship between baseline self-efficacy and post-treatment drinking throughout the one year follow-up, although the self-efficacy matching hypothesis was not supported. Self-efficacy was measured by the confidence score of the Alcohol Abstinence Self-Efficacy Scale (AASC), a 20-item self-report measure of a person’s confidence in their ability to abstain from drinking in specific situations with responses given on a 5-item Likert scale from “not at all confident” to “extremely confident.”
In Witkiewitz et al.’s growth mixture analyses, unlike the original Project MATCH results, evidence was provided in support of the original matching hypothesis: individuals with lower self-efficacy who received cognitive behavior therapy drank far less frequently than did those with low self-efficacy who received motivational therapy (2007). Additionally, Witkiewitz et al.’s analyses identified self-efficacy as a significant predictor of lapse dynamics. Specifically, changes in self-efficacy, as well as the absolute levels of self-efficacy, following treatment were significantly related to outcome, particularly in distinguishing the most frequent drinking class from the inconsistent and infrequent classes. Baseline and 6-month self-efficacy were the best predictors of class membership, with higher self-efficacy predicting a greater likelihood of membership in the infrequent drinking class, in comparison to both the frequent and inconsistent drinking classes. These results help to establish self-efficacy as a significant part of the dynamics of addiction treatment.

A study of predictors of treatment response to a correspondence intervention for alcohol abuse focused on the predictive utility of self-efficacy beliefs (Kavanagh, Sitharthan, & Sayer, 1996). The correspondence intervention involved regular mailings to participants outlining cognitive behavioral techniques for controlling drinking, including goal setting for alcohol use, problem solving and planning for high risk situations, relapse prevention and planning an alcohol-free lifestyle. The treatment also involved follow-up mailings encouraging continued use of the strategies and re-engagement after a relapse. One hundred twenty one alcohol-dependent participants were randomly assigned to either the correspondence intervention group or a minimal
care group (that received information about the effects of alcohol and encouraged self-monitoring). Treatment lasted for six months, and follow-ups were conducted for another six months beyond treatment. Assessments of self-efficacy were obtained at intake (pre-treatment), six months, and 12 months. Pre-treatment self-efficacy levels at intake were predictive of abstinence at 4 months (during treatment) and at 12 months (6 months after treatment ended). Pre-treatment self-efficacy also predicted retention in the study, both during and after treatment. Additionally, participants with the lowest alcohol intake and highest self-efficacy scores at baseline had the highest abstinence levels at 12 months. However, self-efficacy measured at the end of the treatment period did not predict abstinence during the follow-up period. Another study of self-efficacy levels and outcome expectancies in 100 inpatient alcoholic individuals partially supported Kavanagh et al.’s results (Solomon & Annis, 1990). In this study, the level of confidence in the ability to resist drinking heavily, measured at intake into treatment, was strongly predictive of the level of alcohol consumption at follow-up three months after the end of treatment.

In order to address the idea that self-efficacy may predict future abstinence at certain points in treatment and not at other points, Reilly et al. (1995) examined changes in self-efficacy during methadone maintenance treatment. The authors examined 74 opiate-dependent participants in a 180-day methadone detoxification treatment to see if self-efficacy levels varied according to the methadone dosing schedule, which consisted of an initial dose administered at intake, stable doses of methadone for 100 – 120 days (stabilization phase), and a 60 – 80 day detoxification where doses were tapered down to
zero (taper phase). Self-efficacy scores were collected at intake, at 30, 60 and 90 days into the methadone stabilization period, and at 30, 60, and 90 days into the subsequent detoxification phase. Self-efficacy was measured using the Drug-Taking Confidence Questionnaire, modified for heroin use, which lists 50 high-risk situations common to various addictions and asks the respondent to rate their confidence in their ability to resist using drugs in that situation on a percentage scale of 0 – 100. The mean rating across the 50 situations was used as the measure of self-efficacy for drug resistance. Results showed that changes in self-efficacy coincided with changes in heroin use across the three stages of treatment: self-efficacy increased between intake and the start of the stabilization phase while heroin use decreased, self-efficacy did not change across the stabilization phase while heroin use gradually decreased, and self-efficacy gradually decreased across the taper phase while heroin use increased. The authors also found that while self-efficacy at intake did not predict heroin use in the stabilization or taper phases, self-efficacy at the beginning of the stabilization phase predicted abstinence during that phase, and self-efficacy at the beginning of the taper phase predicted abstinence during that phase (Reilly et al., 1995).

These studies show that self-efficacy can be an important predictor of abstinence, although results are mixed, and it appears that the predictive ability of self-efficacy varies across time in treatment. More research is necessary to replicate past results, to specify the predictive ability of self-efficacy at various stages of addiction and treatment, and to understand how self-efficacy can play a role in drug abuse treatment.
Stages of Change in Addictive Behaviors

Theory and research show that self-efficacy beliefs are embedded within a process-of-change cycle that is relevant to addiction and its treatment. DiClemente and Prochaska (1982) developed a linear “stages of change” model using data from a study of smokers who were attempting to quit smoking. Whether the smokers were attempting to quit on their own or through a professional treatment program, all participants were perceived as progressing through stages that the researchers labeled precontemplation, contemplation, preparation, action, and maintenance. This model was widely accepted and supported by many different research studies on individuals who were attempting to change some behavior, regardless of whether they were making the attempt on their own or presenting for outpatient psychotherapy. These stages of change were ascertained from two self-report measures: one categorical measure that uses mutually exclusive questions to assess the current stage of the respondent, and a continuous measure which produces scales for each of the five stages (Prochaska, DiClemente, & Norcross, 1992).

In the precontemplation stage, the individual has no intention to change his behavior because he does not conceive of the fact that he has a problem, and he is resistant to any indication from others that he has a problem. Prochaska et al. (1992) offer a quote from G.K. Chesterton (1935) that describes the mindset of a person in this stage: “It isn’t that they can’t see the solution. It is that they can’t see the problem” (p. 1103). An individual in precontemplation is not seriously planning to make any changes in their behavior in the near future (the next six months).
In the contemplation stage, an individual has acknowledged that a problem exists and is seriously considering addressing the problem but has not made a commitment to do so. People may remain in this stage for long periods of time, although they are put into this category if they indicate on the continuous measure that they are seriously planning to change their behavior in the next six months. Delays may occur as people struggle with the idea of losing the addiction and become overwhelmed by the amount of effort it will take to overcome it. Often they are weighing the positive reinforcement they receive from using a substance against the negative consequences that such use inflicts on their lives. The hallmark of this stage is serious consideration of problem resolution (Prochaska et al., 1992).

In the preparation stage an individual is combining the intention to stop substance use with some small behavioral changes toward that end. In this stage an individual is planning to take action to address the addiction within the next month and has done so unsuccessfully within the past year. The preparation stage is a time where individuals are making small changes in their substance use, such as reducing the amount or delaying use, but these changes are not yet useful enough to qualify as an effective action.

The action stage is where a commitment of time and energy must be made. It is the stage during which the individual is modifying substance use behavior with the goal of overcoming the addiction. Typically abstinence is the goal the individual is working towards in this stage, and he or she must have successfully altered the addictive behavior for a period ranging from one day to six months. Here the individual is making the most visible efforts to change; however, this stage is not equated with complete change.
because it does not address maintenance. The hallmarks of this stage are modification of
the target behavior to an acceptable criterion (or abstinence) and making significant overt
efforts to change.

In the maintenance stage, an individual is addressing relapse prevention and is
experiencing the positive reinforcement from the gains made during the action stage.
Maintenance means that the individual is not only no longer engaging in the addictive
behavior; she is consistently engaging in behaviors that are incompatible with the
addiction (such as maintaining meaningful employment, socializing with drug-free
friends, and avoiding environments that foster or are conducive to the addictive
behavior). Individuals in this stage must be free of the addictive behavior for six months,
and this stage can last for an indeterminate amount of time, perhaps even a lifetime. The
hallmarks of this stage are stabilizing behavior change and avoiding relapse (Prochaska et

As these stages of change apply to addictive behaviors, a cyclical or spiral model
must be used instead of the linear model. As reported by Scott, Dennis, and Foss (2005),
relapse is most often the rule, not the exception, of substance abuse and treatment. These
authors cite statistics from the United States Office of Applied Studies stating that 60% of
people in public substance abuse treatment in 1999 had participated in it previously
(including 23% for the second time, 13% for the third time, 7% for the fourth time, 4%
for the fifth time, and 13% for six or more times). A growing body of studies also
indicates that after discharge from a substance abuse treatment facility, there is often a
pattern of relapse and readmission, particularly when an individual suffers from a
comorbid psychiatric condition (Angst, Sellaro, & Merikangas, 2002; Dennis, Scott, & Funk, 2003; Dennis, Titus, White, Unsicker, & Hodgkins, 2003). Therefore, individuals often progress through some or all of the stages only to relapse and regress back to an earlier stage, where they may remain for various periods of time. However, the spiral model does not imply that relapse is an endless cycle as many people learn from their previous mistakes and experience more success in post-relapse treatment (Prochaska et al., 1992). This conceptualization does lend itself, however, to the idea of a treatment model of relapse prevention in which self-efficacy can play a major role.

Self-Efficacy and a Model of Relapse Prevention

The importance of self-efficacy in substance abuse treatment, the stages of change model, and the problems inherent in relapse are all integrated into one model of relapse prevention proposed by Marlatt and Gordon (1985). It is worthwhile to study this model for many reasons, among which is to see how self-efficacy is emphasized as a critical part of the addiction recovery process. Marlatt and Gordon’s Relapse Prevention model, which is based on social-cognitive psychology, describes a conceptual model of how relapse occurs and provides cognitive behavioral strategies that can be used to prevent or limit relapse episodes. The model includes two factors that they believe contribute to relapse episodes: immediate determinants, such as high-risk situations, coping skills, and outcome expectancies, and covert antecedents (lifestyle factors, cravings). The cognitive behavioral strategies are then used by the client and therapist to identify the characteristics of situations in which relapse is likely (or has already happened), to see what the client’s response is to these situations and how the client’s lifestyle contributes
to increased exposure to high risk situations. This model was originally developed based upon work with alcoholic individuals and therefore it is applicable to the same treatment/relapse cycle typical of substance abuse in general (Larimer, Palmer, & Marlatt, 1999).

In this model, treatment begins with an assessment of situations that are associated with imminent relapse, even after a period of abstinence. These specific factors were developed based on research with inpatient alcoholics (Marlatt, 1996) and include situations of interpersonal conflict and negative emotional states (which accounted for more than half of all relapse episodes in Marlatt’s analysis), social pressure or being around others who are drinking (which accounted for more than 20% of all relapse episodes in the analysis), positive emotional states (i.e., celebrations), exposure to alcohol-related cues, and desire to test willpower.

A person’s response to a high-risk situation, or their coping behavior, is critical in determining whether or not they relapse. One study examined predictors of relapse in 122 individuals seeking outpatient alcohol treatment (Miller, Westerberg, Harris, & Tonigan, 1996). Results showed that it was not simply exposure to high-risk situations that predicted relapse, but the manner in which the participants coped with the situation. Successfully coping with a high-risk situation (remaining abstinent) in turn is assumed to increase self-efficacy for coping with risky situations. This is illustrated in a study by Wong and colleagues (2004), who used the cocaine-modified Situational Confidence Questionnaire (SCQ), a measure of self-efficacy, to examine the predictive abilities of self-efficacy (measured at baseline, six weeks, 12 weeks, and 24 weeks) on abstinence.
during 24 weeks of treatment (using CRA and vouchers) and at a six-month post-treatment follow-up assessment for 126 participants. They found that self-efficacy measurements at all time-points did significantly correlate with concurrent abstinence but none were a significant predictor of later abstinence after controlling for prior abstinence. Wong et al. also found that prior abstinence was a significant predictor of future levels of self-efficacy. Abstinence achieved during treatment weeks 1 – 6, 7 – 12, and 13 – 24 predicted SCQ scores at the 6-week, 12-week, and 24-week assessments, respectively. Abstinence achieved throughout the treatment period significantly predicted confidence at the six-month follow-up.

The relapse prevention model posits that “people with low self-efficacy perceive themselves as lacking the motivation or ability to resist drinking in high-risk situations” (Larimer et al., 1999, p. 153), and studies of smoking cessation have shown that individuals with low self-efficacy for maintaining nicotine abstinence report even lower coping and abstinence self-efficacy when they experience situations where there is a strong urge to smoke or negative affect is involved (Gwaltney, Shiffman, & Sayette, 2005).

Two additional factors are thought to increase the probability of relapse; one is positive outcome expectancies, or anticipation of positive effects after substance use. One innovative study had 305 smokers who achieved initial abstinence record on handheld computers multiple daily ratings of their levels of abstinence self-efficacy, positive smoking outcome expectancies, and any incidents of smoking (Gwaltney, Shiffman, Balabanis, & Paty, 2005). The investigators found that positive outcome
expectancies, along with low abstinence self-efficacy, predicted the occurrence of the first lapse (discrete episode of substance use after a period of abstinence) one day prior to the lapse. However, positive outcome expectancies were not significant predictors of a full-blown relapse episode.

The second factor proposed to be predictive of relapse is the abstinence violation effect, or the individual’s emotional response to an initial lapse and the factors to which the individual attributes the lapse. Marlatt and Gordon (1985) proposed that attribution of the lapse to internal, stable, global personal failure, thus triggering guilt and negative emotions, would make relapse more likely. This is in contrast to people who attribute the lapse to an inability to cope effectively with some specific situation and thus may develop more effective coping skills for the future. Research on the abstinence violation effect has produced varying results due to inconsistency in operationalizing and assessing the effect in research participants, although generally research supports the idea that attributions, perceived control, and affect are important predictors of whether or not a lapse becomes a full-blown relapse (Wheeler, George, & Marlatt, 2006).

Figure 1 illustrates Marlatt and Gordon’s model of the chain-reaction of behavior, cognitions and emotion that can lead to either an increased or decreased probability of relapse (Larimer et al., 1999).
The relapse prevention model offers a variety of cognitive and behavioral approaches that address each step in the relapse process. These approaches are used in multiple sessions between the client and therapist and include lapse-management strategies, stimulus-control and urge-management techniques, coping skills, and self-efficacy enhancement, among others.

Lapse-management strategies focus on how a client reacts to lapsing. These strategies include client-therapist contracts that limit the extent of substance use, evaluation of the factors that contributed to the lapse, and the client and therapist collaborating to provide the client with simple written instructions to refer to in the event of a lapse.

Figure 1. The cognitive-behavioral model of the relapse process.

Stimulus-control techniques encourage the client to remove all materials and items directly associated with substance use from his home, car, office, etc. Stimulus-control techniques also involve the client learning to avoid situations or physical environments (such as social events or particular places or rooms) that are associated with substance use.

Urge-management techniques address the client’s desire to use or craving for the addictive substance. Therapists teach clients to anticipate and accept urges to use as normal parts of the recovery process. Clients are encouraged to imagine urges as a wave swelling up from the ocean and crashing upon the beach – the urge peaks and subsides and the client does not have to get pulled under with it.

Development of general coping skills is also important. The therapist and client collaborate to identify warning signals for relapse, such as stress and lack of balance in the client’s lifestyle and to develop appropriate responses to high-risk situations, such as assertive communication skills, refusing drinks in social situations, anger management skills, medication, and positive self-talk.

The Relapse Prevention model also enhances self-efficacy through techniques such as emphasizing the collaboration of therapist and client in the client’s recovery, framing the changing of the client’s addictive habit as a process of skill acquisition rather than a monumental effort of willpower, and setting smaller, more manageable treatment goals rather than focusing on one goal of lifelong abstinence (Bandura, 1977). The essential idea is that experiencing success in achieving small goals (such as making it through one day without a lapse or successfully coping with an upcoming high-risk
situation) and feeling empowered in one’s own recovery serve to greatly enhance a client’s feelings of self-efficacy toward successfully mastering the skills needed to change (Larimer et al., 1999).

Much research has been conducted on the effectiveness of the Relapse Prevention model as it applies to treatment of different substances of abuse (e.g., alcohol, smoking, marijuana, heroin) (Rawson, Obert, McCann, & Marinelli-Casey, 1993). One meta-analytic study examined 26 published and unpublished studies with a total of 9,504 participants to determine the overall effectiveness of relapse prevention treatment (Irvin, Bowers, Dunn, & Wang, 1999). Results indicated that relapse prevention is generally effective and is most effective when applied to alcoholism or polysubstance abuse. Additionally, its effectiveness is increased when combined with pharmacotherapy.

Another review of over 24 controlled clinical trials found that the relapse prevention approach is effective on substance use when it is compared with no treatment control groups (Carroll, 1996). When compared to usual treatment attention and discussion approaches, relapse prevention was significantly more effective than usual treatment in only 4 out of 10 studies. Follow-up findings were more positive with 7 out of 11 studies indicating that relapse prevention techniques maintained abstinence improvement and were associated with fewer relapse episodes post-treatment. The meta-analysis concluded that although relapse prevention techniques could not be proven to be superior to other forms of effective substance abuse treatment, relapse prevention may be particularly useful in reducing the intensity of relapse episodes and in maintaining
abstinence for users with more severe substance abuse problems and those who have comorbid psychiatric diagnoses (Carroll, 1996).

The Relapse Prevention treatment model was adapted specifically to cocaine abuse after the increased popularity of cocaine in the United States in the 1980s. One study group at Yale University conducted an evaluation of the effectiveness of 12 weeks of relapse prevention treatment versus 12 weeks of interpersonal psychotherapy (IPT) in 42 cocaine-dependent participants (Carroll, Rounsaville, & Gawin, 1991). Although differences between the two groups did not reach clinical significance, participants in the relapse prevention group were more likely to achieve three or more weeks of continuous abstinence, to complete treatment, and to be considered “recovered” at the time of treatment termination. When participants were classified according to severity level of substance abuse, statistical differences emerged in the subgroup of more severe users. In this group, high-severity relapse prevention participants were significantly more likely to achieve abstinence and to be classified as “recovered” at the time of treatment termination than high-severity IPT participants. Treatment results in the less severe substance use groups were comparable between both treatment modalities (Carroll et al., 1991).

Self-Efficacy Research and Cocaine Addiction

As we have seen from our discussion of self-efficacy’s role in addictive behaviors and of the development of the Relapse Prevention model, most of the research concerning self-efficacy and the process of change from addiction to abstinence has been conducted with alcoholism and cigarette smoking. Many researchers are calling for additional
research in self-efficacy and substance abuse, particularly for cocaine abuse. According to Mc Kay, et al. (2005), there have been relatively few studies exploring long-term predictors of abstinence in cocaine users compared to alcoholics or even opiate users. DiClemente, Fairhurst, and Piotrowski, state that few studies have focused specifically on drug abuse and self-efficacy (1995). Bandura agrees that the role of self-efficacy in drug use has received much less attention than in alcohol use (1997).

To address this lack of research on cocaine use and self-efficacy, the current study examined the impact of self-efficacy beliefs on cocaine abstinence by performing secondary analyses on data from a study published in 2004 by Silverman, Robles, Mudric, Bigelow and Stitzer. Silverman et al. examined the effects of voucher-based abstinence-reinforcement contingencies for cocaine use among participants who were in a methadone maintenance treatment program. Their study exposed participants ($N = 78$) to a yearlong program of one of three experimental conditions: (1) a usual care control condition (“usual care”) where participants received standard services including methadone dosing and weekly individual and group counseling; (2) a take-home, methadone-reinforcement contingency condition (“take-home only”) where, in addition to standard services, participants earned take-home methadone doses by providing three consecutive opiate- and cocaine-negative urine samples; and (3) a take-home, methadone reinforcement plus voucher reinforcement condition (“take-home plus voucher”) where, in addition to standard services and take-home methadone contingencies, the participants could earn a monetary voucher for each cocaine-free urine they provided.
The study consisted of four phases of treatment (see Figure 2). The first was a 10-week baseline period during which participants were administered doses of methadone and their urine samples were tested three times a week for cocaine and heroin. In this first phase, no participants were required to remain abstinent from cocaine or heroin. Participants were also given weekly individual and group counseling addressing behavioral management of drug use (e.g., using reinforcement techniques with patients to decrease drug use, improve family and social relations, find employment, and decrease illegal activities; McLellan, et al., 1993). In the second phase, participants were randomly assigned to one of the three treatment groups: usual care, take-home only, or take-home plus voucher. The participants were then given 52 weeks of methadone maintenance treatment during which they were also exposed to their treatment condition. After the 52-week period, the voucher intervention was discontinued, but all participants were given an additional nine weeks of methadone maintenance treatment, during which post-intervention effects, such as frequency of drug use and reports of drug cravings, were studied. The last phase of the study was a 90-day post-study disposition period during which all participants were either transferred to other methadone maintenance programs or their methadone dose was titrated down to zero milligrams.
During the study, a total of 29 participants out of the original 78 did not complete treatment due to various reasons (stopped attending, were incarcerated, were discharged due to violation of program rules). Their data, however, was included in the final analysis of the intent-to-treat sample with all missing urine samples considered positive. Because treating the missing samples this way could overestimate participants’ drug use, the authors conducted secondary analyses where, for each participant, they calculated the percentage of urine samples negative for each drug during the 10-week baseline period and during each of the four consecutive 13-week blocks of the intervention period without replacing values for the missing samples. Those values then were analyzed with multilevel analyses, with group and time as factors, and post hoc tests were used to compare the mean for each group with the mean for each of the other groups at each of the five time points. The results of the secondary multilevel analyses were generally consistent with the primary analyses and the authors therefore did not present the results.
of these secondary analyses for the intent-to-treat sample. See Figure 3 for the pattern of participant recruitment, assignment, and attrition in the study.

Data were collected weekly during each phase of the study and included urine samples (provided every Monday, Wednesday, and Friday and tested for cocaine and opiates) and a battery of assessments. The assessment battery was administered one day per week throughout the baseline, treatment evaluation, and post-intervention periods,
and then again at 26 and 52 weeks after the end of the intervention evaluation period.

The weekly assessment battery included six computerized self-report questionnaires: the Intravenous Drug Use Questionnaire (Silverman, et al., 1999); the Nonintravenous Drug Use Questionnaire (Silverman et al., 1999); the Lifestyle Changes Questionnaire, which asks participants what types of behaviors they engaged in to stop, reduce or avoid cocaine/heroin use in the past week (Silverman et al., 1999); the Visual Analog Questionnaire, which asks questions about the participants’ methadone dose and their levels of cocaine and heroin craving (Silverman, et al., 1999); the Beck Depression Inventory (Beck & Steer, 1987); the Drug Availability Questionnaire, which assesses where and how the participant has access to drugs (Silverman, et al., 2004); and a brief questionnaire that assessed each participant’s interest in initiating or sustaining cocaine abstinence.

In addition to the weekly assessments, a major battery of assessments was administered at six different time points during the study: the participant’s day of intake to the baseline period of methadone maintenance, Week 8 of the baseline period, Weeks 26 and 52 of the intervention period, and Weeks 26 and 52 after the scheduled end of the post-intervention period. The battery included urine collection, the Addiction Severity Index, which assesses a person’s substance abuse treatment needs (McLellan et al., 1985), the Pleasant Events Scale, which assesses the number and frequency of positive events and behaviors a person has recently experienced (MacPhillamy & Lewinsohn, 1982), the Situational Confidence Questionnaire (SCQ), which asks a person to rate their ability to resist using cocaine in a variety of situations (Annis & Graham, 1988), and an
HIV risk assessment (King, Kidorf, Stoller, & Brooner, 2000). During the third week of the baseline period, the Structured Clinical Interview for DSM–III–R (Spitzer, Williams, Gibbon, & First, 1992) was conducted with each participant to ascertain whether or not the participant met the criteria for any other psychiatric diagnoses. See Figure 4 for a graphic representation of the time points at which the major batteries were administered.

![Figure 4. Major Batteries of Assessment Time Points](image)

Results supported the authors’ hypotheses that the highest and most consistent rates of abstinence during the treatment intervention period would be obtained by participants in the take-home plus vouchers condition, followed by the take-home condition and finally the usual care condition. A repeated-measures analysis of variance (ANOVA) conducted on cocaine urinalysis results in the intent-to-treat sample revealed that during the 10-week baseline intervention, there were no significant differences between the three treatment groups. During the 52-week intervention, participants in the
take-home plus vouchers group achieved significantly more cocaine abstinence than those in the usual care control group. Take-home plus vouchers participants also achieved more cocaine abstinence than the take-home only group in the final 13-week block. Additionally, cocaine abstinence in the take-home only group increased significantly compared to the usual care control group during the first three 13-week blocks of the intervention, but not during the last 13 weeks. Opiate abstinence results were similar to cocaine abstinence results except that opiate abstinence in the take-home only group did not differ from the usual care control group. Abstinence results when both substances are considered were identical to cocaine abstinence (Silverman et al., 2004).

The researchers also performed analyses on data from participants who completed the entire study. Out of the original total of 26 participants in each treatment group, at the end of the study there remained 14 participants in the usual care control group, 16 participants in the take-home only group, and 19 participants in the take-home plus voucher group. Urinalysis using repeated-measures ANOVAs for study completers yielded similar results to the intent-to-treat analysis, except that abstinence rates were higher in completers. Abstinence rates in completers during the post-intervention period for cocaine, opiates, and both combined were significantly higher for the take-home plus vouchers group than for the other two groups.

An analysis of individual patterns of drug abstinence revealed that 42% of participants in the take-home plus vouchers group achieved over six months of sustained cocaine abstinence, compared to 8% of participants who achieved the same duration of
cocaine abstinence in the take-home only group and none in the usual care control group. Opiate abstinence generally paralleled cocaine abstinence although rates of opiate abstinence were typically higher than cocaine (Silverman et al., 2004).

The take-home plus voucher group had longer periods of sustained abstinence from cocaine, opiates, and both combined when compared with the other two groups (average of about 19 weeks for the intent-to-treat group). The average sustained abstinence for both substances was 2.3 weeks for the usual care control group and 6.3 weeks for the take-home only group (Silverman et al., 2004).

An encouraging and particularly clinically relevant finding was the 100% rate of abstinence from both opiates and cocaine that participants in the take-home plus vouchers group were able to achieve, particularly in the last half of the 52-week intervention. For example, in the take-home plus vouchers group, approximately 45% of participants were completely cocaine and opiate abstinent for the third 13-week block of the study, and 40% of participants were able to sustain those results in the fourth (and last) 13-week portion. In contrast, during the third 13-week block, approximately 5% of the take-home only and usual care control participants were 100% cocaine and opiate abstinent. These differences between the three groups were significant both the intent-to-treat sample as well as completers (Silverman et al., 2004).

Urinalysis results at the end of the 52-week treatment period show that the take-home only group had significantly more cocaine-free urine samples than did the other two groups and more opiate-negative urine samples than did the usual care control group. However, urinalysis results revealed no differences on abstinence levels between the
three groups at the follow-up time points of 26 weeks and 52 weeks after the end of the intervention period (Silverman et al., 2004).

Finally, analysis of the self-report data obtained during the major assessments was inconclusive, although there were significant ($p < .05$) group effects on (a) self reports of the total number of cocaine injections per week; (b) the number of times that participants reported using injection equipment after someone else; (c) the number of times participants smoked crack cocaine; (d) how often participants avoided drug-using friends or relatives, found new things to do, spent time with people who did not use drugs, or looked for a job; and (e) how many times someone offered to sell or give heroin or cocaine to them (Silverman et al., 2004).

**Current Study Hypotheses**

Self-efficacy has emerged as a predictor of long-term treatment success (DiClemente, C.C., Fairhurst, S.K., & Piotrowski, N.A., 1995; Gulliver, Hughes, Solomon, & Dey, 1995; Kavanagh, Sitharthan, & Sayer, 1996; Reilly et al., 1995; Solomon & Annis, 1990), particularly in cocaine-using patients (Coon, Pena, & Illich, 1998; Rounds-Bryant, Flynn, & Craighead, 1997; McKay, et al., 2005). In order to address the absence of cocaine outcome studies and to further explore the role of self-efficacy in drug addiction, this study used data from the study conducted by Silverman and colleagues (2004) to focus on the role of self-efficacy in cocaine use and abstinence. The data from this study provided an excellent opportunity for further research considering the extraordinary cocaine abstinence outcomes that were achieved. The data that were analyzed include urinalysis outcomes as well as data from the Situational
Confidence Questionnaire (SCQ) (Annis & Graham, 1988), which were collected but not included in the original analysis. The SCQ was originally chosen as the measure of self-efficacy because it is a widely-used measure of self-efficacy in alcoholics, it was easily modified for use with cocaine dependent patients, and it has acceptable psychometric properties for cocaine abusers (Wong et al., 2004).

More specifically, the following hypotheses were tested by the current analyses:

a) Pre-treatment self-efficacy, as measured by the SCQ, will be a significant predictor of cocaine abstinence over the course of the entire 52-week intervention period,

b) Pre-treatment self-efficacy will be a significant predictor of cocaine abstinence at the last 13-week block of the study (weeks 40 – 52), and

c) Pre-treatment self-efficacy will be a significant predictor of the time period of complete abstinence that some participants were able to achieve in the last 13-week block of the study.
METHOD

Permission to access the data was obtained from the primary investigator of the original study and approved for use by the Johns Hopkins Medical Institutions Institutional Review Board and the George Mason University Human Subjects Review Board.

Participants

In the original study, participants ($N = 78$) were selected from newly admitted patients to a methadone treatment program in Baltimore, Maryland, who enrolled between June 1996 and January 1998. The methadone program accepted applicants who (a) were 18–50 years old, (b) provided an opioid-positive urine sample at intake, (c) reported regular opioid use (70% of days) in the 30 days before intake and for half of the year preceding intake, (d) had prior methadone treatment at least one year before intake, (e) had not been in a study that evaluated voucher reinforcement, and (f) showed objective evidence of injection drug use (e.g., needle tracks and fresh injection sites). Applicants were excluded if they were pregnant, had a medical condition for which methadone treatment was contraindicated, or had a serious psychiatric illness (e.g., schizophrenia). Participant characteristics of the three groups were compared using chi-square tests for dichotomous variables and analyses of variance for continuous variables.
There were no significant differences between groups on these variables (Silverman, et al., 2004).

Participant demographic information gathered at intake to the original study is presented in Table 1 and is organized within each treatment condition. There were no significant differences between groups on these measures.
Table 1

*Selected Demographic Characteristics of Study Participants*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Usual Care Control ($n = 26$)</th>
<th>Take-home Only ($n = 26$)</th>
<th>Take-home Plus Voucher ($n = 26$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age in years (SD)</strong></td>
<td>37.1 (6.8)</td>
<td>39.3 (5.6)</td>
<td>40.9 (5.6)</td>
</tr>
<tr>
<td>Men (%)</td>
<td>65</td>
<td>54</td>
<td>46</td>
</tr>
<tr>
<td>Women (%)</td>
<td>35</td>
<td>46</td>
<td>54</td>
</tr>
<tr>
<td><strong>Race (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>65</td>
<td>73</td>
<td>69</td>
</tr>
<tr>
<td>White</td>
<td>31</td>
<td>27</td>
<td>31</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Addiction Severity Index Interview</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days Used in Past 30 Days (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td>28 (5.7)</td>
<td>29 (2.3)</td>
<td>29 (3.5)</td>
</tr>
<tr>
<td>Cocaine</td>
<td>15 (11.6)</td>
<td>14 (12.3)</td>
<td>11 (11.3)</td>
</tr>
<tr>
<td>Alcohol (any use)</td>
<td>3 (6.8)</td>
<td>5 (7.5)</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td>Other sedatives-tranquilizers</td>
<td>0.5 (1.1)</td>
<td>0.2 (0.4)</td>
<td>0.3 (1.0)</td>
</tr>
<tr>
<td>Marijuana</td>
<td>1 (2.9)</td>
<td>0.2 (0.6)</td>
<td>1 (4.9)</td>
</tr>
<tr>
<td><strong>Urinalysis at Intake (% negative)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opiates</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cocaine</td>
<td>4</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>92</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Methadone</td>
<td>100</td>
<td>92</td>
<td>96</td>
</tr>
<tr>
<td><strong>SCID Diagnoses (% with current diagnosis)</strong></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Opioid dependence</td>
<td>81</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>Cocaine dependence</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Sedative dependence</td>
<td>8</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>12</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Cannabis dependence</td>
<td>35</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>Antisocial personality disorder</td>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

Measures

In the original study, urine samples were collected Monday, Wednesday, and Friday of each week of the study. Specimen collections were directly observed and temperature tested to ensure that sample temperatures were near body temperatures. Samples were tested (enzyme multiplication immunoassay technique; Dade Behring Diagnostics Inc., San Jose, California) for cocaine (benzoylcegonine) and opiates (morphine). Samples were positive for cocaine and opiates if concentrations were at or above 300 nanograms per milliliter (Silverman, et al., 2004).

Of the major assessments collected at six different time-points in the original study, the current study examines participants’ overall confidence scores from the baseline time-point administration of the Situational Confidence Questionnaire (SCQ) (Annis & Graham, 1988), a self-report measure of self-efficacy originally developed for use with alcoholics. The questionnaire asks individuals to imagine themselves in high-risk situations and to indicate on a 6-point scale (0 = not at all, 20 = 20% confident, 40 = 40% confident, 60 = 60% confident, 80 = 80% confident, and 100 = very confident) how confident they are that they would be able to resist the urge to use cocaine in each situation.

For the original study, the SCQ was modified for use with cocaine-dependent patients by inserting the phrase “use cocaine” in place of “drinking heavily” and by replacing phrases associated with alcohol use with those associated with cocaine use on 11 items (e.g., “If I would pass by a liquor store” was changed to “If I would pass by a dealer”). Additionally, the SCQ was administered through the computer, and instead of a
six-point scale, participants were asked to mark a point on a line to indicate their confidence level. The left end of the line was labeled “0 – Not at all confident” and the right end of the line was labeled “100 – Very Confident.” The computer program then assigned a numeric score for the item based on the location of the point that the participant marked on the line. (See the Appendix for a copy of the SCQ that was used in this study).

Although the SCQ contains 42 items, only 39 items were used to calculate the overall and subscale confidence scores; the three remaining items were excluded on the basis of Annis and Graham’s (1988) findings that these items had poor psychometric properties in evaluating problem drinkers, which is true for cocaine abusers as well. Those 39 items contributed to an overall mean confidence score and eight subscale scores. The eight subscales are Unpleasant Emotions (e.g., “if I were angry at the way things had turned out”), Physical Discomfort (e.g., “if I felt nauseous”), Pleasant Emotions (e.g., “if I felt satisfied with something I had done”), Testing Personal Control (e.g., “if I convinced myself that I was a new person and could take a few hits of cocaine”), Urges/Temptations (e.g., “if I were out with friends and they wanted to use cocaine”), Social Problems at Work (e.g., “if there were problems with people at work”), Social Tension (e.g., “if I felt uneasy in the presence of someone”), and Positive Social Situations (e.g., “if I were enjoying myself at a party and wanted to feel even better”).

The SCQ has undergone data analysis to demonstrate its reliability and validity. The results of the analysis indicate the “internal consistency reliability (alpha) of each subscale was excellent, ranging from .81 to .97. The reliability of the overall mean score
of the 39 items was .98” (Annis & Graham, 1988, p. 9). The SCQ was also correlated with the Beck Depression Inventory, the Drinking Locus of Control Scale, and the Helplessness Scale to test for validity. The alpha coefficient results were -.52, -.45, and -.37, respectively. These moderate negative correlations suggest that individuals who are depressed, externally motivated to drink, and who perceive themselves as more hopeless would rate themselves as having lower self-efficacy on the SCQ (Annis & Graham, 1988).

Wong and colleagues (2004) examined the reliability and validity of the SCQ as modified for cocaine users in a previous study. The researchers noted high levels of internal reliability (alpha coefficient of .98) consistent with internal reliability of the original SCQ. Construct validity of the cocaine-modified SCQ was also supported by correlating the overall confidence score with number of days per week that cocaine was used ($r = -.27$, $p < .01$) and grams of cocaine used per week ($r = -.20$, $p < .05$). These levels of validity are comparable to those reported for the original SCQ, and according to Wong, et al., “the psychometric properties of this modified instrument appeared to be acceptable and closely comparable with versions used in prior studies on coping self-efficacy in problem drinkers” (p. 195).

Procedure

The current study used simultaneous multiple regression and logistic regression to predict cocaine abstinence using the following data from the original study as the independent variables: overall confidence score from the SCQ administered at week eight of the baseline period of the study, percentage of opiate-negative urines during the
baseline period, percentage of cocaine-negative urines during the baseline period, and treatment group. These variables were entered into the regression equation to see if they could predict cocaine abstinence as measured by the following: percentage of cocaine-negative urines throughout the entire study (weeks 1-52), percentage of cocaine-negative urines during the last 13-week block of the study (weeks 40-52), and achievement of complete cocaine abstinence (100% cocaine-negative urines) during the last 13-week block of the study.

The graphs in Figure 5, taken from the original study, illustrate the pattern of drug use throughout the study phases for each individual participant. Examination of these graphs allows one to understand the patterns of drug use and abstinence over time, including the extended periods of abstinence that some participants achieved.
Figure 5. Cocaine urinalysis results across consecutive urine samples for individual participants in each of the three experimental conditions during baseline (left), intervention (center), and postintervention (right) periods. Horizontal lines represent the cocaine urinalysis results for individual participants across the consecutive scheduled urine collections of the study, ranked from most abstinence (top) to least abstinence (bottom). The heavy portions of each line represent cocaine-negative urinalysis results, the thin portions of each line represent cocaine-positive urinalysis results, and the blank portions represent missing urine samples. The numerals on the ordinates represent participant identification numbers. Post = postintervention.

RESULTS

In this study, as in the original study, the analyses were based on an intent-to-treat sample of all participants who were randomly assigned to one of three experimental conditions ($n = 26$) with a total sample size of 78. Because missing data is a frequent problem in longitudinal studies and must be addressed statistically, this study, like the original one, conducted two sets of analyses on the urinalysis outcomes to address the missing data: one where missing urine samples are considered positive (“missing-positive analysis”) and one where no value is substituted for missing urine samples (“no substitution analysis”). Conducting two analyses is important because the primary analysis, which considered all missing urine samples to be positive, can overestimate drug use and thus cause inaccurate results. As has been previously described in the section outlining the original study, most of the original study’s secondary analyses (substituting no value for missing urine samples) were consistent with the primary analyses (substituting positive values for missing urine samples), and the secondary analyses were not reported. In this study, results for the no substitution analysis will be reported when they differ statistically from results for the missing-positive analysis. Overall, 24.7% of the urine samples were missing for the usual care control group, 21.8%
were missing for the take-home only group, and 18.4% were missing for the take-home plus voucher groups.

Descriptive statistics for SCQ confidence scores and percentage negative urines are presented in Table 2. The mean SCQ confidence scores of the three treatment groups were analyzed using PROC MIXED analysis, and no significant differences were found \( F(2, 75) = .98, p = .38 \). A two-tailed Pearson product-moment correlation was used to investigate the correlations among the independent and dependent variables. This inter-correlation matrix is presented in Table 3. There are four differences in the no substitution correlation analysis. Two correlations emerged as significant in the no substitution analysis that were not significant in the missing positive analysis. When no value was substituted for missing urine samples, the SCQ Overall Confidence score is positively significantly correlated with the percentage of cocaine-free urines during the last 13-week block, \( r = .32, n = 56, p < .05 \). The SCQ Overall Confidence score also approaches significance in its relationship to the percentage of cocaine-negative urines throughout the 52-week study, \( r = .19, n = 78, p = .09 \). When no value is substituted for missing urine samples, the relationship between percentage of cocaine-negative urines at baseline and percentage of cocaine-negative urines during the last 13-week block is no longer significant, \( r = .02, n = 56, p = .89 \), nor is the relationship between percentage of cocaine-negative urines at baseline and percentage of cocaine-negative urines throughout the 52-week study, \( r = .17, n = 78, p = .13 \). Because pre-treatment abstinence has been shown in the research literature to be a robust predictor of abstinence during treatment, it is not certain why these outcomes occurred. It may be that because there are fewer data
points in the no-substitution analysis, it was more difficult to detect a statistically
significant relationship. This lack of relationship may also account for why self-efficacy
had a significant relationship with abstinence in the last 13-week block, because past
studies (e.g., Wong et al., 2004) have shown that self-efficacy does significantly predict
cocaine abstinence during treatment, until one accounts for prior abstinence, after which
self-efficacy is no longer significantly related to abstinence. It may be that because prior
abstinence had no relationship to later abstinence in the no-substitution analyses, the
relationship of self-efficacy to later abstinence was free to emerge as significant.

Table 2

Descriptive Statistics for SCQ Scores and Percent Negative Urine Samples (Missing-
Positive Analysis)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Collapsed Across Group (N = 78)</th>
<th>Usual Care Control (n = 26)</th>
<th>Take-home Only (n = 26)</th>
<th>Take-home Plus Voucher (n = 26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M SCQ confidence score (SD)</td>
<td>50 (23.9)</td>
<td>47.9 (25)</td>
<td>46.7 (24.3)</td>
<td>55.3 (22.4)</td>
</tr>
<tr>
<td>M urinalysis at baseline (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Opiate negative</td>
<td>27.2 (25.9)</td>
<td>26.2 (27.6)</td>
<td>26.1 (24.8)</td>
<td>29.4 (26.1)</td>
</tr>
<tr>
<td>% Cocaine negative</td>
<td>13.2 (17.8)</td>
<td>12.7 (19.6)</td>
<td>12.2 (16.3)</td>
<td>14.7 (17.9)</td>
</tr>
<tr>
<td>M % Cocaine negative urine (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Across entire study (weeks 1-52)</td>
<td>36.3 (36.2)</td>
<td>15.2 (24.3)</td>
<td>36.1 (32.9)</td>
<td>47.7 (37.9)</td>
</tr>
<tr>
<td>During final 13-week block (weeks 40-52)</td>
<td>33.9 (41.5)</td>
<td>15.5 (27.2)</td>
<td>27.5 (37.4)</td>
<td>58.5 (46.4)</td>
</tr>
<tr>
<td>% Participants with 100% cocaine negative urines during weeks 40-52</td>
<td>46</td>
<td>0</td>
<td>4</td>
<td>42</td>
</tr>
</tbody>
</table>
Table 3

*Inter-correlation Matrix of Study Variables Collapsed Across Group (Missing-Positive Analysis)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SCQ confidence score</td>
<td>-</td>
<td>0.10</td>
<td>0.30**</td>
<td>0.13</td>
<td>0.14</td>
<td>0.11</td>
</tr>
<tr>
<td>2. % Opiate negative urines at baseline</td>
<td>-</td>
<td>0.34**</td>
<td>0.17</td>
<td>0.07</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>3. % Cocaine negative urines at baseline</td>
<td>-</td>
<td>0.37**</td>
<td>0.26*</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. % Cocaine negative urines across entire study (weeks 1-52)</td>
<td>-</td>
<td>0.90***</td>
<td>0.55***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. % Cocaine negative urines during final 13-week block (weeks 40-52)</td>
<td>-</td>
<td></td>
<td>0.65***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. 100% cocaine negative urines during weeks 40-52</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05. **p < .01. ***p < .001.

Simultaneous multiple regression analyses were used to assess the ability of four independent variables (treatment condition, overall SCQ confidence score, the percentage of cocaine-negative urine samples at baseline, and the percentage of opiate-negative urine samples at baseline) to predict cocaine abstinence as measured by the percentage of cocaine-negative urines throughout the 52-week study and the percentage of cocaine-negative urines during the last 13 weeks of the study (see Table 4). A logistic regression was used to evaluate the independent variables’ ability to predict the dichotomous
variable of whether or not participants achieved 100% abstinence during the last 13 weeks of the study.

### Table 4

Summary of Simultaneous Regression Analysis for Variables Predicting Cocaine Abstinence (N = 78)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cocaine Abstinence</th>
<th></th>
<th>Cocaine Abstinence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weeks 1 – 52</td>
<td></td>
<td>Weeks 40 - 52</td>
<td></td>
</tr>
<tr>
<td>Treatment Condition</td>
<td>20.67 4.19 0.47***</td>
<td></td>
<td>20.83 5.20 0.41***</td>
<td></td>
</tr>
<tr>
<td>SCQ Confidence score</td>
<td>-0.05 0.15 -0.04</td>
<td></td>
<td>0.03 0.19 0.02</td>
<td></td>
</tr>
<tr>
<td>% Cocaine negative urines at baseline</td>
<td>0.70 0.21 0.34**</td>
<td></td>
<td>0.58 0.26 0.25*</td>
<td></td>
</tr>
<tr>
<td>% Opiate negative urines at baseline</td>
<td>0.04 0.14 0.03</td>
<td></td>
<td>-0.06 0.17 -0.04</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>.35</td>
<td></td>
<td>.24</td>
<td></td>
</tr>
<tr>
<td>$F$</td>
<td>9.91***</td>
<td></td>
<td>5.74***</td>
<td></td>
</tr>
</tbody>
</table>

Note. Missing-positive analyses. *$p < .05$. **$p < .01$. ***$p < .001$.  

The first hypothesis stated that pre-treatment self-efficacy, as measured by the SCQ, would be a significant predictor of cocaine abstinence over the course of the entire 52-week intervention period. Regression analysis indicated that there was a significant main effect for the group of predictors, which explained 35% of the variance in cocaine abstinence, $F(4, 73) = 9.91, p < .001$. The two significant individual predictors of abstinence across all 52 weeks were treatment condition ($\beta = .47, p < .001$) and
percentage of cocaine negative urines at baseline ($\beta = .34, p < .01$), with treatment condition accounting for more of the variance in abstinence. There was one difference in the no-substitution regression analysis. The main effect was still significant with 26% of the variance explained, $F(4, 73) = 6.54, p < .001$, as was treatment condition as an individual predictor ($\beta = .46, p < .001$); however, percentage of cocaine-negative urines at baseline was no longer a significant predictor when controlling for the other predictors ($\beta = .11, \; p = .34$). Again, although the reasons for this are unclear, the predictive ability of prior abstinence may have been negated by too few data points in the no substitution analysis.

The second hypothesis stated that pre-treatment self-efficacy would be a significant predictor of cocaine abstinence at the last 13-week block of the study (weeks 40–52). Regression analysis indicated that there was a significant main effect for the group of predictors, which explained 24% of the variance in cocaine abstinence, $F(4, 73) = 5.74, p < .001$. The two significant individual predictors of cocaine abstinence in weeks 40-52 were treatment condition ($\beta = .41, p < .001$) and percentage of cocaine negative urines at baseline ($\beta = .25, p < .05$), with treatment condition again accounting for more of the variance in abstinence. There were two differences in the no substitution regression analysis. The main effect of the group of predictors was still significant, explaining 35% of the variance, $F(4, 51) = 6.94, p < .001$, as was treatment condition as an individual predictor ($\beta = .50, p < .001$); however, percentage of cocaine-negative urines at baseline was no longer a significant predictor when controlling for the other predictors ($\beta = -.09, p = .49$). Additionally, the SCQ Overall Confidence score emerged
as a significant individual predictor of cocaine abstinence during the last 13-week block, 
(β = .30, p < .05).

This last finding, which supports the hypothesis, is an important result. Self-
efficacy did emerge as a significant predictor of abstinence at weeks 40 – 52 when the 
statistical analysis did not substitute any value for missing urinalysis data. For this 
reason, it was important to further explore whether the statistical methodology (i.e., 
substituting a positive value or no value for missing urinalysis data) might be masking a 
true relationship between self-efficacy and abstinence. Therefore, a third method of 
treating missing data was applied and another simultaneous regression was conducted. 
Using this method of data substitution, which is common in many fields of research, each 
missing urinalysis data point for each participant was substituted with the urine result 
(whether positive or negative) based on the participant’s urine results immediately prior 
to and after the gap of missing data. The reasoning behind this method of substitution is 
that participants generally had a pattern of abstinence or drug use (see Figure 5), and 
therefore it is reasonable to substitute gaps in their data – times when they did not show 
up at the research study and give a urine sample – with data matching their pattern of 
behavior at that point in the study. In order to maintain uniformity with the other two 
methods of treating missing data, this procedure was performed for every missing data 
point in the intent-to-treat sample (all 78 participants in the study) as all the other 
analyses were.

After the missing data was treated in this manner, the simultaneous regression 
was conducted again using the same independent variables as previously to determine
which variables predicted cocaine abstinence during weeks 40 – 52. There was a
significant main effect for the group of predictors, which explained 24% of the variance
in cocaine abstinence, $F(4, 73) = 5.75, p < .001$. Treatment condition again emerged as a
significant individual predictor ($\beta = .35, p = .001$). This time, self-efficacy also emerged
as a significant individual predictor ($\beta = .31, p < .01$). These results support the second
hypothesis and indicate that pre-treatment self-efficacy can predict abstinence during the
last phase of the treatment period. These significant results may be because using a data
substitution method that is less likely to overestimate drug use provides a clearer picture
of drug use and allows the relationship self-efficacy has with abstinence to emerge as
significant.

The third hypothesis stated that pre-treatment self-efficacy would be a significant
predictor of whether or not complete abstinence was achieved in the last 13-week block
of the study. Logistic regression analysis indicated that the overall model containing all
predictors was significant, $\chi^2 (4, N = 78) = 20.96, p < .001$, indicating that the model was
able to distinguish between participants who achieved 100% abstinence and those who
did not. The model as a whole explained between 23.6% (Cox and Snell R square) and
42.3% (Nagelkerke R square) of the variance in achieving complete abstinence.
However, only one of the independent variables made a unique statistically significant
contribution to the model: treatment condition with an odds ratio of 17.19, $p < .01$ (See
Table 5). There were no differences between missing-positive and the no substitution
analyses.
Table 5

*Logistic Regression Predicting Likelihood of Achieving 100% Cocaine Abstinence in Weeks 40 – 52 (N = 78)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Condition</td>
<td>2.84*</td>
<td>1.04</td>
<td>17.19</td>
</tr>
<tr>
<td>SCQ Confidence score</td>
<td>0.01</td>
<td>0.02</td>
<td>1.01</td>
</tr>
<tr>
<td>% Cocaine negative urines at baseline</td>
<td>-0.00</td>
<td>0.03</td>
<td>1.00</td>
</tr>
<tr>
<td>% Opiate negative urines at baseline</td>
<td>0.01</td>
<td>0.02</td>
<td>1.01</td>
</tr>
</tbody>
</table>

\[ \chi^2 \]

\[ df = 4 \]

*Note.* Missing-positive analyses. *p < .01. **p < .001.
The purpose of this study was to examine the ability of pre-treatment self-efficacy ratings to predict cocaine abstinence levels throughout 52 weeks of treatment and specifically during the final 13 weeks of treatment. It was hypothesized that higher self-efficacy scores would predict greater abstinence. Specifically, it was hypothesized that pre-treatment self-efficacy ratings would predict percentage of cocaine-negative urine samples throughout the 52-week study and during the last 13-week block of the study. Additionally, it was hypothesized that pre-treatment self-efficacy would predict the complete abstinence (100% of urine samples negative for cocaine and opiates) that 15% of participants achieved during the last 13-week block of the study.

Because missing data is a frequent problem in longitudinal studies and must be addressed statistically, this study, like the original one (Silverman et al., 2004), conducted two sets of analyses on the urinalysis outcomes to address the missing urine data: one where missing urine samples are considered positive (“missing-positive analysis”) and one where no value is substituted for missing urine samples (“no substitution analysis”). Conducting two analyses is important because the primary analysis, which considered all missing urine samples to be positive, can overestimate drug use and thus cause inaccurate results. For the analyses where a positive value was substituted for each participant’s missing urine data, findings did not support the ability of pre-treatment self-efficacy to
predict abstinence during and at the end of treatment. Treatment condition was the only variable to emerge as a predictor of abstinence for all three dependent variables, meaning that participants in the group that could earn take-home methadone doses plus vouchers contingent upon providing drug-free urine samples achieved more abstinence than participants in the other two groups. Participants in the group that could earn take-home methadone doses achieved more abstinence than the control group, which received only usual-care methadone treatment. These results are commensurate not only with the results of the original study (Silverman et al., 2004), but with the voucher reinforcement treatment literature in general (e.g. Silverman et al., 1996; Higgins et al., 1994; Higgins et al., 2000). The percentage of cocaine-negative urines at baseline predicted abstinence throughout the entire intervention period as well as during the last 13-week block, which replicates findings in the treatment literature that prior abstinence predicts later treatment and post-treatment abstinence (e.g. Alterman et al., 1997; Budney et al., 1996; Preston et al., 1998).

The archival data set (Silverman et al., 2004) from which the current study draws produced abstinence outcomes rarely seen in substance abuse research. As discussed previously in the section on the results of the original study, 16% of all participants in that study were able to achieve a period of complete abstinence from both heroin and cocaine for over six months. These outcomes are visually represented in Figure 5. All analyses conducted in the current study showed specifically that the sole factor that was predictive of 100% abstinence in the final 13-week block of the study was treatment condition. This study demonstrated that those participants who received take-home
methadone doses along with vouchers contingent upon drug abstinence were significantly more likely than any other group to achieve and maintain complete drug abstinence. This finding is clinically significant and extremely encouraging for clear reasons – in the “real world,” the treatment goal is 100% abstinence, not merely a statistically significant decrease in frequency of drug usage. Receiving the voucher reinforcement treatment also predicted abstinence across the entire study as well as during the final 13-week block. The results from the current study add unique support to the use of voucher reinforcement not just for substance abuse treatment but for treatment with the ideal goal of complete abstinence.

As previously mentioned, the analyses that substituted a positive value for missing urine samples could potentially overestimate drug use. Therefore, all analyses were conducted again using a different method: substituting no value for missing urine samples. This means that rather than providing an estimation of the values of missing data, the missing data were simply not included in the analysis. Although this method does not overestimate drug use, it leaves fewer data points to work with, thus reducing the power of the analyses. The results of the no substitution analyses differed in two ways from the missing-positive analyses: (1) self-efficacy was significantly positively correlated with abstinence during the last 13 weeks of treatment, meaning that as self-efficacy increases, abstinence increases, and (2) self-efficacy was predictive of abstinence during the last 13 weeks of treatment, meaning that an increase in abstinence is dependent upon an increase in self-efficacy. These relationships may have emerged through the no-substitution analyses because drug use was no longer potentially being
overestimated during the study, and therefore the relationship between self-efficacy and abstinence was free to emerge from the analyses. Additionally, the percentage of cocaine-negative urine samples at baseline was no longer significantly related to abstinence across the 52 weeks and abstinence during the last 13-week block. This change may have been the result of a reduction of power, thus leaving the analyses unable to detect the relationship between prior abstinence and later abstinence. However, the different results that emerged when substituting no value for missing data are important because they not only support the second hypothesis (that self-efficacy would predict abstinence in the last 13 weeks of treatment) and point to a possible flaw in the treatment of missing data, but they are also consistent with some previous self-efficacy literature (Wong et al., 2004; Reilly et al., 1995; Baer, Holt & Lichtenstein, 1986).

Because self-efficacy emerged as a significant predictor of abstinence in the last 13 weeks of treatment when no value was substituted for missing urines, post-hoc analyses were conducted to apply a third method of data substitution to ascertain if self-efficacy would remain a significant predictor of abstinence. This method involved examining each participant’s pattern of abstinence and attendance (see Figure 5) and substituting a value for missing urine samples based on the samples that participant had given immediately prior to and after the missed urine sample sessions. This method allowed for a more individualized treatment of missing data and possibly reduced the likelihood of overestimating drug use, which is a risk when using the method that substitutes positive values for all missing urine sample data. After conducting the
regression using this substitution method, self-efficacy remained a significant predictor of abstinence in the last 13 weeks of treatment, as did treatment group.

Because these significant results emerged due to differences in strategies for dealing with missing data, it is difficult to interpret the analyses that produced the significant predictive ability of self-efficacy. These significant results could be related to the fact that within the post-hoc analysis, prior abstinence (during the baseline period) was not associated with abstinence in the last 13 weeks. It has been shown in other cocaine abstinence studies (e.g. Wong et al., 2004) that self-efficacy predicts future abstinence until one accounts for past abstinence. Therefore, without a relationship between past abstinence and future abstinence, the relationship between self-efficacy and future abstinence emerged. Another explanation for self-efficacy emerging as a significant predictor of abstinence in the last 13 weeks of the study is that participants with higher self-efficacy ratings (and therefore held the belief that they would be able to cope with drug use situations in the future and remain abstinent) may have taken more advantage of the counseling and methadone treatment offered during the study. They may have utilized the treatment more because they believed that (a) it was possible for them to maintain abstinence, and (b) treatment would help them achieve this goal. The longer they were exposed to treatment, the more likely they would be to achieve abstinence toward the end of the study.

Because of the mixed findings of the current study, it is important to compare methodology and results with other studies of self-efficacy and substance abuse. One such study by Wong and colleagues (2004), described in detail in the first chapter,
examined the predictive ability of self-efficacy on abstinence during 24 weeks of treatment and at a six-month post-treatment follow-up assessment for 126 participants. They found that self-efficacy measurements at all time-points did significantly correlate with concurrent abstinence but none were a significant predictor of later abstinence after controlling for prior abstinence.

Although both Wong et al. (2004) and the current study used identical versions of the cocaine-modified SCQ, there are several important differences between the two studies. The former study exposed participants to only 24 weeks of treatment instead of 52 weeks. In addition, participants in the current study were primarily African-Americans from an urban setting, while Wong and colleagues’ participants were primarily rural Caucasians. Additionally, Wong et al. measured self-efficacy several times during treatment, whereas the current study only examined pretreatment self-efficacy. These differences make comparison between the two studies difficult and may account for the difference in results.

Another difference between the two studies is in the treatment of missing data. Although the results of the current study are the same as Wong et al. (2004) when substituting positive values for missing data, the results of the two studies diverge when no values are substituted or when data is substituted according to the individual’s pre- and post-gap data. Wong et al. used maximum-likelihood estimation, a method of dealing with missing data that calculates estimates for missing data that would make the data obtained maximally likely to have occurred given the sample data that was collected. Maximum-likelihood estimation has been shown to produce unbiased estimates when
data is missing at random and produces the least biased estimates in cases with nonrandom missing data. The different methods of data substitution between the current study and Wong et al. may account for different results in the predictive ability of self-efficacy.

Another study on self-efficacy and smoking cessation, described in detail in the first chapter, is comparable to the current study. Baer, Holt and Lichtenstein (1986) examined 146 smokers who were participating in cognitive-behavioral treatment to quit smoking. Self-efficacy ratings were taken before, during, and after treatment. Results indicated that post-treatment self-efficacy ratings for ability to resist smoking predicted future abstinence, until the researchers controlled for the effects of prior abstinence, after which self-efficacy was no longer a significant predictor. However, the authors did find that self-efficacy, measured during and after treatment, predicted future smoking rate (i.e., how much smoking increased from abstinence levels) even when it could not predict whether or not a person would remain abstinent from smoking in the future. These results indicate that self-efficacy ratings may be clinically useful because they predict future use.

There are many reasons why studies of the relationship between self-efficacy and substance abuse yield different results. First is the method of measuring self-efficacy. In the previous study examples, self-efficacy was measured in cocaine-dependent users and in smokers with two different self-report questionnaires. The original SCQ was created to measure self-efficacy in problem drinkers. Although the cocaine-modified SCQ used in the current study has been shown to have validity in cocaine users, it is important for
all self-efficacy studies to ensure that they are using valid instruments for their population. Although most models of addiction assume that the process of lapse, relapse and abstinence is essentially the same across substances, it may differ enough that a measure of self-efficacy for abusers of one substance may not quite capture self-efficacy for abusers of another due to the unique differences in the substances of addiction. For example, alcohol use is generally accepted by society, but use of illicit drugs like cocaine or heroin is not. Therefore, measurements of self-efficacy may need to take into account social desirability factors or a respondent’s fear of discussing his or her illegal activities. These fears of admitting to illegal or socially unacceptable activities could impinge upon accurate self-efficacy ratings by causing respondents to respond at random or give the same response for every item to avoid having to admit to not having confidence in their ability to resist drug use. Respondents may also inflate their self-efficacy scores to make it appear as if they believe they have the ability to stop or are planning to stop their illicit drug use.

Another factor may help to explain the failure of pre-treatment self-efficacy to predict abstinence during treatment in the primary analyses, which is that a person’s beliefs about his or her ability to abstain from substance use may not be accurate. Individuals assessed prior to treatment may be ignorant about their abilities to cope with many problem situations until they actually begin an attempt to change their behavior. They may believe that initiating abstinence and successfully resisting drug use will be easier for them than it actually is. Therefore these individuals would rate their confidence in their ability to successfully cope with high risk situations as high, when in
fact that high self-efficacy rating does not translate into abstinent behavior. An influential factor here may be the amount of previous treatment and the type of treatment the individual has received. The more treatment they have experienced, the more likely they are to understand the difficulties in resisting relapse in the future and how likely it is that they will do so. Thus, because of the individuals’ past experiences in learning coping skills, initiating abstinence, experiencing drug cravings, lapsing or relapsing back into substance use, and initiating abstinence again, it is likely that their pre-treatment self-efficacy scores are more likely to be based in a realistic assessment of their abilities to cope with high risk drug use situations in the future. Conversely, participants who have not been using substances as long or who have not experienced many previous abstinence or treatment attempts may be more likely to score higher on self-efficacy as they overestimate their abilities to cope with future relapse risk situations. This possibility points to the need for self-efficacy studies to either gather and incorporate data on participants’ levels of previous treatment or to make multiple assessments of self-efficacy throughout the study.

This point about the accuracy of self-efficacy ratings changing across treatment is illustrated in a study conducted by Reilly et al. (1995), described in detail in the first chapter. The researchers examined changes in self-efficacy during treatment to determine whether the influence of self-efficacy varied according to the methadone dosing schedule. Results showed that changes in self-efficacy coincided with changes in heroin use across the three stages of treatment: self-efficacy increased between intake and the start of the stabilization phase while heroin use decreased, self-efficacy did not
change across the stabilization phase while heroin use gradually decreased, and self-efficacy gradually decreased across the taper phase while heroin use increased. The authors also found that while self-efficacy at intake did not predict heroin use in the stabilization or taper phases, self-efficacy at the beginning of the stabilization phase predicted abstinence during that phase, and self-efficacy at the beginning of the taper phase predicted abstinence during that phase (Reilly et al., 1995).

Reilly et al. (1995)’s findings can be compared with the results of the current study. Our analyses also found that self-efficacy was reflective of concurrent drug use, as did results in Wong et al. (2004). In the current study’s initial analyses, as with Reilly et al., self-efficacy at the time of intake was not predictive of abstinence over the course of treatment. However, the current study was unable to explore the predictive ability of self-efficacy ratings taken at later time points throughout the study. If that had been the case, the results may have been more comparable to Reilly et al. Both studies had a similar sample size and participants were on methadone maintenance treatment, although different measures of self-efficacy were used.

The results of the current analyses and of similar studies raise questions about the mechanisms of self-efficacy in substance lapse, relapse, and abstinence. Self-efficacy ratings may be indicative of different things at different times in treatment and are influenced by past behavior. Baer, Holt and Lichtenstein (1986) proposed several models of self-efficacy. One model views self-efficacy as a mediator variable incorporating behavioral precursors to influence behavioral change. Baer et al.’s second (and competing) model proposes that self-efficacy does not exert a causal influence, but
reflects the diminished level of drug use achieved in time with treatment. Baer et al.’s analyses supported neither model and instead suggested the existence of a third model, that self-efficacy has parallel influences on future drug use. The parallel influence model, supported by the results of Reilly et al. (1995), suggests that at particular junctures in treatment, self-efficacy influences future behavior in conjunction with previous behavioral precursors. Initially, the self-efficacy ratings of participants prior to the beginning of treatment are based only on their personal judgments of their overall ability to organize and execute alternatives to drug use in high risk situations, which may be inaccurate. Thus they may not predict future abstinence, which was the case in the current study. However, after some amount of time in treatment, their self-efficacy ratings are based on their changes in behavior during treatment and how those changes have altered participants’ beliefs about their own future ability to change. In Reilly, et al., self-efficacy measured at the beginning of the stabilization and taper phase did predict abstinence during those phases, possibly because patients had experienced increasing abstinence behavior during the initiation phase after intake because of receiving doses of methadone, which thus altered their beliefs about subsequent ability to remain abstinent. The parallel influences model states that after participants gain enough knowledge about their abilities to cope with high risk situations, subsequent ratings of self-efficacy become more related to their current drug use rather than a belief influencing subsequent behavior change. In essence, participants may be telling themselves, “This is how much I have been able to abstain from drug use so far during treatment, so I don’t expect to be able to change this very much in the future.” One must be careful in generalizing Reilly et al.’s
results or in overestimating the validity that they lend to the parallel influences model as that study was conducted only with patients on methadone maintenance therapy. However, it is useful to explore how that model may apply to self-efficacy research.

Given the parallel influences model of self-efficacy, the missing-positive analysis results from the current study would be expected – that self-efficacy measured at baseline would not have predicted abstinence throughout treatment because those ratings of self-efficacy were possibly inaccurate in terms of the individual’s actual ability to remain abstinent. However, if self-efficacy data were available at subsequent time points throughout the study, self-efficacy ratings taken at the beginning of the treatment phase might have predicted abstinence throughout treatment, and self-efficacy ratings taken at the beginning of the post-treatment phase might have predicted abstinence during that time period. In keeping with the model, it would then be expected that self-efficacy ratings taken in the middle of the 52-weeks of treatment would be more indicative of concurrent cocaine use due to the influence of abstinence behavior acquired during treatment.

The possibility that self-efficacy ratings can reflect different indicators at different time points leads to a discussion of the clinical applications of self-efficacy research. There is no doubt that self-efficacy beliefs are an important target of intervention for substance abuse treatment. First, the relationship between self-efficacy and concurrent drug use, as found in this study as well as in Wong et al. (2004), indicates that self-efficacy ratings could be used as a proxy measure of current drug use, particularly if treatment is occurring in situation where urine samples are difficult or too costly to
obtain, or where it is otherwise deemed appropriate to collect urine samples on an irregular basis. Many community health clinics and agencies have neither the staff available to take individual urine samples from multiple participants several times a week, nor the funds available to pay for the costly, one-time-use testing kits. A self-efficacy measure could provide a quick, easy, and inexpensive way to measure drug use indirectly.

In a clinical treatment setting, self-efficacy ratings can also be a way for clinicians to identify the participants who are struggling with coping skills in risky situations and offer an avenue through which more individualized treatment can be applied. Self-efficacy ratings can specify the areas in which a participant is particularly struggling and thus inform the targets of additional treatment, whether it is to increase the person’s social support with attendance at a self-help group or family therapy, increase coping skills training to target specific relapse risk situations, help deal with a recent lapse and prevent it from becoming a relapse, or initiate the individual on some course of pharmacological therapy. Even the self-efficacy ratings that an individual gives at the beginning of treatment can be helpful indicators of which areas treatment should concentrate. Although those ratings are possibly inaccurate measures of the individual’s actual ability to successfully deal with high risk situations, clinicians can use the pre-treatment ratings to begin discussions with patients about the reality of the difficulties of achieving abstinence and the importance of remaining in treatment, learning and applying coping skills, and building and utilizing social support networks. Such discussions could help patients adjust their expectations of treatment to be more realistic.
Given the possibility that self-efficacy may be based on different beliefs at different times during treatment, it may be useful to develop self-efficacy ratings that are more specific to the phase of treatment or to the specific point in the relapse cycle that treatment is focusing on. It may be useful to create these measures according to the model of self-efficacy that has been proposed by Marlatt and colleagues (1995). Their typology includes five self-efficacy categories for two stages: initiation and subsequent change of addictive behaviors. It begins with two types of self-efficacy in the initiation phase. The first is resistance self-efficacy, beliefs about an individual’s ability to resist using prior to first use of a substance, and the second type is harm-reduction self-efficacy, beliefs about one’s ability to reduce the risks of using after the initial use. The last three types of self-efficacy are in the behavior change stages. Action self-efficacy is belief in one’s ability to achieve the desired goal of abstinence (or, for alcohol or food, controlled use). Fourth is coping self-efficacy, belief in the ability to cope positively with relapse crises, and finally there is recovery self-efficacy, involving the ability to use positive coping skills after relapse episodes (Marlatt et al., 1995). These measures would be inexpensive and easy to administer in both research and clinical settings.

Ratings specifically created to measure self-efficacy in the initiation stages could reveal a significant amount of clinically useful data for a patient’s treatment plan in terms of his or her attitudes towards abstinence, such as whether to try to attain complete abstinence or merely reduce substance use, and whether or not the patient’s beliefs about his or her abilities to resist use are grounded in reality. Again these ratings could be used by clinicians as part of an assessment of the point in treatment at which the patient needs
to begin, or to ascertain what treatment modality would be most useful. Such ratings might be used as a screening tool for which patients should enter therapy or treatment, or to determine patient eligibility for a research study.

Ratings developed to measure self-efficacy in the behavior change stages would not only, as previously mentioned, offer a sense of the patient’s current substance use, but would also give more insight as to the more specific intervention needs, because the self-efficacy measures would offer items based on situations targeting self-efficacy at that particular stage. For example, if a patient scored lower on the action self-efficacy measure, then it would be clear that treatment needed to center around the patient’s belief that he or she could even achieve abstinence, rather than possibly waste time or resources teaching the patient coping skills for something they believe they cannot achieve. Understanding a patient’s beliefs in his or her abilities to cope with high risk situations or relapses could again pinpoint the specific coping skills that treatment should focus on, or bolster a patient’s ability to return to treatment after a lapse or relapse.

Another interesting application for self-efficacy research involves the finding from some studies (e.g. Kavanagh et al., 1996) that self-efficacy ratings predict treatment retention. Kavanagh et al., described in detail in the first chapter, found that pretreatment self-efficacy ratings predicted treatment retention throughout the 12-month treatment phase, and self-efficacy ratings at 6 months into treatment predicted retention from months 6 to 12 of the treatment phase as well. This application of self-efficacy measures not only allows for an estimation of dropout rate in research studies, but also provides the opportunity to prevent treatment dropout in both research and clinical settings. Knowing
which participants are most likely to terminate treatment could lead to the development of interventions used at the beginning of treatment that would identify the specific reasons for likely dropout and to address those through coping skills training and other treatment modalities.

If self-efficacy continues to be shown as a significant variable in abstinence studies, such findings might also have implications for substance abuse research policy. For example, more research investigators may be able to procure funding for their substance abuse studies if it would be less costly to measure drug use by using self-efficacy ratings rather than urine tests. The effects could even reach the level of substance abuse legislation if the development and application of self-efficacy research were able to reduce the cost of substance abuse treatment, which was discussed previously as having reached $16 billion in the year 2002. More effective treatment modalities may also influence legislative policy by turning governmental attention and funding from the criminal justice system, which prosecutes and imprisons those who commit drug-related crimes, to substance abuse treatment, which arguably approaches the problems of substance abuse in a more positive and productive manner. Policy may shift to integrate substance abuse treatment as part of judicial sanctions and as part of incarceration as appropriate. Such a shift could truly make the prison system more rehabilitative rather than just punitive. Such a shift in criminal justice policy could significantly reduce the overall cost of illicit drug abuse to society, where the price of all criminal justice system-related costs reached $107.8 billion in 2002. If many drug users are incarcerated because of illegal activities related to drug use, and they receive
substance abuse treatment in prison that is more effective because it is based on targeting self-efficacy and thus increasing the likelihood of future abstinence, then it is less likely that such individuals will commit drug-related crimes in the future after they are released from prison. This in turn would reduce the rate of incarceration for drug use, thus lessening all the costs associated with drug-related investigations, arrest, and imprisonment.

If, as mentioned before, self-efficacy is increased through treatment and increased experience with drug abstinence, then prolonged abstinence is likely to be maintained in a kind of increased-self-efficacy-increases-abstinence cycle. Thus associated increases in quality of life and stability related to maintaining abstinence may extend into other areas of a patient’s life. If an individual is abstinent from drugs, then they are unlikely to commit crimes to fund drug use. They are also more likely to be able to find and maintain employment, which not only contributes to an increased quality of life but also makes it less likely that they would turn to criminal activities to make money. These possibilities provide ample areas to be explored in future self-efficacy research.

There are also implications of self-efficacy not just in substance abuse treatment, but also in substance abuse prevention work. Developing self-efficacy measures, possibly based on the previously mentioned resistance self-efficacy category in Marlatt et al. (1995), could allow for prevention work at many levels and in many settings. Measures of self-efficacy for the ability to resist using drugs at all can easily be given in an educational setting, from middle school through college, and an age-appropriate preventative program of education about substance abuse and coping skills to prevent
first use can subsequently follow. Individuals at higher risk for initiating substance use could be identified and referred to school counselors for more individualized interventions. Such self-efficacy measures could be incorporated into medical settings as well, beginning with primary care physicians or doctors at a university health center. Because substance use and abuse is a pertinent issue in college-aged individuals, college counseling and health centers would be ideal places to take quick and easy measures of self-efficacy for resisting substance use and offer prevention education and interventions accordingly. This is another area in which the opportunities for self-efficacy research are abundant.

In continuing a discussion on the applications of self-efficacy research, mention must be made of the limitations of the current study. There are several limitations that are inherent in any study based on an analysis of archival data. The first is that the original study was, of course, not designed to answer the questions posed by the current study, and therefore was limited in what hypotheses could be tested using the available data. Additionally, it is certain that we would have acquired more in-depth information about self-efficacy by including SCQ scores of the same participants at later time-points in the analysis; however, there was not enough SCQ data collected over time for enough participants to do so. Therefore, the exploration of how self-efficacy ratings relate to actual substance use across time and with treatment was limited. Another limitation was the small sample size, which may have contributed to the mixed results achieved in this study based on how missing data was treated.
This leads to a discussion on how the analysis of data in substance abuse research influences the outcomes purely because of statistical methodology rather than because the results reflect the relationships that exist in reality. The results of the current study draw attention to the importance of the data analysis techniques that are employed, particularly in a field such as addiction research where there are many complex and dynamic relationships among factors that influence treatment-seeking, the initiation of abstinence, the response to lapses and relapses, and the continuation of abstinence or substance use. It is becoming increasingly important for substance abuse researchers to be aware of the development of research techniques and new statistical analyses as they pertain to the complex data offered up by addiction research studies. An excellent example of this principle is the 2007 study conducted by Witkiewitz, van der Maas, Hufford and Marlatt that re-examined data from Project Matching Alcohol Treatments to Client Heterogeneity (Project MATCH), which examined treatments for alcoholism. The results of the study are described in detail in the first chapter.

Witkiewitz et al. (2007) applied new statistical analysis techniques to the original Project MATCH data. Witkiewitz et al. stated that although alcohol relapse is characterized in the literature as a dynamic and complex process, the most common statistical methods used in alcohol research are continuous linear models such as regression and ANOVA that do not account for the complexity in the observed data. Therefore, the authors chose to use Project MATCH data to reexamine one of the original matching hypotheses, this time using two complementary analyses that treated the relapse process as a nonlinear dynamical system: latent growth mixture modeling (LGMM) and
catastrophe models (CM). According to the authors, LGMM attempts to identify common patterns of growth across time, but allows for more than one mean growth pattern to occur in a given population. Other empirical studies using LGMM have identified four common patterns of drinking trajectories: non-drinking, chronic drinking, increasing and decreasing drinking over time (Jackson & Sher, 2005; White, Johnson, & Buyske, 2000).

Catastrophe modeling can be used to study nonlinear relationships between variables and the discontinuity in behavior resulting from this nonlinearity and is used to examine the movement between stable and unstable states. As this applies to alcohol relapse, it is thought that at critical points of relapse risk factors, there are sudden changes in drinking behavior. However, individuals facing the same relapse risk factor will not respond in the same manner. The relapse process is not a continuous process of drinking becoming incrementally greater after the first lapse; rather it is a more discontinuous process in which behavior oscillates among heavy drinking, lighter drinking and abstinence. CM is able to take into account the variability surrounding the critical relapse risk points, whereas traditional linear modeling approaches would treat this variability as random error. The authors proposed using both methods together because LGMM provides information about within and between person drinking dynamics over time, whereas the catastrophe models assess between person dynamics at a single point in time (Witkiewitz et al., 2007).

In Witkiewitz et al.’s growth mixture analyses, unlike the original Project MATCH results, evidence was provided in support of the original matching hypothesis:
individuals with lower self-efficacy who received cognitive behavior therapy drank far less frequently than did those with low self-efficacy who received motivational therapy (2007). Additionally, the new analyses identified self-efficacy as a significant predictor of lapse dynamics. Specifically, changes in self-efficacy, as well as the absolute levels of self-efficacy, following treatment were significantly related to outcome, particularly in distinguishing the most frequent drinking class from the inconsistent and infrequent classes. These findings are important because they demonstrate the impact of statistical methodology on the ability to find true relationships among factors. Although Project MATCH focused on alcohol outcomes, the statistical methods used in the Witkiewitz et al. study pertain to relapse processes in general, which are thought to be similar across substances. The results from the Witkiewitz et al. study, as well as the mixed results in the current study, underscore the importance of utilizing statistical methods that are powerful enough to most accurately analyze the data and the real-world dynamics being studied.

Future research in substance abuse would do well to utilize the most appropriate statistical methods for such a dynamic process as relapse as evidenced by Witkiewitz et al. (2007). The current study could also be expanded upon in future research by designing a study where self-efficacy ratings are administered at different points throughout treatment and the parallel influences model is tested in populations other than methadone treatment patients. In this manner, researchers could pinpoint at exactly which times self-efficacy ratings are more likely to predict future abstinence and when
self-efficacy ratings are more likely to be reflective of current drug use. This in turn would influence how self-efficacy measures are used in substance abuse treatment.

As the phenomenon of substance abuse changes in our society, research has the difficult task of keeping up with trends, new drugs, new methods of drug use and of drug use treatment. Two such avenues for future research include the effects of self-efficacy in the use of methamphetamine (or “crystal meth”) and in the abuse of prescription drugs, such as painkillers and stimulants, taken for nonmedical reasons. Although, as with most other drug research, it can be reasonably assumed that addiction to these substances involves the same abstinence-lapse-relapse cycle as addiction to cocaine, heroin or alcohol, research should be conducted to provide evidence for that, as well as to see if self-efficacy plays the same role in addiction to these substances.

It would also be valuable for future research to investigate differences in self-efficacy according to gender, socioeconomic status, age, and level of education and how these factors may interact with self-efficacy to produce abstinence outcomes. Knowing the significance of these factors could again provide points of treatment intervention in applied settings to maximize self-efficacy and coping skills throughout the course of treatment.

The importance of self-efficacy in substance abuse research and treatment has been well-established. It is necessary to continue to explore the specific ways that measuring self-efficacy can not only reveal more about the course of addiction treatment, but also provide effective methods of intervention that can help people achieve abstinence. The positive implications of incorporating measures of self-efficacy into
addiction treatment, such as reduction in the cost of treatment and research, increasing
the specificity and effectiveness of treatment modalities, promoting more effective
prevention measures, and directing drug legislation policy towards more cost efficient use
of the criminal justice system, make it clear that self-efficacy research is a valuable and
worthwhile field of research that can and should continue to develop.
Situational Confidence Questionnaire

LONG-TERM DRUG ABUSE TREATMENTS
CLINICAL COMPUTER CENTER FORM
Study 9618

Name: ___________________________       ID: ________________________

Staff: ___________________________       Date: ________________________

INSTRUCTIONS:
Imagine yourself as you are right now in each of these situations. Indicate on the scale provided how
confident you are that you would be able to resist the urge to use Cocaine in that situation.

I would resist the urge to use cocaine:

   if I had an argument with a friend.
      0    100
      Not at all confident     Very Confident

   if I felt uneasy in the presence of someone.
      0    100
      Not at all confident     Very Confident

   if someone criticized me.
      0    100
      Not at all confident     Very Confident

   if I would have trouble sleeping.
      0    100
      Not at all confident     Very Confident

   if I want to heighten my sexual enjoyment.
      0    100
      Not at all confident     Very Confident

   if other people around me made me tense.
      0    100
      Not at all confident     Very Confident

   if I would be out with friends & they would begin to use Cocaine.
      0    100
      Not at all confident     Very Confident
if I wanted to feel closer to someone I liked.

0
Not at all confident
100
Very confident

if I felt that I had let myself down.

0
Not at all confident
100
Very confident

if other people treated me unfairly.

0
Not at all confident
100
Very confident

if I were to remember how good it felt.

0
Not at all confident
100
Very confident

if I felt confident and relaxed.

0
Not at all confident
100
Very confident

if I would convince myself I was a new person now and could just use a little Cocaine.

0
Not at all confident
100
Very confident

if I would pass by a dealer.

0
Not at all confident
100
Very confident

if I felt drowsy and wanted to stay awake.

0
Not at all confident
100
Very confident

if I would be out with friends "on the town" and wanted to increase my enjoyment.

0
Not at all confident
100
Very confident

if I would unexpectedly find some Cocaine.

0
Not at all confident
100
Very confident

if other people didn’t seem to like me.

0
Not at all confident
100
Very confident

if I felt nauseous.

0
Not at all confident
100
Very confident
if I would wonder about my self-control over Cocaine and would feel like having a little Cocaine to try out.

0 100
Not at all confident Very Confident

if other people interfered with my plans.

0 100
Not at all confident Very Confident

if everything were going well.

0 100
Not at all confident Very Confident

if I would be at a party and other people would be using Cocaine.

0 100
Not at all confident Very Confident

if pressure would build up at work because of the demands from my supervisor.

0 100
Not at all confident Very Confident

if I were afraid things weren’t going to work out.

0 100
Not at all confident Very Confident

if I felt satisfied with something I had done.

0 100
Not at all confident Very Confident

if I would be in a situation and the people with me would purchase Cocaine.

0 100
Not at all confident Very Confident

if I wanted to celebrate with a friend.

0 100
Not at all confident Very Confident

if I were angry at the ways things had turned out.

0 100
Not at all confident Very Confident

if I would feel under a lot of pressure from family members at home.

0 100
Not at all confident Very Confident
if something good would happen and I would feel like celebrating.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I would start to think that just a little Cocaine could cause no harm.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I felt confused about what I should do.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I would meet a friend and he/she would suggest that we do a little Cocaine.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I were not getting along well with others at work.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I would be enjoying myself at a party and wanted to feel even better.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I would suddenly have an urge to use Cocaine.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I wanted to prove to myself that I could take a little Cocaine without going in a binge.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if there were fights at home.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if there were problems with people at work.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

if I would be relaxed with a good friend and wanted to have a good time.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>

my stomach felt like it was tied in knots.

<table>
<thead>
<tr>
<th>Option</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>0</td>
</tr>
<tr>
<td>Very Confident</td>
<td>100</td>
</tr>
</tbody>
</table>
REFERENCES


Silverman, K., Wong, C. J., Umbricht-Schneiter, A., Montoya, I. D., Schuster, C. R.,


CURRICULUM VITAE

Christine Sylvest was born on November 11, 1978 in Fort Worth, TX. She grew up in a variety of places including Virginia, Florida, and Japan. Christine graduated from Broad Run High School in Ashburn, Virginia in 1996, and went on to earn her Bachelor of Arts in Psychology in 2000 from the College of William and Mary in Williamsburg, Virginia. After working as a research assistant in the field of substance abuse at the Johns Hopkins University School of Medicine, Christine entered the Ph.D. program in clinical psychology at George Mason University, where she earned her Master of Arts degree in Psychology in 2004. While in graduate school, Christine participated in clinical training experiences at the George Mason University Counseling Center and at the Center for Multicultural Human Services in Falls Church, Virginia. Christine completed her predoctoral internship through the Central California Psychology Internship Consortium at Kaiser Permanente Hospital in Fresno, California in 2007.