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The Relationship of Temporal Discounting and Working Alliance to Substance Abuse Treatment Process in Hispanic Adolescents

James J. Weidel
University of Miami, jweidel@miami.edu

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THE RELATIONSHIP OF TEMPORAL DISCOUNTING AND WORKING ALLIANCE TO SUBSTANCE ABUSE TREATMENT PROCESS IN HISPANIC ADOLESCENTS

By

James John Weidel

A DISSERTATION

Submitted to the Faculty of the University of Miami in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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THE RELATIONSHIP OF TEMPORAL DISCOUNTING AND WORKING
ALLIANCE TO SUBSTANCE ABUSE TREATMENT PROCESS IN HISPANIC
ADOLESCENTS

James John Weidel

Approved:

Daniel A. Santisteban, Ph.D.
Research Professor of Nursing

M. Brian Blake, Ph.D.
Dean of the Graduate School

Brian E. McCabe, Ph.D.
Research Assistant Professor of Nursing

Rosa M. Gonzalez-Guarda, Ph.D.
Assistant Professor of Nursing

Janet York, Ph.D.
Research Professor of Nursing
Medical University of South Carolina
WEIDEL, JAMES JOHN  
(Ph.D., Nursing)  
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The association between impulsivity and substance abuse has important implications in the clinical substance abuse treatment field. Adolescents who are characteristically more impulsive by nature of their developmental may be more at risk for treatment failure. The inclination by which individuals devalue future rewards in favor of more immediate rewards with lower monetary values is a type of impulsivity that has received much attention in the substance abuse research field. Identified as temporal discounting (TD) or delay discounting, this phenomenon is not only a factor that influences substance abuse, but also may be a factor that leads to failure in substance abuse treatment. Another important factor that has been shown to influence treatment outcome is the therapeutic relationship between a provider and a client. 

The purpose of this study was to examine the relationship between TD, working alliance and treatment experiences among substance-abusing adolescents enrolled in outpatient drug abuse treatment. For this study, a descriptive within-subjects repeated measures design was used. Data was collected from a convenience sample of Hispanic adolescents 14-17 years of age meeting DSM-IV-TR criteria for substance abuse or
dependence. Participants were recruited from a larger 60 month National Institute on Drug Abuse funded parent study that examined Culturally Informed and Flexible Family-based Treatment of Adolescents and Traditional Family Therapy among adolescents.

Variables included participant age, working alliance, whether participants attended weekly therapy sessions for at least the first 5 weeks (retention), number of sessions in which subjects participated in therapy 8 weeks after enrollment (dosage), and the change in TD from the time of enrollment and (T1) to approximately 5 weeks after enrollment (T2). Working alliance was measured at 5 weeks after initiation of therapy.

It was hypothesized that TD would be inversely related to age, inversely related to working alliance, inversely related to treatment retention after 5 weeks of therapy, inversely related to the number of therapy session in the first 8 weeks of therapy, and that TD would decrease after 5 weeks of therapy.

Statistical analysis including linear and logistic regressions as well as analysis of variance was used. No significant relationships were found between TD and the independent variables of age, treatment retention, dosage, the change is TD from T1 to T2, and working alliance. Although statistically significant findings were not achieved in this study, the research has clinical relevance.

Analyzing treatment methodologies and differences in alliance and retention among a Hispanic adolescent population provides data that has not heretofore been reviewed. Impulsivity is linked to risk behaviors. Further research is needed to identify how treatment methodologies may be refined to address temporal discounting and impulsivity among Hispanic adolescents thereby improving treatment retention and decreasing the substance abuse to improve long term outcomes among this vulnerable population.
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CHAPTER 1

Adolescent Substance Abuse

Adolescence is a critical period in human development. Marked by active experimentation and a common tendency toward risk-taking behaviors (Cooper, Wood, Orcutt, & Albino, 2002; Donovan & Jessor, 1985), adolescence is a time when young people are at increased risk for development of substance-related disorders (Grant et al., 2001; Thatcher & Clark, 2008; Von Diemen, Bassani, Fuchs, Szobot, & Pechansky, 2008). Abuse of alcohol and drugs often leads to failures in meeting developmental challenges like emotional regulation, interpersonal skills, peer relations, and academic success (Liddle, Rowe, Dakof, Henderson, & Greenbaum, 2009). Substance abuse, particularly among adolescents, has been linked to delinquency (Donovan & Jessor; Elliott, Huizinga, & Menard, 1989; Sanders, 2011), early sexual intercourse (Cavazos-Rehg, et., 2011; Donovan & Jessor; Newcomb & Bentler, 1986), and low educational performance (Cooper, et.; Schulenberg, Bachman, O'Malley, & Johnston, 1994; Ramchand, Morral & Becker, 2010). Viewed, developmentally, adolescents have an intrinsic inclination to take risk. Adolescents who abuse alcohol and drugs are engaged in risk behaviors; however, not only imperil their own health and well-being, but also jeopardize the health and wellbeing of families and individuals who are impacted by alcohol and drug related behaviors (Anthony & Petronis, 1995; Jessor, 1994; Kandel, Yamaguchi, & Chen, 1992).
Numerous studies support the notion that deficient impulse control (i.e. impulsivity) may be an important mechanism related to adolescent risk-behavior (Ainslie, 1975; Koop et al., 1996; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Low cognitive executive functioning and dis-inhibition or lack of behavior control may contribute to risk-taking behaviors in adolescents (Tarter, Kirisci, Feske, & Vanyukov, 2007). Being impulsive interferes with the ability to make wise decisions, which may predispose adolescents to experiment with alcohol and other illicit drugs (Zuckerman, 1994). Likewise, individuals who are impulsive may lack the ability to foresee potential negative consequences of behavior, or they may be reluctant or unable to consider the costs and benefit surrounding particular behaviors (Cooper et al., 2002).

A current way of thinking about adolescent risk-taking behavior and impulsivity stems from historical and multi-disciplinary perspectives. Theories based on personality and personality traits examine individual differences that might account for a propensity to take risk (Botvin, 1985; Eysenck, & Eysenck, 1978; Kaplan, 1980; McCord, 1990; Petersen et al., 1993; Rolison & Scherman, 2002; Zuckerman, 1971, 1994). Biological models of adolescent risk-taking examine genetic factors such as neuro-endocrine, and neuro-anatomical influences (Cloninger, 1987; Irwin & Millstein, 1986; Rolison & Scherman; Udry, 1988). Developmental perspectives, which consider biopsychosocial changes during adolescence, view varying degrees of risk-taking as a mechanism by which some adolescents learn to cope with normal developmental tasks related to achieving autonomy and exploring the adult world (Lavery, Siegel, Cousins, & Rubovits, 1993; Millstein & Igra, 1995; Rolison & Scherman).
Although developmental, biological, and personality trait models of risk-taking behavior in adolescents independently offer important theoretical support for the relationship between risk-taking behavior and impulsivity, no specific one-dimensional theory (whether developmental, biological, or personality) exclusively appears to explain the relationship between impulsivity and risk-taking behavior among adolescents (Rolison & Scherman, 2002). Developmental, biological, and personality perspectives of impulsivity share similar elements that, in combination, may explain substance abuse behaviors among adolescents (Ainsle, 1975; Cooper et al., 2003; Koop, Pesaran, & Potter 1996; Moeller et al., 2001), thus strengthening arguments for a comprehensive multidimensional framework to explain impulsivity and risk-taking behavior.

Owing to a growing body of literature that links impulsive behavior with substance abuse and other risk behaviors, the concept of impulsivity has become an important construct within the drug and alcohol abuse literature (Allen et al., 1998; Bickel & Marsch, 2001; Brady et., 1998; Coffey, Gudleski, Saladin, & Brady, 2003; Kirby, Petry, & Bickel, 1999; Moeller et al., 2002). The association between impulsivity and substance abuse has important implications in the clinical substance abuse treatment field. Impulsivity may not only be a factor that contributes to substance abuse, but impulsivity may also be a factor that leads to failure in substance abuse treatment. This may be especially so among adolescents who characteristically may be more impulsive by nature of their developmental stage in human maturation and development.

Several studies found high rates of substance abuse among impulsive individuals (Allen, Moeller, Rhoades, & Cherek, 1998; Brady, Myrick, & McElroy, 1998; Jentsch & Taylor, 1999; Moeller et al., 2002; Soloff, Lynch, & Moss, 2006). Others studies
identified direct links between the personality trait of impulsivity and other risk-taking behaviors (De Wit, Enggasser, & Richards, 2002; Butler & Montgomery, 2004; Plant & Plant, 1992). Studies of adolescents showed elevated self-reported impulsivity to be related to alcohol use disorders (Soloff et al.). Impulsivity has been associated with the onset of alcohol consumption at earlier ages (Dougherty, Mathias, Tester, & Marsh, 2006; Kollins, 2003), the number of illicit drugs used, and frequency of cigarette use in high school students. Impulsive behaviors may predict alcohol use in college students (Zuckerman & Kuhlman, 2000) and the development of alcohol dependence later in life (Poikolainen, 1995). Preliminary evidence also suggests that baseline scores of impulsivity may be valuable in predicting treatment retention among adults (Moeller et al., 2001) and adolescents (Thompson, Whitmore, Raymond, & Crowley, 2006).

The 2011 Youth Risk Behavior Survey (YRBSS) (United States Department of Health and Human Service [HHS], 2012) and the 2011 Monitoring the Future (MTF) (Johnston, O’Malley, Bachman, & Schulenberg, 2012) survey results illustrated a propensity for high school students to engage in harmful behaviors that put them at risk for disease, injury and other negative impacts on their health. The 2011 MTF Survey results also showed that prescription and over-the-counter drugs are among the most commonly abused drugs by high school seniors, after alcohol, marijuana, and tobacco (Johnston et al.). In addition, young people experiment with a growing repertoire of illicit drugs that become popular and widely used for short periods of time only to be replaced by another drug such as novel forms of synthetic marijuana. By their late teens or early adult years, occasional and regular drug users have established patterns of drug, alcohol, and tobacco use (McCrystal, Higgins, Percy, & Thorton, 2003).
U.S. students are among the highest users of illicit drugs as compared to their counterparts in an ongoing study of students in 37 other countries. At 18 percent, the U.S. ranks third of 37 countries on the proportion of students using marijuana or hashish in the prior 30 days (Johnston et al., 2012). While past-year nonmedical use of sedatives and tranquilizers decreased among 12th graders over the last 5 years (Johnston, O’Malley, Bachman, & Schulenberg, 2011), this is not the case for the nonmedical use of amphetamines or opioid pain relievers. Among youth aged 12 to 17, 3% reported past-month nonmedical use of prescription medications (Johnston et al.).

Alcohol ranks first in the preferred substance of abuse by American adolescents and is used by more young people in the United States than tobacco or illicit drugs. Nationwide, 70.8% of high school students surveyed in the 2011 YRBSS reported having consumed at least one drink of alcohol on at least 1 day during their life (i.e., ever drank alcohol). Nearly 39% of students also reported that they had consumed at least one drink of alcohol on at least 1 day during the 30 days before the survey i.e., current alcohol use). The prevalence of current alcohol use was higher among 11th-grade male (45.2%) and 12th-grade male (51.2%) students and higher among Hispanic male (42.1%) and white male (41.6%) than black male (29.5%) students (HHS, 2012) (See table 1). Excessive consumption of alcohol is associated with approximately 80,000 deaths per year and is a contributing factor in 10,288 deaths from motor vehicle crashes at an economic cost of $224 billion a year (Centers for Disease Control and Prevention [CDC], 2012a). Among youth, the use of alcohol and other drugs has also been linked to unintentional injuries, physical fights, early sexual activity, an increased rate of sexually transmitted infections (STIs), pregnancy, academic and occupational problems, and illegal behavior (HHS,
Long-term health consequences of alcohol misuse include liver disease, cancer, cardiovascular disease, and psychiatric problems like depression and anxiety (CDC, 2012a).

Despite a generalized downward trend in alcohol consumption over the past decade, binge drinking remains a major concern. In 2010, 39% of high school students reported drinking some alcohol and 22% reported episodic heavy or binge drinking (CDC, 2012b). This pattern of drinking may be fueled by an apparently dwindling of attitudes towards the dangers of alcohol among youth (National Institute on Drug Abuse [NIDA], 2012). Fewer 10th graders, for example, viewed weekend binge drinking as harmful, and fewer high school seniors showed disapproval of having one or two drinks every day (NIDA, 2012). As reported in YRBSS, (2011), more than 21% of students reported having consumed five or more drinks of alcohol in a row (i.e., within a couple of hours) on at least 1 day during the 30 days before the survey (i.e., binge drinking). The current prevalence of binge drinking is higher among Hispanic (24.2%) and white (24.0%) than black (12.4%) students, and higher among white male (26.1%) and Hispanic male (25.9%) than black male (14.5%) students (HHS, 2011).

Cigarette smoking is on the decline, and is at the lowest point in the survey’s history on all measures for 8th, 10th and 12th graders. The prevalence of having ever smoked cigarettes did not change significantly during 1991–1999 (70.1%–70.4%) and then decreased during 1999–2011 (70.4%–44.7%). The prevalence of having ever smoked cigarettes did not change significantly from 2009 (46.3%) to 2011 (44.7%) (HHS, 2011). Although cigarette and alcohol use by 8th, 10th, and 12th graders are at their lowest point since the MTF survey began polling teenagers in 1975. According to this
year's survey results (Johnston et al., 2012), there are continued high levels of abuse of alternate tobacco products, marijuana and prescription drugs.

Marijuana, the most commonly used illicit drug in the United States, represents 16% of all admissions to drug treatment facilities in the country. In 2007, approximately 6,000 people per day used marijuana for the first time. Among that number, 62.2% were under the age of 18. Overall, current marijuana use decreased from 27% in 1999 to 20% in 2007; however, in 2011, the rate increased to approximately 24%, encroaching on the previous positive decline (Johnston et al., 2012).

Current cocaine use increased from 2% in 1991 to 4% in 2001. As reported in the YRBSS, for 2011, the rate of current cocaine use is approximately the same as it was a decade ago at 3%, with lifetime cocaine use reported at 6.8% (Johnston et al., 2012). Nearly 4 in 10 youth reported lifetime inhalant use (Howard & Perron, 2009). Lifetime use of ecstasy among high school students has remained at a rate greater than 10% for the past 5 years and is currently reported at 11.4% (YRBSS, 2011). Methamphetamine use reported for all high school students is 3.8% (YRBSS). Lifetime use of heroin remained unchanged 1999 to 2007 at 2%, and rose slightly in 2011 to approximately 2.9% (NIDA, 2012).

After alcohol, the most commonly abused drug for high school students is non-prescribed prescription medication. Approximately 21% of all high school students reported using in the past year some kind of non-prescribed scheduled prescription drugs such as codeine, Oxycontin®, Percocet®, Vicodin®, Adderall®, Ritalin®, or Xanax®. In 2010 nearly 1 in 12 high school seniors reported past year non-medical use of Vicodin®; one in 20 reported abusing Oxycontin® (NIDA, 2011).
Substance Abuse among Hispanics

The Hispanic population in the United States grew by 15.2 million, or 43 percent, between 2000 and 2010 and accounted for more than half of total growth in the U.S. population in the last ten years (Humes, Jones & Ramirez, 2010). Based on data from the 2011 YRBSS, Hispanic youth appear higher rates of some substance abuse risk behaviors when compared to white and black youth. The prevalence of driving after drinking alcohol was highest among Hispanic male adolescents (11.5%) as compared to white male (8.9%) and black male (7.8%) adolescents. Table 1 indicates the rates of various substances used among White, Hispanic and Black males reported in the 2011 YRBSS as compared to the overall high school student population (HHS, 2012).

Additionally, research findings reveal differing patterns of illicit substance abuse among Hispanic males and females and those born in the United States versus those born outside of the country. Prevalence rates for US born Hispanic across all classifications of substances are higher compared to non-US born. Among Hispanic adolescents, marijuana was used by 8% of the population in 2010 (Johnston et al., 2012), however, the prevalence rate among Hispanic males was much greater at 27% (HHS, 2012). Overall, current non-medical use of prescription-type drug use of Hispanic adolescents was 3.4% in 2010 (Johnston et al.), but for Hispanic males, the current use rate is 19.7% (HHS).

Hispanic adolescents born in the United States had higher rates of alcohol use, cigarette use, and marijuana use within the previous 30 days than those who were not born in the United States (Substance Abuse and Mental Health Services Administration [SAMSHA], 2011). Additionally, a larger percentage of Hispanic adolescents born in the United States (12.3%) were significantly more likely to have used illicit drugs in the past
month than Hispanic adolescents born outside the United States (5.7 %) (SAMHSA, 2008).

The impact of adolescent substance abuse can be felt on both individual and societal levels. For the developing young adult, drug and alcohol abuse undermines motivation, contributes to problem behavior, and interferes with cognitive processes (Jessor, 1991). For this reason, considerable effort has been directed toward identification of effective prevention and treatment strategies. A constructive manner with which to address substance abuse is a risk-focused approach. Knowledge gained from the scientific investigation of the interplay among risk factors, risk behaviors, and substance abuse serves as a basis from which substance abuse treatment interventions have been developed (Hawkins, Catalano, & Miller, 1992; Peterson, Baer, Wells, Ginzler, & Garrett, 2006).

Much of the substance abuse literature focuses on identifying predictors of treatment outcome. Researchers have examined a variety of factors, such as demographics, social, and environmental factors and type of treatment received (Tetzlaff et al., 2005). Yet, for years, providers have been challenged to find the most appropriate treatment methods for drug abusing clients, and considerable sophisticated assessment and treatment strategies have been employed for the sake of establishing the most suitable treatment methods for clients. Nonetheless, concerns remain as to whether clients receive treatments that lead to the best possible outcomes (Simpson, Brown, & Joe, 1997).

An area in behavioral and substance abuse research has involved factors that underlie drug abusing clients’ persistent inclination for short-term rewards that lead to
long-term negative consequences. Measuring the devaluation of future rewards, the
tendency for immediate gratification, and the subsequent lack of avoidance of known
future negative consequences is a promising area of research into understanding,
predicting, and guiding treatment (Tucker, Vuchinich, & Rippens, 2004). Quite possibly
an index or measure of this type of impulsive decision-making could serve as a predictor
of substance drug related behaviors such as abstinence and relapse (Baker, Johnson, &
Bickel, 2003).

**Therapeutic Alliance**

An important factor that has been shown to influence treatment outcome among
adults with mental health issues is the therapeutic relationship between a provider and a
client (Barber et al., 1999, 2001, 2006; Horvath & Symonds, 1991). This relationship has
been conceptualized and measured in terms of the extent to which a client and therapist
connect and work collaboratively and purposefully (Auerbach, May, Stevens, & Kiesler,
2008; Hanson, Curry, & Bandalos, 2002). A good working alliance has been consistently
a robust predictor of outcomes in psychotherapy (Hersoug, Hoglund, Monsen, & Havik,
2001; Horvath & Symonds; Martin, Garske, & Davis, 2000; Meier, Barrowclough, &
Donmall, 2005), including counseling of clients with substance abuse disorders
(Auerbach et al.; Saarnio, 2002). In particular, early alliance has been found to be a better
predictor of outcome than alliance measured in the middle or late phase of treatment
(Martin, Garske, & Davis), and patients’ ratings of working alliance tend to be more
highly correlated without outcome of therapy than do therapists’ ratings (Horvath &
Symonds; Piper, Azim, Joyce, & McCallum, 1991).
Relatively little research on the topic of therapeutic alliance has been conducted with specifically with adolescent clients (Hogue, Dauber, Stambaugh, Cecero, & Liddle, 2006), including those undergoing substance abuse treatment (Auerbach et al., 2008; Williams & Chang, 2000). Recently, several studies (Auerbach et al.; Tetzlaff et al., 2005) have addressed the role of working alliance to actual treatment outcome among adolescent substance abusers. Tetzlaff et al. found that working alliance at both 3 months and 6 months of treatment was found to predict post-treatment substance use, while Auerbach et al. found that only working alliance based on counselor perceptions predicted outcome, while working alliance for clients did not. This area of inquiry clearly merits more research for understanding the relationship of working alliance to treatment among adolescents who abuse drugs and alcohol.

**Theoretical Framework**

The theoretical framework used to understand substance abuse and risk behaviors among adolescents is the “Problem-Behavior Theory” (Jessor, 1991). Problem-behavior theory is a systematic, multivariate, social-psychological conceptual framework derived initially from the concepts of value and expectation from Rotter’s (1954,1990) social learning theory, Merton’s (1957) concept of anomie, Lewin’s (1951) field theory, and Macmahon, Pugh, and Ipsen’s (1960) web of causation theory. The theoretical framework includes five major systems of explanatory variables: the perceived environment, the personality system, the social environment, the social structure, and the behavior and socialization system (Jessor, 1991, 1992). Each system is composed of variables that act either as instigations for engaging in problem behavior (risk factors) or controls against involvement in problem behavior (protective factors). The collective
balance of risk and protective factors across the five systems determines adolescents’ overall level of proneness for problem behaviors (Jessor, 1987, 1991, 1992). In other words, when individual’s risk factors outweigh or overpower protective factors, then there is greater chance that the individual will engage in problematic behavior.

Within the perceived environment system, examples of risk factors include high peer approval of problem behavior and low parental disapproval of problem behavior. Protective factors include parental interest and involvement. The personality system is comprised of personal values, expectations, beliefs, and attitudes derived from social learning and developmental experiences. Risk factors in the personality system include lower value on academic achievement, higher value on independence, greater social criticism, higher alienation, and greater tolerance of deviance. The social environment involves risk factors like poverty and racial inequity, while protective factors may be quality schools and a cohesive family. The concepts that constitute the behavior system include socially approved or conventional behaviors and problem behaviors themselves. Problem behaviors like alcohol use, cigarette smoking, drug use, deviant or delinquent behavior risky driving, and precocious sexual intercourse are included within their own system because any problem behavior contained in the other system (perceived environment, personality system, social environment, social structure, and the behavior and socialization system) increases the likelihood of involvement in other problem behaviors (Jessor, 1987, 1991, 1992). To account for an increased understanding of the role biology and genetics play in human behavior, Jessor (1992) added a fifth domain, biology/genetics, to the Problem-Behavior Theory. Variables within this realm include family history of substance abuse, intelligence, and genetic characteristics.
In combination, all five domains constitute a general explanatory framework for adolescent risk behavior. While each broad domain represents a separate source of risk and protection with both direct and indirect effects on adolescent risk behavior, explanations of adolescent risk behavior that can be found both in multiple domains as well as their interactions. This complexity allows for a thorough description and explanation for adolescent risk behavior (Jessor, 1991).

Because impulsivity impacts risk behaviors like substance abuse, impulsivity can be regarded as a component of the Problem Behavior framework. Impulsivity may be a risk factor present within the behavior, personality, or biology/genetics domains, or it may act as an intervening variable between domains. Investigation into temporal discounting (TD) as a component of the theoretical model may provide valuable insight into the role of impulsivity in adolescent risk-taking behavior. It is plausible that TD could predict success and failure in substance SA treatment as well help to tailor appropriate treatments for substance abusing adolescents. Clearly TD plays a role in risk-taking behaviors of adolescent substance abuse, but the nature of the role is not fully understood. Further research is needed to understand the role impulsivity, and more specifically, TD plays in SA treatment for adolescents.

**Purpose**

The purpose of this study was to examine the relationship between temporal discounting (TD), working alliance, and treatment experiences among substance-abusing adolescents enrolled in outpatient drug abuse treatment. Several important research questions were addressed. Is there a relationship between age and TD? Is the relationship between the therapist and the client influenced by TD? Does impulsivity as measured by
TD influence the adolescent’s participation in therapy? Does an adolescent with a higher impulsivity score attend therapy sessions regularly? Does the TD score decline after therapy is instituted? Hypotheses to study these questions were formulated and answers were sought to the questions.

**Research Hypotheses**

1. Age will be inversely related to TD.
2. TD will be inversely related to alliance.
3. TD will be inversely related to retention in the first 5 weeks of therapy.
4. TD will be inversely related to the number of therapy sessions in the first 8 weeks of therapy.
5. TD decreases after 5 weeks of therapy.

**Conceptual and Operational Definitions**

**Age**

*Conceptual definition:* The length of time that an individual has existed.

*Operational definition:* The total number of years that an individual has lived at the time of enrollment.

**Treatment Retention**

*Conceptual definition:* A common finding in the substance abuse literature is that patients who stay in treatment longer have better outcomes (Condelli & Hubbard, 1994; De Leon, 1985; Etheridge, Craddock, Hubbard, & Rounds-Bryant, 1999; Hubbard, Craddock, Flynn, Anderson, & Etheridge, 1997; Simpson, Joe, Fletcher, Hubbard, & Anglin, 1999). The duration of time an individual remains in treatment has been found to
be a significant predictor of positive drug treatment outcomes (Zarkin, Dunlap, Bray, Wechsberg, 2002).

**Operational definition:** Having attended weekly therapy sessions for at least the first 5 weeks.

**Dosage**

*Conceptual definition:* The number of treatment sessions of an intervention or the length of time in treatment (Ouimette, Finney, Moos, 1997).

*Operational definition:* and/or the number of treatment sessions completed in the first 8 weeks of therapy.

**Temporal Discounting (TD).**

*Conceptual definition:* TD refers to the phenomenon in which smaller rewards that are available immediately are chosen over larger rewards that are available later. TD also refers to the preference for immediate rewards, as opposed to future rewards, despite any apparent larger future punishments or negative consequences that may occur as a result choosing the more immediate reward. When smaller more immediate rewards are chosen over greater later rewards, the perceived value of the immediate rewards is said to be discounted (Ainslie, 1992; Soman et al., 2005).

*Operational definition:* TD is represented by the mathematical $k$ coefficient in Mazur’s (1987) hyperbolic equation and is the rate of discounting for a particular dollar amount across time delay.

$$V_p = \frac{V}{(1 + kD)}$$

$V_p$ is the present subjective or perceived discounted portion of a reward with an objective undiscounted value of amount $V$. The $k$ represents sensitivity to delay, $D$ (Baker
et al., 2003) and indicates the rate at which delayed consequences are discounted i.e. the TD score or discount rate. Higher $k$ values on a scale of 0-1 indicate greater TD or impulsivity and will show steeper declines relative to lower $k$ values. Conversely, lesser rates of impulsivity or TD are marked by lower $k$ values. When, $k = 0$, no value is lost to delay (Kowal, Yi, Erisman, & Bickel, 2007; Yoon et al., 2007).

**Working Alliance.**


*Operational definition:* The total score on the Working Alliance Inventory Client Long Version (WAI) (Horvath & Greenberg, 1989; Tracey & Kokotovic, 1989). Scores on the WAI range from 12 to 84 with higher scores indicating a stronger Working Alliance.

**Summary**

Chapter one presents the problem of substance abuse among adolescents. Epidemiological information is offered which highlights the serious nature of the problem. This study draws upon the conceptual framework of Jessor’s (1987, 1991, 1992) Theory of Problematic Behavior. The purpose of this study along with relevant research questions, hypotheses, operational and conceptual definitions, are presented. In chapter 2, an examination of the concept of impulsivity as it relates to substance abuse is be explored. A review of literature pertaining to concepts of impulsivity is also presented.
CHAPTER 2
LITERATURE REVIEW

Theories of Impulsivity

Contemporary theories of human behavior and impulsivity have been shaped by pre-scientific and pre-empirical schools of thought. Perhaps the first contemporary theorist to formally discuss impulsive behavior was the German psychiatrist Kahn (1876-1930) who described an impulsive person as one who demonstrated characteristics such as excitability, rapidity, and explosiveness. Not unlike Kahn, the German psychiatrist Tramer (1888-1952) postulated that impulsive individuals were quick to change and quick to discharge tensions (McCown, Johnson, & Shure, 1996). Although not subjected to any type of empirical verification, many of the early theories of impulsivity shared similarities to current personality theories. With a rise in psychoanalysis and psychoanalytic theory though, early psychologists became less interested in attributes of personality and instead chose to focus on the etiology and nature of impulsive thoughts. Freud, for example, took interest in the frequency of impulsive thoughts in both normal behavior and in the clinical recollections of “psychoneurotic” patients (Weiss, 1991).

A variety of psychoanalytic perspectives define the unconscious mind (comprised of instinctual drives, wishes, and fantasies) as a dynamic force that presses for outward expressions of the unconscious mind by way of human behavior. For Freud, impulsive behaviors occur as a result of intrapsychic conflicts that arise between unconscious drives and opposing forces. The intrapsychic conflicts that develop become expressed in thought, feelings, and behaviors of everyday life (Vaughan & Salzman, 1996) and
materialize into aggressive drives of the id (Siever, 1996). When drives break through the inhibitory defenses of the ego, the id acts in a manner contrary to the mandates of the superego (McCown et al., 1996; Siever). An ego that is thought of as too weak can neither contain the drive nor harness the energy behind the drive for less impulsive behavioral pursuits (Vaughan & Salzman). The ensuing “welling up” of primary drives leads to sudden and sometimes repetitious behaviors, thereby causing the resultant impulsive behaviors to be viewed as undistorted expressions of primary drives or symptomatic manifestations of underlying intrapsychic conflicts (Siever; Vaughan & Salzman).

**Psychoanalytic Theories**

The concept of impulsivity – whether described by symptoms, thoughts, or by character-defining patterns of behavior – are viewed in psychoanalytic terms from three primary perspectives: drive theory, structural theory, and object relations models (Oldham, Hollander, & Skodol, 2005). In drive theory, emotional states like anxiety arise as a result of conflicts between agencies of the mind – often between the id and ego or superego. Impulsive behavior occurs when negative affective states such as anxiety generated by intrapsychic conflict become unbearable and need to be dissipated. When conflict is handled through compromise that partially satisfies the aims of each side in the struggle, the resultant behavior is adaptive — and although there may be underlying conflict — symptoms do not arise (Vaughan & Salzman, 1996).

In Freud’s earliest explanation of human action, drive theory, Freud described tension in the central nervous system, which when discharged, expressed itself as an impulsive action in the human organism (Freud, 1913; Kohut, 1959). The release that
resulted from performing an impulsive act was described as having an enigmatic fetishlike component which would explain an individuals’ inclination to repeat the behavior (Sperling & Sperling, 1978). Although drive theory had been frequently referenced for decades, the model has not proven to be a sufficient explanatory model either for human actions (Lansky, 1989).

Several decades after describing impulsive action in terms of drive theory, Freud developed a more sophisticated view of behavior. According to the structural model perspective, differences exist among individuals with respect to relative roles of the ego and the superego in the genesis of impulsive behavior (Oldham et al., 2005). Freud, however, conceptualized impulsive behavior, neither an excess nor lack of will power nor ego strength, but rather as intentional acts that resulted from narcissistic injury from a traumatic past. Impulsive behaviors were viewed as adaptive attempts to control the dynamics of a relationship or to gain mastery over past events. If a relationship, for example, becomes too close or intimate then an impulsive action could result in order to restore a more comfortable distance between an individual and significant close person (Lansky, 1989).

Early in the history of contemporary psychology, psychoanalysts began to describe mental disorders that were characterized by impulsivity and inattention. Examples of current psychiatric disorders could include attention deficit disorder (ADD) and attention deficit hyperactivity (ADHD) disorder. Such individuals were thought to lack the ability to integrate functions of both the ego and the superego and were believed to lack the capacity for self-observation and self-reflection – both of which are deemed necessary for the creation of sense and awareness of a personal self (Gilmore, 2002).
Psychoanalysts viewed drug use in much the same way as mental disorders characterized by impulsivity and inattention. Drug use and impulsive acts were manifestations of a weak ego (Chein, Gerard, Lee, & Rosenfeld, 1964). People took drugs in order to compensate for a weak self-concept and an inability to relate to others. The early recognition by psychoanalysts of the similarities between substance abuse and disorders involving impulsivity is noteworthy, as it lends support for a long-established and varied theoretical basis linking impulsivity to substance abuse (Moeller et al., 2002).

**Developmental Theories**

Psychosocial scientists describe impulsivity as behaviors of hyperactivity, hyperkinetic, or learning-disabled children. A commonly recognized characteristic of child behavior, impulsivity has been associated with poor problem-solving ability, lower test performance (Paulsen & Johnson, 1980), and a lack of inhibitory control (Schachar & Logan, 1990). Although the association between impulsivity and childhood development can be considered that of common knowledge today, during the 18th and 19th centuries, little was known or documented about the topic.

What was known about childhood development and impulsivity was strictly anecdotal. Not until the middle of 20th century did the topic of impulsivity in children receive social acceptance, and, as a result, become scientifically studied. Researchers like Kagan, Rossman, Day Albert, & Phillips legitimized the study of impulsivity and made the topic respectable in the empirical developmental literature (Oldham et., 2005).

As theories of human problem-solving developed during the 1960’s, research into the various aspects of childhood development and learning emerged. Early empirical research of childhood impulsive behavior was focused on the impulsive aspects of
decision-making and problem-solving processes of children (Kagan, 1966). Proper and effective decision-making involves a weighing of plausible hypotheses within reasonable time constraints. Researchers, however, observed that some children (and adults) select and report solutions and answers more quickly and with minimal consideration for their probable accuracy. In contrast, others of equal intelligence took more time to decide about the legitimacy of a solution (Dickman & Meyer, 1988; Kagan). Based on this knowledge, development psychologists theorized that impulsivity in children and adolescents (and continuing into adulthood) arose from aberrations in basic cognitive problem-solving steps (comprehension and decoding, hypothesis selection, hypothesis, evaluation of the validity of a solution, and reporting of the solution). The nature of this decision-making process was theorized to fall along a continuum from highly reflective to highly impulsive (Dickman & Meyer; Kagan).

Reflection impulsivity describes the tendency to reflect on the validity of a problem’s solution under special conditions, namely, in situations where several possible alternatives are available and there is some degree of uncertainty about which one is the most appropriate (Dickman & Meyer, 1988; Messer, 1976; Paulsen, 1978). Research into reflection-impulsivity involved performance on visual recognition tasks as the primary index of the child’s position on this dimension (Kagan, 1966). Experimental subjects (usually children) who responded quickly and erred frequently were labeled “impulsive”, whereas, those who paused on response alternatives that were often correct were regarded as “reflectives” (Shafrir & Pascual-Leone, 1990). Research into reflection-impulsivity revealed the important finding that children who were found impulsive (as opposed to reflective) were also found to be impulsive into their adult years (Kagan, Rosman, Day,
Albert, & Philips, 1964). This finding – that individuals were impulsive over time and across situations – suggested that reflection impulsivity could be regarded as a cognitive or personality style and trait-like in nature (Messer & Brodzinsky, 1979).

**Impulsivity and Personality**

In the history of personality research, there has been lack of consensus as to the position of impulsivity in relation to other fundamental personality traits. A critical consequence of a diversity of views has been a lack of consensus on how to conceptualize the structure of impulsivity itself, or, even how to best measure it. In some models, impulsivity is not considered a major factor but instead a component or a combination of factors (Cogdon & Canli, 2008). For example, in Costa and McCrae’s five-factor model, impulsivity reflects mostly low-consciousness (Costa & McCrae, 1992); in Cloninger’s three-factor model, impulsivity reflects a combination of harm avoidance and high novelty seeking (Cloninger, Svrakic, Bayon, & Przybeck, 1999), and in Tellegen’s, (1991) five-factors model of personality structure, impulsivity represents a lower-order factor of constraint or self-control (Waller, Lilienfeld, Tellegen, & Lykken, 1991). Furthermore, the concept of impulsivity often has been viewed as a combination of interacting state-and trait-like characteristics (Najt et al., 2007; Swann, Pazzaglia, Nicholls, Dougherty, & Moeller, 2003). Regardless of the disparate and contested views, impulsivity remains an important psychological construct that has appeared, in one form or another, in every attempt to measure and typify personality (Whiteside & Lynam, 2001).

For personality researchers, who discuss impulsivity in terms of a general model of personality (Whiteside & Lynam, 2001), impulsivity, as a whole, is perceived of as a
stable trait (Fisher, Smith, & Cyders, 2008). Impulsivity, like any other personality trait, is regarded as a fixed style of relating to the world and represents an inflexible predisposition to behave, think, and feel in a certain way (Funder, 2006; Tellegen 1991). Numerous studies support the notion that impulsivity is a fixed element of personality. Evidence of this can be seen in the literature on reflection-impulsivity, which examines the relationship between fast and inaccurate performance on a number of tasks (Kagan, 1966; Kagan et al., 1964). In this area of research, subjects are categorized as “impulsive” on the basis of rapid and inaccurate responses on tests like the Matching Familiar Figures test (Dickman & Meyer, 1988). There has been some difficulty, however, on the part of researchers in demonstrating a direct relationship between the personality trait of impulsivity and a particular willingness to sacrifice accuracy for speed of information processing (Shafrir & Pascual-Leone, 1990).

Other aspects of personality such as sensation seeking may weigh heavily when inferring that an individual is impulsive (Dickman & Meyer, 1988; Zuckerman, Eysenck, & Eysenck, 1978). Early personality researchers identified an association between sensation seeking and impulsivity (Fisher, Smith & Cyders, 2008). Due to their apparent preference for acting on feelings of the moment and without regard for rules or regulations, sensation seekers came to be labeled as impulsive (Cloninger, Przybeck, Svrakic, & Wetzel, 1994; Cloninger, Svrakic, and Przybeck 2006; Whiteside & Lynam, 2001). Interestingly the need for sensory input and stimulation (sensation seeking) was also considered pathological because this characteristic was commonly observed among psychopathic personalities (Blackburn, 1969; Eysenck & Eysenck, 1971; Quay, 1965).
**Biology**

Even though many personality theories predated current advances in biology, medicine and technology, personality models of behavior continue to be influential in understanding impulsivity. Advances in non-invasive neuroimaging, such as positron emission tomography (PET), functional magnetic imagining (fMRI), and molecular genetics have opened new avenues of inquiry and have lent increasing support to personality researchers and their theories (Congdon & Canli, 2008). Personality theories in effect have been enhanced as a result of new scientific knowledge. For example, Eysenck’s previous research of personality and impulsivity has been enhanced by greater knowledge of the biological determinants of personality (Eysenck, 1990).

A growing body of research suggests that variations in anatomic structural features of the brain are associated with differences in personality (Cogdon & Canli, 2008). Much of the knowledge about the neuroanatomy of personality stems from neuropsychological research with patients who show poor decision making and symptoms of abnormally elevated impulsivity (Bechara, Damasio, Damasio, & Anderson, 1994; Bechara, Tranel, & Damasio, 2000; Bechara, Tranel, Damasio, & Damasio, 1996; Kalenscher, Ohmann, & Güntürkün, 2006; Kolb & Whishaw, 1998). Research into the neurological, biological, and anatomical aspects of impulsivity, such as research using functional magnetic resonance imaging (fMRI), has focused on brain regions that are normally involved in response disinhibition (impulsivity) and reward motivation i.e. dorsolateral prefrontal cortex, ventrolateral prefrontal cortex, dorsal anterior cingulated cortex and striatum (Bush, Valera, & Seidman, 2005).
Results of studies looking at white matter microstructure suggest that elevated impulsivity is associated with poor axonal and/or myelin fiber integrity (Cogdon & Canli, 2008; De Win, 2006; De Win et al., 2006; Hoptman et al., 2004; Liston et al., 2006; Moeller et al., 2004). Similarly, the volume and density of gray matter has been found to play a role in impulsive behavior in human subjects (Cogdon & Canli). More specifically, reduced gray matter density has been associated with elevated impulsivity (Carmona et al., 2005; Casey et al., 1997; Casey et al., 1998; Hazlett et al., 2005; Matsuo et al., 2008).

Prefrontal cortex, especially orbital frontal cortex, is thought to be a critical part of the circuitry involved in impulsivity, associated with failure to inhibit responses (Thompson, Whitmore, Raymond, & Crowley, 2006). Two other key regions are the right inferior frontal cortex (IFC) and the subthalamic nucleus (STN). The IFC plays a central role in controlling behavior inhibition. The STN, on the other hand, plays a central role in the stopping of a motor response; its position within the frontostriatal circuit is particularly responsible for braking ongoing motor commands that are in the later stages of being processed by the brain (Aron, 2007; Gerfen, 2000; Mink, 1996; Nambu, Tokuno, & Takada, 2002).

Research in frontal lobe dysfunction has revealed that patients with lesions in their ventromedial prefrontal cortex tend to be overly impulsive by strongly discounting, or even neglecting the future consequences of their decisions (Bechara et al., 1994, 1996, 2000). Due to this evidence, and the fact that the frontal cortex is generally associated with decision-making, prefrontal regions are generally considered prime candidate structures to control or delay discounting and impulsiveness (in this context defines to choose the small, immediate rewards). Pathologies include ADHD, drug addiction,
problematic gambling, and frontal lobe syndrome. All of these conditions presumably involve a pathological modulation of frontal lobe function (Kalenscher & Pennartz, 2008).

In an attempt to link anatomic structure and with other aspects of personality, psychologists have recently begun to investigate how individual differences within these anatomical structures are related to the individual differences in self-reported impulsivity (Congdon & Canli, 2008). Correlating brain structures with psychometric tests of impulsivity, however, has been difficult. This is likely due to the fact that the numerous self-report instruments of impulsivity have not been found to involve one particular anatomical structure of the brain, but rather different brain regions of the brain altogether (Congdon & Canli).

In addition to anatomy and physiology, findings in the field of genetics have shown that individual differences in personality traits can be related to individual differences within specific genes. Data from twin studies specifically support a genetic component of impulsivity (Cogdon & Canli, 2008). Several twin studies have derived estimates that approximately 45% of the variance in self-reported impulsivity may be accounted for by genetic factors (Hur & Bouchard, 2004; Pedersen, Plomin, McClearn, & Friberg, 1988; Seroczynski, Bergeman, & Coccaro, 1999).

Genetic contributions to impulsivity are possibly mediated through neurotransmitters such as serotonin and dopamine (Carver & Miller, 2006; Evenden, 1999; Everitt & Robbins, 2005; Mannuck, Muldoon, & Ferrell, 2003). Behavioral inhibition, in particular, is known to be under dopaminergic control (Cogdon & Canli, 2008). The evidence for the role of dopamine in impulsivity is supported by
pharmacological studies in humans (De Wit et al., 2002; Friedel, 2004; Grady et al., 2003) and animals (Cardinal et al., 2001; Dellu-Hagedorn, 2005; Winstanley, Theobald, Cardinal, & Robbins, 2003; Dalley, Cardinal, & Robbins, 2004). This may partly explain why psychostimulant drugs that target the dopaminergic system are effective in treating symptoms of ADHD (Thanos et al., 2010). If psychostimulant drugs treat disorders whose major component includes impulsive behaviors and thoughts such as craving and drug-seeking, then future implications for treating impulsivity in patients in the absence of other psychiatric disorders are profound. Quite conceivably, treatment for pathologically high levels of impulsivity could reduce relapse or even prevent new onset of substance abuse (Volkow, Wang, Fowler, & Ding, 2005).

**Impulsivity and Clinical Pathology**

Although biology, genetics, physiology, and clinical practice have had a profound influence on the current view of impulsivity, few theories of impulsivity are products of one discrete scientific discipline (Crean, De Wit, & Richards, 2000; Oas, 1985). In actuality, patients in clinical settings are diagnosed based on a heterogeneous constellation of symptoms – much of which is gathered from self-report, direct interviews, or reports from parents or teachers (Quartier, Zimmermann, & Nashat, 2010) that are more influenced by psychoanalytic, personality, and developmental theories rather than from more rigid biological, genetic or neuroscientific corroboration (Cogdon & Canli, 2008).

An example of a conventional clinical approach toward diagnosis can be seen in the condition ADHD a condition characterized by dysregulation of action, poor inhibitory control, and a diminished capacity to delay rewards (American Psychiatric Association,
2000; Nigg, Willcutt, Doyle, Sonuga-Barke, 2005). ADHD is also relevant to this discussion because even early clinical research among children and adolescents diagnosed with ADHD revealed inappropriate development of sense of time that likens to TD. In particular, children and adolescents diagnosed with ADHD were found to be influenced more by immediate events and rewards rather than by rewards or consequences more distant in time. Levine and Spivack (1959) reported constricted conception of time and longer time estimations in a group of impulsive and emotionally disturbed boys compared to non-impulsive emotional boys. Gibello (1976) later would develop the concept of dyschronia to explain specific inability of children with ADHD to develop “proper” time representations, and Barkley (1997) and Quartier et al. (2010) would come to describe children and adolescents with ADHD as exhibiting a form of temporal myopia or impairment.

The concept of impulsivity is a multidimensional construct, an amalgamation of well-established historical (and sometimes opposing) views, which come from psychoanalytic, development, personality, genetic, and neurobiological theories as well as from common clinical approaches toward diagnosis. For that reason, individuals who are currently regarded as impulsive pose a challenge to more recent investigations of biological, neurological, or genetic determinants of impulsivity. The conceptual challenge is to better integrate empirically supported approaches to form a better understanding of a comprehensive structure of impulsivity (Cogdon & Canli, 2008).

Measures of Impulsivity

Whether considered a stable personality trait or a class of behaviors, the concept of impulsivity has received considerable attention by scientists and clinicians interested
in substance abuse or other disorders marked by highly impulsive behavior (Lane, Cherek, Rhoades, Pietras, & Tcheremissine, 2003). A noteworthy outcome of this focus has been the development of several instruments intended to quantify impulsivity (Dougherty et al., 2009; Lane et al.). Impulsivity, albeit measured in many different ways, has been implicated as an important mechanism for understanding alcohol-related problems (Dougherty, Marsh-Richard, Hatzis, Nouvion, & Mathias, 2008), and given the diversity of behavioral and cognitive components subsumed by the impulsivity construct, it is unlikely that any single measure of impulsivity can provide an adequate account of all the unique characteristics related to impulsivity (Butler & Montgomery, 2004). Despite its complexity, impulsivity remains an important mechanism for understanding drug related problems and the success and/or failure of treatment (Dougherty et al., 2008).

In early clinical research, impulsivity was gauged by observing the presence of “signs of impulsivity” that resulted from standard psychological test batteries such as the Rorschach and the Porteus Maze test (Oas, 1985). Subjects’ reaction times or prevalence of particular anticipated responses indicated the level or amount of impulsivity. Theoretically, the quickness of a subject’s response suggested a short-circuiting of analytic or reflective thought processes (Oas).

**Self-Report Questionnaires**

More recently measurements of impulsivity have expanded to incorporate experimental and psychometric approaches (Lane et al., 2003). Such approaches include performance-based tests, direct observation of behavior in both structured and controlled situations, self-report questionnaires, and behaviorally-based laboratory task measures.
(Barrett, Petrides, Eysenck, & Eysenck, 1998; Halperin, Wolf, Greenblatt, & Young, 1991; Kagan, 1966, 1966; Cherek, Moeller, Dougherty, & Rhoades, 1997; Patton, Stanford, & Barratt, 2006; Rachlin & Green, 1972; Thompson et al., 2006). These psychometric instruments cover a broad multi-dimensional range of aspects related to impulsivity (Lane et al.). Some instruments are specifically focused on the impulsivity construct; others are part of a more global assessment with subscales that may correspond to impulsive personality traits (Cloninger, Przybeck, & Svrakic, 2009; Lane et al.).

In studies focused on substance abusing individuals, a variety of methods for measuring impulsivity have been employed (Moeller et al., 2002). One frequently used method is the self-report questionnaire. Examples include the Eysenck Impulsiveness Questionnaire (Eysenck, Eysenck, & Barrett, 1985) and the Barratt Impulsiveness Scale: two common self-report inventories (Patton, Stanford, & Barratt, 1995). Numerous studies employing self-report measures have found significantly elevated levels of impulsivity in persons who abuse substances when compared to non-substance abusing controls (Allen et al., 1998; Fishbein, Lozovsky, & Jaffé, 1989; King, Jones, Scheuer, Curtis, & Zarcone, 1990; Moeller et al., 2002; Moss, Yao, & Panzak, 1990; Patton et al.).

By measuring aspects related to impulsivity over a period of time and in a variety of situations, questionnaires are able to assess individuals’ long-term patterns of behavior (traits) related to impulsivity (Moeller et al., 2001). Since self-report questionnaires are able to capture individuals’ long-term patterns of behavior related to impulsivity, they are viewed as measuring trait-like rather than state-like aspects of impulsivity (Moeller et al.).
In addition to their focus on trait-like aspects of impulsivity, self-report questionnaires characteristically include a number of subscales aimed at measuring variables that may be related to the impulsivity construct. Eysenck’s Impulsiveness Scale, for example, covers two factors: impulsivity and venturesomeness. Impulsivity is associated with risk-taking behaviors, where decisions are made without adequate consideration of consequences (Butler & Montgomery, 2004). Venturesomeness, on the other hand, is linked to extraversion and risk-taking behaviors where the individual is aware of the risk, but engages in the behavior for the sake of thrill or adventure (Eysenck & Eysenck, 1980).

**Behavioral Laboratory Task Measures**

Behavioral laboratory tasks are another method that has been used to quantify the level of impulsivity in both animals and human beings (Moeller et al., 2002). Many behavioral task measures designed to measure impulsivity have explored response inhibition or delay of reward and are variations of the go no/go procedure. Examples include the continuous performance task, the stop task, and the delayed time task. A common feature in all these tasks is that the subject must respond in the presence of certain stimuli (visual, auditory, or temporal) but not respond to the presence of others. Impulsivity is determined from the failure to inhibit a response when required (omission of error) or by making an error (commission of error) (Lane et al., 2003).

Although much of the literature suggests that impulsivity may be a multidimensional construct, laboratory behavioral measures primarily focus on a single aspect of impulsive behavior: namely impulsivity as a state (Lane et al., 2003). Even so, the use of laboratory-based behavioral task assessments has several notable advantages.
Behavioral measures provide precise and specific measures that do not rely on personal introspection or self-assessment, but rather rely on direct examination or direct observation of subjects’ behavior or performance on tasks in a controlled environment (Thompson et al., 2006). An early example is the Porteus maze tests. In these test, impulsivity was measured by scoring subjects’ inattention to detail, carelessness, and lack of planning or proper judgment (Oas, 1985).

Laboratory behavioral task measures also provide an opportunity for concomitant physiological assessments that foster better understanding of underlying neurobiological and physiological aspects of impulsivity. Since behavioral laboratory measures of impulsivity imply variability due to their ability to capture state-like (versus trait-like) characteristics (Dougherty, Mathias, Marsh, & Jagar, 2005; Moeller et al., 2001), the use of behavioral tasks has enabled researchers to study the effects of pharmacological or behavioral interventions on impulsive behaviors (Thompson et al., 2006).

**Temporal Discounting**

Temporal discounting (TD) or delay discounting is a behavior task measure of impulsivity that involves the choice (either theoretical or actual) between a larger, delayed reward and a smaller, more immediate reward (Moeller et al., 2002). In this type of task, the choice of the smaller more immediately available reward or reinforcer is considered to be a measure of impulsivity and the choice of a larger delayed reward is a measure of self-control (Moeller et al.; Lane et al., 2003). Studies that used delayed reward (temporal discounting) tasks found that substance using individuals are more likely to choose the immediate (impulsive) reward compared to non-substance using
individuals (Kirby et al., 1999; Madden, Petry, Badger, & Bickel, 1997; Mitchell, 1999; Vuchinich & Simpson, 1998).

The TD model of impulsivity is based on the assumption that the value of a delayed reward is discounted in inverse proportion to its delay (Richards, Zhang, Mitchell, & De Wit, 1999). Discounting occurs when the present value of future reward declines as the delay to that reward increases (Kirby et al., 1999). Each individual has a particular discount rate (Kirby, 1997), which represents the steepness or proportion of reduction in perceived present value with increases in delay. The higher the rate at which a person discounts future rewards, the lower the present values of future rewards and the less impact those rewards will have on current choices (Kirby et al.).

All human beings consistently demonstrate some degree of delay discounting when given the choice between small, immediate and large, delayed rewards. Common among drug abusers is the persistent choice for relatively immediate and short-term rewards over a variety of later larger rewards or adverse consequences (Kirby et al., 1999; Richards et al., 1999); however, this greater discounting of delayed rewards is considerably greater in drug addicts in comparison with non-addicts (Garavan & Stout, 2005; Simon, Mendez, & Setlow, 2007). Greater delay discounting or TD is a common characteristic of individuals who abuse drugs. The more remote a future reward is, the lower its present value, and, therefore, the less likely the reward is to be chosen among current alternatives (Kirby et al.).

An accumulating body of evidence supports validity of TD as a measure of impulsivity. TD measures follow logical mathematical models that reliably predict and quantify choice behavior and provide a precise quantitative approach for studying
behavior in the laboratory in both nonhuman and human populations (Crean et al.). Measures of TD are also consistent with earlier investigations and conceptualizations of impulsivity (Coffey et al., 2003). For example, in developmental research, older adults exhibit a stronger preference for delayed rewards than do younger adults, and children demonstrate the least preference for delayed rewards (Crean et al.). Similarly, in psychology research, impulsive psychiatric patients, including those with opioid-dependence, severe personality disorders, and alcoholism have shown to exhibit stronger preferences for immediate rewards compared to healthy participants (Allen et al., 1998; Madden et al., 1997; Petry & Casarella, 1999; Vuchinich & Simpson, 1998).

Among substance abusers, the preference for immediate rewards over later larger rewards or adverse consequences is common, yet meaningful phenomenon. Drug abusers can derive immediate positive effects from drugs such as a high, reduction in anxiety, or relief from withdrawal symptoms, in the short term, yet the drug use is punished by the occurrence of hangovers, loss of employment, financial difficulties, estrangement from family and friends, legal problems, ill health, and premature death (Petry, Bickel, & Arnett, 2002). However irrational or illogical, chronic substance abusers will repeatedly choose the brief but immediate rewards of intoxication, and they will also do so over the larger but delayed rewards of a non-drug use lifestyle such as a stable family life, gainful employment, and improved health (Coffey et al., 2003).

The empirical evidence for the use of a laboratory task for the measure of impulsivity (more specifically TD) is mounting. Positive associations between TD and various types of drug abuse have been documented (Bickel & Marsch, 2001). For example, a delayed-reward laboratory measure of impulsivity was employed by Kirby et
al. (1999). In this study 50 subjects with heroin dependence were compared with 60 non-using controls. The researchers found that the tendency to discount the value of delayed rewards for heroin-dependent subjects was twice the rate in controls. Garnering further support for the TD laboratory task was the finding in this study that the rate of discounting (measured by a laboratory task) positively correlated with impulsivity scores that were measured by questionnaire (Kirby et al. 1997). Another study using delayed-reward measures in subjects with a history of drug dependence and controls found that individuals with a history of drug dependence were less likely than controls to tolerate delays for a larger reward (Allen et al., 1998). Similarly, Kirby and Petry (2004) used a delayed-reward laboratory measure of impulsivity for cocaine, heroin and alcohol abusers, comparing them to non-abusing with controls (Kirby & Petry, 2004). On average, the cocaine and heroin groups had higher rates of TD than controls, but alcoholics did not. Greater discounting was also observed in both heavy and problem drinkers when compared to light drinkers (Vuchinich & Simpson, 1998), in opiate-dependent patients compared with non-abusing controls (Madden, Bickel, & Jacobs, 1999; Madden et., 1997), and in current smokers when compared with both ex-smokers and never smokers (Bickel, Odum, & Madden, 1999).

Not only do substance abusers vary in TD as a measure of delayed-reward or impulsivity when compared to non-abusing controls, variability in the degree of TD has been found within the particular subgroups of substance abusers (Tucker, Vuchinich, & Rippens, 2002). Moeller and Dougherty (2002) found that cocaine users with higher measures of impulsivity reported higher levels of cocaine use and were more likely to drop out of treatment. Similarly, Coffey et al. (2003) found that crack/cocaine dependent
clients in treatment with longer time perspectives were more likely to finish treatment compared to those with shorter time perspectives. Abstinence was also found to be associated with lower TD rates for heroin abusers, but not for cocaine or alcohol abusers, suggesting that discount rates vary with the preferred drug of abuse (Kirby et al., 1999) as well as within subgroups for other addictive behaviors such as eating disorders (Evans, Searle, & Dolan, 1998) and pathological gambling (Raylu & Oei, 2002).

**Reliability and Validity of the TD Measure**

Computer task measures of TD have been shown to have acceptable reliability in past studies. Simpson and Vuchinich (2000) measured TD rates for hypothetical monetary gains among college students and found high test-retest reliability. Correlations for a series of hypothetical delays were as follows: for a 6 month delay, \( r = .832 \); for a 1 year delay, \( r = .875 \); for a 3 year delay, \( r = .85 \); for a 5 year delay, \( r = .891 \); for a 10 year delay, \( r = .921 \); for the 25 year delay, \( r = .951 \). The test-retest reliability for the \( k \) parameter was .906. Baker et al. (2003) determined TD rates (\( k \)) in current and never-before smokers. For current smokers correlations were as follows: for $10, \( r = .74 \); for $100, \( r = .78 \); and for $1,000, \( r = .71 \). For never-before smokers, the test-retest correlations were as follows: for $10, \( r = .82 \); for $100, \( r = .87 \); and for $1,000, \( r = .90 \). The strong correlations suggest that the TD computer task is a reliable instrument for measuring impulsivity (Baker et al., 2003).

Computer task measures of TD also have been shown to have acceptable validity in multiple studies. Discriminative validity can be evaluated by correlation scores among samples, which when tested are significantly unrelated (Bagozzi, Yi, & Phillips, 1991). TD rates have shown discriminative validity across a wide range of samples of substance
abusers, with individuals who use drugs having been more likely to make choices that favor immediate rewards than nonusers (Bickel, Odum, & Madden, 1999; Coffey et al., 2003; Kirby et al., 1999). External validity involves the extent to which the results of a study can be generalized beyond a particular sample or setting (Bracht & Glass, 1968). Several studies have used the TD paradigm to examine impulsivity in a variety of substance abusing populations (Bickel & Marsch, 2001; Critchfield & Kollins, 2001). Madden et al. (1997) examined TD in opioid-dependent and matched non-drug using controls. Results indicated that opioid dependent participants discounted delayed monetary rewards to a greater degree than did non-drug abusing controls. Similarly, heavy social drinkers and problem drinkers (Vuchinich & Simpson, 1998), cigarette smokers (Bickel, Odum, & Madden, 1999; Mitchell, 1999), heroin addicts (Kirby et al., 1999; Madden et al., 1997), marijuana-dependent individuals (Johnson et al., 2010), crack/cocaine dependent individuals (Bickel & Marsch, 2001; Coffey et al., 2003; Dixon, Marley, & Jacobs, 2003; Heil, Johnson, Higgins, & Bickel, 2006; Reynolds, 2006), and mixed-substance use populations (Petry & Casarella, 1999) have been found to discount delayed rewards at significantly higher rates than controls. There are few studies specifically evaluating the validity and reliability of TD measures among ethnic groups however, in one study of discounting among adolescents, there were significantly lower planning scores among adolescents between 12 and 15 than among younger or older individuals but the discounting rates age did not vary as a function of gender or ethnicity (Steinburg, Graham, O’Brien, Woolard, Cauffman, & Banich, 2009).

The validity of TD measure has also been strengthened by studies exploring the relationship of TD to other reliable and valid measures of impulsivity. Using both
hypothetical money and hypothetical drug rewards in opioid-dependent patients and non-drug using controls, Madden et al. (1997) compared the TD rates to the scores from the impulsivity subscale of the well-established Eysenck Personality Questionnaire. The correlations between TD rates ($k$) and scores from the Eysenck Personality Questionnaire for hypothetical money rewards were similar for the opioid-dependent group, $r = .40$ and the control group, $r = .39$ respectively. The correlation between TD ($k$) scores and Eysenck Personality Questionnaire scores for hypothetical heroin rewards was comparable, $r = .40$. Kirby et al. (1999) compared TD scores ($k$) with the self-report impulsiveness subscale of the Eysenck’s I-5 and the non-planning subscale of the BIS-10. The correlation between $k$ and the I-5 impulsiveness subscale was significant, $r = .27$. The correlation between $k$ and the BIS-10 cognitive impulsiveness subscale was also significant $r = .25$. The magnitudes of these two correlations are within the typical range for correlations between self-report and behavioral measures of impulsivity (Gerbing, Ahadi, & Patton, 1987; Kirby et al.; Logan, Schachar, & Tannock, 1997; White et al., 1994). Richards et al. (1999) examined the effects of alcohol on several measures of impulsivity and found that TD measures of impulsivity positively correlated with scores obtained on several standard personality questionnaires. TD ($k$) correlated with the Eysenck Personality Inventory subscale for impulsivity, $r = .35$ and the disinhibition subscale of Zuckerman (1971) Sensation Seeking Scale, $r = .45$.

**The Relationship of TD to Substance Abuse**

Despite the strong association between drug addiction and increased impulsive choice, the direction of this relationship between drug use and TD remains unclear. Several studies on humans and animal models suggest that preexisting impulsivity may
be a causal factor in drug abuse. That is to say that persistent impulsive choice (TD) on the part of drug abusers may be related to an actual inability to assess adequately the long-term consequences of their actions (Simon et al., 2007). By nature, drug abusers may be less responsive to the prospect of delayed punishments associated with drug use because these punishers are not readily apparent in a shortened and poorly perceived future (Petry et al., 1998; Smart, 1968). Furthermore, substance abusers may not be able to appreciate the degree to which future outcomes and consequences impact their current decisions (Kirby et al., 1999). For example, given a choice between $1000 now and $5000 in a year, most people would opt for the latter; however, substance abusers may be inclined to choose the former. This behavior of devaluing of future rewards, may be a defining feature of addictive disorders (Moeller & Dougherty, 2002). Growing evidence also suggests that impulsive choice behavior may be a consequence of exposure to drugs themselves. This, however, does not preclude the role of preexisting impulsivity in predispositions to drug addiction (Simon et al.). Nonetheless, drug altered decision making appears to promote selection of the immediate short-term rewards like continued drug use over the long-term benefits often associated with being drug free or abstinent (Petry et al., 1998; Kirby et al., 1999).

The degree of discounting among substance abusers may have a prognostic value with respect to recovery attempts and the outcomes of interventions (Rosenqvist, Blomqvist, Koski-Jännes, & Öjesjö, 2004). Instruments that measure levels of TD among untreated substance abusers may predict long-term outcomes for natural resolution attempts (Tucker et al., 2002). Substance abusers who presumably discount future rewards to a greater degree actually may have poorer prognoses as compared to substance
abusers who discount less and organize a portion of their present behavior around delayed non-drug related activities (Keough, Zimbardo, & Boyd, 1999). Individual differences in drug patterns of TD may add new information about addiction severity or the degree of substance abuse. Empirically based measures that capture the severity of the condition and the within group variability of drug abusing clients can enhance prediction of long term outcomes (Tucker & Roth, 2006).

In addition to predictive value, a reliable and valid measure of TD may prove to be an important patient-treatment matching variable. Interventions that help patients to plan or make constructive goals for their future may have beneficial effects on addictive behaviors, especially among persons who have difficulty perceiving future consequences and rewards. By increasing the extent to which substance abusers organize their behavior around future rewards, interventions that aim to increase the relative perceived importance of future rewards on present behavior may lead to longer periods of recovery and abstinence (Tucker et al., 2002). This can be accomplished by helping substance abusers make choices that involve long-term decision making and goal setting as opposed to choosing more immediate and harmful returns (Rosenqvist et al., 2004). Much of what we do already in treatment is to help the client make healthy plans for their future and to make the decision that drug use will interfere with those plans. If an intervention were found to be effective in changing how substance abusers perceive their future, substance abuse treatment could be greatly improved.

Certain applications that already have established effectiveness appear likely to reduce the degree of TD and lengthen the time horizons around which substance abusers organize their behavior patterns (Rosenqvist et al., 2004). Although not designed
explicitly for this purpose, Motivational interviewing (MI) techniques are used to create motivation for change by discussing with clients about the likely course of their lives if they continue or discontinue the abuse (Miller & Rollnick, 2002). Therapists who use MI techniques attempt to create ambivalence about substance abuse by engaging with clients about the likely course of their lives if they refrain from use of substances. By highlighting the value of future rewards, MI may elicit change by helping clients to lengthen time horizons and shift allocation patterns from impulsive and immediate gratification to future rewards based on balanced and judicious decision making (Tucker et al., 2002). Substance abuse programs using contingency management treatment programs, which reward appropriate behavior or achievement treatment goals, might decrease impulsivity by eliciting thoughts about one’s future actions. Similarly cognitive-behavior therapy may lengthen time horizons or the way an individual perceives his future. This may explain why, when combined, these two treatments produce better outcomes (Bickel et al., 2007).

Certainly the laboratory task measure of impulsivity is a promising tool for expanding our understanding of the relationship and between impulsivity and substance. Measurement of TD may prove to be an important mechanism for expanding the knowledge base of impulsivity among individuals who abuse substances. Additionally, the theoretical component of this measure, coupled with a sound biological and behavioral economic foundation, may help in the development of future models that narrow the theory gap between theory and biology. Of critical importance also is how this variable relates to demographic variables and other variables associated with outcomes in substance abuse treatment.
TD and Age

The extant literature on the relationship between TD and age is equivocal. Green, Myerson, Lichtman, Rosen, and Fry (1996) compared the discounting rate of 30 year old participants with income-matched 70 year old participants and found no significant differences in TD between the two age groups. More recently in a genetics study by Smith & Boettiger (2012) investigating COMTval met genotype polymorphism effects on TD in samples of adolescents 18 to 21 year old and adults 22 to 30 years and found no correlation between age and TD in a study.

Results of other studies have been mixed. Age was associated with differences in TD (Reimers, Maylor & Chater, 2009). Green, Fry, and Myerson (1994) found that elementary school age children discounted future rewards more than younger adults (aged around 20), who in turn discounted future rewards more than older adults (aged around 68). Using a wide range of participants from age 21 to 65 years, Reimers et al., found an effect of age on TD with lower rates of TD being associated younger age. Similar findings were reported by Whelan & McHugh (2009). In a study that combined findings from Green et al. and Green et al. (1996), TD rates that were high in young adults declined at age 30 and remained relatively constant after the age of 30, suggesting a developmental and maturational association between TD and age. Scheres et al. (2006) examined TD and age and found that children (ages 6 through 11 years) had higher TD scores than adolescents (ages 12 through 17 years).

Working Alliance

The relationship between client and therapist is a critical component of any treatment plan (Howard, Turner, Olkin, & Mohr, 2006). Effective treatment involves the
development of mutual treatment goals and tasks as well strong relational bond between client and therapist (Busseri & Tyler, 2004). Studies of individual psychotherapy have demonstrated the importance of therapeutic alliance in psychotherapy outcome (Martin et., 2000). Research has consistently demonstrated that alliance and therapist-client relationship factors predict treatment gains more strongly than any other widely investigated aspect of the treatment process (Orlinksy, Ronnestad, & Willutzki, 2004).

Considerable research has been conducted on therapeutic alliance with adult psychotherapy clients, yet in adolescent populations, therapeutic alliance remains a relatively new area of investigation. Therapeutic alliance research on adolescent clinical populations holds great promise for identifying treatment processes that promote successful outcomes (Hogue et al., 2006). Recent meta-analyses, in fact, have demonstrated that, for children and adolescents in psychotherapy, strong therapeutic alliance results in better treatment outcomes (Kadzin, Stolar, & Marciano, 1995; Shirk & Karver, 2003). Consequently, this knowledge has led to increased emphasis on the cultivation of therapeutic alliance in the treatment of adolescents (Liddle, 1999).

In early explorations of client-therapist relationship factors, Bordin (1979) theorized that, throughout the course of treatment, a “working alliance” developed in all therapist-client therapeutic relationships. Defined as the “collaborative and affective bond between therapist and patient” (Martin et al., 2000, p. 438), Working Alliance is now considered an important and integral component in any client-therapist interaction (Hogue et al., 2006). Furthermore, when measured empirically, Working Alliance has shown to be significant predictor of treatment outcome across a variety of therapeutic
modalities, alliance measures, and patient groups, accounting for up to 26% of the variance (Horvath & Symonds, 1991; Martin et al., 2000).

Several research studies examined the predictive relationship between early Working Alliance in therapy and later therapy outcomes (Busseri & Tyler, 2003). Stronger early alliance was associated with greater retention in individual drug counseling (Barber et al., 2001). Among adolescents greater therapeutic alliance has been associated with greater probability treatment success, but not in a straight-forward “more means better” manner. Paradoxically weaker early alliance predicted more success in treatment as opposed to stronger alliance. The explanation may lie in the potential for a positive shift in alliance level. Adolescents, whose alliances started low, but improved during therapy showed corresponding symptom improvement. Conversely, declining alliance was associated with symptom escalation (Hogue et al., 2006). However, few studies to date include substance abusers (Robbines et al., 2006). Clearly further research is needed to examine factors that may impede or improve WA among adolescents in substance abuse programs.

The specific relationship between impulsivity (TD) therapeutic alliance and outcome in outpatient treatment settings remains unexamined. Impulsivity (TD) may be a variable that may affect early WA. Although higher levels of TD are thought to impact the time until relapse, dropout rate or length of time in treatment (Kirby & Petry, 2004), this relationship could possibly be mediated by therapeutic alliance. Perhaps in much the same way impulsive adolescents devalue long term treatment goals, they may also devalue a relationship with their counselor, whose role is to help guide them toward a better future without drugs.
Cultural Considerations for Substance Abuse in Hispanic Adolescents

The role of culture and ethnicity is a common consideration by clinicians from diverse theoretical orientations (Tharp, 1991). One of the objectives of treatment outcomes research with Hispanics is the evaluation of the efficacy of treatments and the comparison of the effectiveness of treatments across cultural boundaries. Research interventions that take into account the cultural context in which the treatment is evaluated and delivered are referred to as culturally sensitive (Bernal, Bonilla & Bellido, 1995). The movement toward culturally sensitive treatments (Rogler, Malgady, Constantino, & Blumenthal, 1987), psychotherapists (Lopez et al., 1989), culturally compatible interventions (Tharp, 1991), and ethnicity in therapy (McGoldrick et al., 1982) are all attempts to increase the congruence between the client’s cultural world and experiences and the properties of the treatment delivered by the clinician (Bernal et al).

Marin (1990) defined culturally appropriate interventions as strategies for behavioral change in which the interventions are based on the patients’ cultural values of, are congruent with the expectations and the preferences of the cultural group as a whole.

A number of cultural and societal influences associated with risk and protective factors experienced Hispanic youth has been identified (Strait, 1999). One variable, acculturation, has been associated and negative and positive health outcomes. Described as an interactive process between individuals and the host culture, acculturation represents a general orientation toward both native or heritage cultures and host or receiving cultures (Tadmor & Tetlock, 2006). Acculturation also refers to the psychosocial changes that individuals and groups experience when in contact with different cultures (Alvidrez, Azocar, & Miranda, 1996; Williams & Berry, 1991). For an
individual, the level of acculturation refers to the newly acquired attitudes, behaviors, values, norms and attitudes, and perceptions. Individuals may acquire behaviors and values from the host culture, but at the same time they may retain and preserve elements from their native culture (Berry, 2005). Positives aspects of this bi-acculturation include the retention of supportive traditional cultural elements and acquisition of beneficially adaptive cultural elements from a host society (Rogler, Cortes, Malgady, 1991). Negative aspects related to acculturation like stress and anxiety have been considered maladaptive (Schwartz, Zamboanga, & Jarvis, 2007).

Historically Hispanics have maintained close ties to their native language and country by preserving their language, cultural distinctiveness, and traditions (Sommers, 1991). Hispanics in the United States tend to maintain a strong cultural identity which may make the acculturation process especially difficult. Integrating native cultural values and traditions into the prevailing host culture may lead to conflicts with self-identity, affiliation, and feelings of connectedness. Hispanic immigrants experience the effects of contact with an unfamiliar language, culture and often hostility and disdain in their new host communities (Hovey & King, 1996). Acculturative stress occurs when external or internal demands exceed the individual’s ability to adapt or cope (Smart & Smart, 1994). Acculturative stress is not only a function of conflicting cultural values, but also is related to external pressure to conform to a prevailing culture (Mena, Padilla, & Maldonado, 1987). Physiological and psychological changes produced by the demands to acculturate result in acculturative stress (Berry, Kim, Minde, & Mok, 1987; Hovey, 2000).

Numerous cultural clashes are thought to contribute to acculturative stress in Hispanics. *Familism,* a core Hispanic value that embodies the strong emotional ties that
are central to Hispanic family life, often conflicts with individualism and independence: values stressed more in U.S. society than in traditional Hispanic countries (Gil & Vega, 1996; Hovey, 2000; Hovey & King, 1996; Kaplan, Turner, & Badger, 2007). Familism is a cultural value held by Hispanics in which family relationships are highly valued and individual identity is seen as a product of those associations (Bean, Perry & Bedell, 2001; Ho, 1987). Loss of family support, increased family conflict, and separation has been is have also been studied among various immigrant groups (Dalla & Christensen, 2005). Immigrants often feel forced to take low paying labor despite having held white-collar employment of higher social status in their home countries (Kaplan et al.). This decline in social standing and socioeconomic status has been found to be a strong influence on drug use (Schinke, Orlandi, Vaccaro, Espinoza, 1992). Hispanics have been characterized as being more present oriented and more fatalistic than non-Hispanic white Americans, for example, planning for the future may be a behavior that is done to a greater degree among non-Hispanic white Americans than than among Hispanics, who may be concerned with immediate problems and solutions (Diaz & Avala, 1999; Garcia-Preto, 1996; Inclan, 1985).

Gender roles have been identified to have an impact on acculturative stress levels and subsequent risk behavior. Traditional gender roles are more clearly defined in Hispanic culture than in U.S culture (Salgado De Snyder, Cervantes, & Padilla, 1990). Within a household, marital conflict may emerge when women acculturate to the American values of gender equality while Hispanic men attempt to maintain traditional gender roles (Hunt, Schneider, & Comer, 2004).
While there are important and substantive differences between various Hispanic subcultures, the cultural, attitudinal, and behavioral similarities of different Hispanic subgroups often lead researchers to aggregate different subgroups into a group (Epstein, Botvin, Baker, & Diaz, 1998; Fan & Zuicker, 1998; Plath & Stevenson, 2005; Wagner & Soberon-Ferrer, 1990). Multicultural competence is generally conceptualized as involving three main areas: therapists’ awareness of their own culture, therapists’ knowledge of the worldview of the culturally different client, and therapists’ behaviors or use of culturally appropriate treatment strategies and interventions (Sue, Arredondo, & McDavis, 1992).

**Substance Abuse Treatment**

Substance abuse treatment is complicated by a number of factors that are particular to or problematic for adolescents. In treatment samples, adolescents typically use multiple substances. This coupled with the fact that substance-abusing adolescents have high rates of comorbid psychiatric disorders, such as ADHD, depression, and conduct disorders complicates treatment delivery modalities and treatment outcomes. Treatment of substance-abusing adolescents is also affected by high rates of substance abuse in their immediate families (Henggeler et al., 1996; Winters, 2000). Exposure to drug use and drug-related cues within the household is likely to erode sanctions against drug use, dissuade adolescents from seeking treatment, and reinforce or promote current drug use. Similarly, parental substance abuse is associated with poor parenting practices and low levels of parental monitoring (Chilcoat, Dishion, & Anthony, 1995). Another obstacle to treatment for adolescents is that adolescents rarely seek treatment voluntarily, but are usually coerce by legal, medical, or school related problems (Evans et al., 2005).
Existing programs focusing primarily on substance-abusing adolescents can be generally grouped into four categories, although there is considerable overlap between programs (Evans et al., 2005; William & Chang, 2000). The most common is the “Minnesota model.” This is a short (generally 4-6 week) inpatient hospital program typically involving a comprehensive range of treatment services including individual counseling, group therapy, medication, family therapy, schooling, and recreational therapy. Twelve-step programs like Alcoholics Anonymous or Narcotics Anonymous may be included or integrated within such programs (Evans et al.; Williams & Chang; Winters, Stinchfield, Oplan, Weller, & Latimer, 2000). The second and common type of treatment delivery is outpatient therapy. These programs usually focus on individual counseling coupled with family therapy (Williams et al., 2000). The delivery of this type therapy tends to be less intensive compared to inpatient hospital treatment (Evans et al., 1995, Williams et al.). Duration may vary from 1 session to 6 months with an average length of 3 months (Williams et al.).

Supported conceptually for use with Mexican American, (Soto-Fulp & DelCampo, 1994), Central Americans, (Arredondo, Orjuela, & Moore, 1989), and Cuban Americans (Szapocznik et al., 1993), family therapy has been the preferred method of working with Hispanics substance-abusers and their families. Family therapy is seen as being culturally relevant for Hispanics because it reinforces their view of familism and extended family (Paniagua, O’Boyle, Tan, & Lew, 2000). Family therapy have been found to be more effective in treating antisocial behavior and drug use in Hispanic youth when compared with group therapy and/or control groups (Santisteban, Mena, McCabe, 2011; Santisteban et al., 2003).
A third type of treatment is the “therapeutic community” type of program based in specialized substance abuse treatment facility (Jainhill, Bhattacharya; Williams). These tend to be regimented residential settings with treatment facilitated by paraprofessionals, but run by the residents who themselves were former substance abusers. Members progress through a hierarchy of responsibilities and may earn higher privileges as they progress through the program (Inciardi, Martin, & Butzin, 2004; Williams et al., 2000).

Length of stay in community-based substance abuse treatment programs represents one of the best indicators of patient outcome (Gerstein & Harwood, 1990). Several months of treatment appear to be necessary for sustaining behavioral improvements over time (Hubbard & Simpson, 2009; Simpson & Sells, 1982). A common finding in the substance abuse treatment literature is that patients who stay in treatment longer have better outcomes (Condelli & Hubbard, 1994; Etheridge, Craddock, Hubbard, & Rounds-Bryant, 1999; Hubbard, Craddock, Flynn, Anderson, & Etheridge, 1997; Hubbard, Simpson, & Woody, 2009; Prendergast, Hall, Wexler, Melnick, & Chao, 2004; Simpson, Joe, & Broome, 2002). Based on these studies, researchers, policy makers, and treatment providers have explored ways to both increase lengths of stay and improve treatment for patients (Luchansky et al., 2006)

**Study Framework**

Large segments of adolescents are growing up in circumstances that put them in situations of risk. A common goal among nurses, sociologists, psychologists and other social science disciplines involved the care of adolescents is to seek agents or conditions that compromise health, quality of life, or life itself and to develop strategies to illuminate or minimize their effects (Jessor, 1991; France, Freiberg, & Homel, 2010). In essence,
persons involved in the care of adolescents must work to ensure that sum strength of protective factors outweighs risk factors. A social environment with limited social, economic, resources, inequity, discrimination compromises their future health and development. Contrary to common belief, adolescent behaviors are purposeful, meaningful and goal-directed. Behaviors such as drug abuse, risky sexual behavior may be instrumental in gaining acceptance among peers, coping with anxiety and depression, and establish autonomy. These behaviors are deemed problematic because of their perceived and projected negative consequences. Yet the same motivations (establishment of autonomy, acceptance of peers, independence, and repudiation of authority) that underlie such risk behaviors remain the goals of any other adolescent who is deemed to be on a healthy trajectory toward adulthood. It may not be the risk behaviors that impede normal development, but rather the predisposing factors that jeopardize a healthy transition to adulthood. For example, biological risk factors like organic depression or a genetic predisposition propensity for alcoholism contribute to behaviors that impair normal maturation (Jessor). Often, however, the agents or conditions that put adolescents at risk for long term consequences are not detected or even faced until the ramifications are so severe as to pose an obvious threat to the health and welfare to family, society, and to the individual adolescents themselves. For adolescents, these agents or conditions constitute risk factors that are precursors to maladaptive coping, unsuccessful transition to adulthood, and poor outcomes like substance abuse (Dickson, Derevensky, & Gupta, 2002).

Current etiological models emphasize complex interactions among genetic, biomedical and psychosocial risk and protective factors (Coie et al., 1993). Jessor’s
(1991) Theory of Problem Behavior is a complex and comprehensive structure that provides an explanation for the multidimensional and broad nature of the concept. Impulsivity has been empirically portrayed as an integral element to human growth and development, pathology, personality, cognition, motoric behavior, decision making, and neuropsychological and biological functioning. Within Jessor’s framework, impulsivity can be viewed as a potential risk factor within each system (the perceived environment, personality, social, behavioral, and biological), all of which have similar corresponding associations within corresponding scientific research realms. Whether they be environmental, biological, social, or behavioral, the risk factors affecting adolescents most likely are interconnected and occur simultaneously in differing degrees of impact on the individual. See Appendix 2.

An understanding of how impulsivity interacts within and between each system is essential for successful risk-focused programs aimed at eliminating, reducing, or minimizing risk (Jessor, 1991). Effective working alliance between provider and client may be one way in which to strengthen protective factors. Impulsivity and more specifically, TD may influence or affect substance abuse behaviors among adolescents. Moreover, TD may act as a risk factor by influencing the behavior itself, or it may act as a mediating variable that ultimately leads to problematic behavior.

Summary

Chapter 2 provides a literature review of the concept of impulsivity by integrating a historical review and an analysis of theoretical perspectives of the topic. The variables and measures associated with the concept of impulsivity and a measure of Working Alliance are discussed. A discussion of the variable of TD and its relationship to risk-
taking and substance abuse is introduced. The following research hypotheses will be tested:

**Research Hypotheses**

1. Age will be inversely related to TD.
2. TD will be inversely related to alliance.
3. TD will be inversely related to retention in the first 5 weeks of therapy.
4. TD will be inversely related to the number of therapy sessions in the first 8 weeks of therapy.
5. TD decreases after 5 weeks of therapy.
CHAPTER 3

Method Section

The purpose of this study was to examine the relationship between temporal discounting (TD), working alliance, retention in treatment, age, and number of sessions in which subjects participated in the first 8 weeks after starting the program in a sample of adolescents receiving outpatient substance abuse treatment. This chapter describes the methods for this study, including the study design, the setting, the sample, instrumentation, data collection procedures, data management, data analysis, and protection of human subjects.

Design

This study of the relationship between TD, age, working alliance, treatment retention, the number of sessions attended after 8 weeks of therapy, and the change in TD after 5 weeks, is a nested study of a larger 5 year National Institute on Drug Abuse (NIDA) funded, phase 2 of a randomized clinical trial that examined Culturally Informed and Flexible Family-Based Treatment for Adolescents (CIFFTA) (Santisteban & Mena, 2009) versus Traditional Family Therapy (TFT) in a sample of Hispanic adolescents. The TD study involved data collected from a prospective convenience sub-sample of the 220 adolescents (14 to 17 years of age) who met DSM-IV-R, (2000) criteria for Substance Abuse over an 18 month period from 2010 to 2013.

Setting

Prior to initiation of this project, the CIFFTA study was approved by the Institutional Review Board (IRB) at the University of Miami. Participants were recruited from an outpatient substance abuse treatment programs located in Miami-Dade County,
Florida: Miami Behavioral Health Center in Miami, and from local high schools, or from juvenile justice alternative programs. Participation was voluntary and all participants and parents were consented both as outlined below and within the guidelines of the IRB.

Sample

Participants for this research were adolescents between the ages of 14 and 17 years old and their parents who were recruited for the larger parent study, CIFFTA. Families were assessed at baseline, randomized to one of two outpatient conditions (CIFFTA or TFT) and received treatment twice weekly for four months. The current study required a sample size of 55 adolescents to achieve an alpha of .05 and a power of 80%. Because the parent study was an examination of CIFFTA, a therapy tailored specifically for substance abusing Hispanic adolescents and their families, all participants in this sample were Hispanic. Participation was delimited to adolescents with at least one family member with origins in a Spanish speaking county. All variables named in this study were also included in the parent study and continued to be collected until the parent study ended.

To be eligible for the randomized trial, participants must have been between the ages of 14 and 17 years of age and have met DSM-IV-R criteria for Substance Abuse. For this study, there were inclusion criteria in addition to those of the parent study. Because the TD computer task was written in English, adolescents had to be able to understand, speak, and read English. It was not required that parents be able to understand or speak English because only the adolescents completed the TD computer task. Participants also had to be able to perform basic psychomotor tasks associated with using a laptop computer, and understand the purpose, benefits, and risks of the study.
Frequencies and percentages were conducted on gender, education, age at enrollment, and retention at 5 weeks. The majority of participants were male (43, 78%) and were currently attending school (41, 75%). There was a good distribution of cases along all ages from 14 to 17 years old. Most participants were retained in the program at 5 weeks (44, 80%). The primary substances used were THC (85%) and Alcohol (62%). Frequencies and percentages are presented in Table 2.

Table 2

*Frequencies and Percentages of Participant Characteristics*

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<thead>
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<th>Variable</th>
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Measures

Demographics

Demographic variables collected for this study included age, gender, treatment retention, education level, and school attendance. Age was defined as the number of months lived at the time of enrollment and gender was defined as male or female. This information was collected from parents when adolescents were enrolled into the program.

Treatment Retention

Retention in treatment was conceptually and operationally defined as having remained in treatment for at least 5 weeks from the time of enrollment. Upon enrollment into the parent study, participants were randomized into either traditional family therapy or CIFFTA. After 5 weeks in the program, the total number of therapy sessions attended was calculated. Treatment retention was calculated as a dichotomous variable. Retention was determined as being in treatment after five weeks (1) and not being retained was considered withdrawing from treatment prior to five weeks of therapy (0).

Therapeutic Alliance

The therapeutic alliance refers to the relationship between a mental health therapist and a client (Horvath & Symonds, 1991). Therapeutic alliance was measured with the Working Alliance Inventory (WAI). The WAI is a commonly used empirical measure for therapeutic alliance. Based on Bordin’s (1979) theoretical work, the WAI is a 36 item self-report instrument that measures working alliance from the client, therapist or observer perspective and is designed to assess three aspects of alliance: Tasks, Goals, and Bond (Horvath & Greenberg, 1986, 1989). The Goals subscale measures the amount of agreement between the client and the therapist on the “goals (outcomes) that are the
target of the intervention” (Horvath & Greenberg, 1989, p. 224). The Tasks subscale measures the extent to which a client and therapist agree on the “counseling behaviors and cognitions that form the substance of the counseling process” (p. 224). The Bond subscale measures the extent to which a client and therapist hold “mutual trust, acceptance, and confidence” (p. 224). A 7-point Likert-type scale ranging from 1 (never) to 7 (always) is used to score the 36 item inventory which has 12 non-overlapping items to measure each subscale. Subscale scores can range from 12 to 84 and can be summed to obtain a total score. Total WA scores can range from 36 to 252. Higher scores reflect more positive ratings of WA (Horvath & Greenberg).

Three versions of the WAI are available: a client version, a therapist version, and an observer version. For this study, only the client version was used. Internal consistency estimates of the three subscale scores, based on initial validation samples of 29 and 25 actual clients and their therapists, ranged from .85 to .92 (client version) (Horvath & Greenberg, 1989). An internal consistency estimate of the total score was .93 (Horvath & Greenberg). For the purposes of this study, WAI data was collected at approximately 4-8 weeks from the date of the participant’s first therapy session. This point in therapy was chosen because the initial 4-7 weeks of therapy are a time in which the therapist establish rapport and formulate goals for the client. Cronbach’s alphas were conducted to assess the internal consistency of the total score and subscales of the WAI. The alpha values ranged from .64 to .91, where > .9 is Excellent, > .8 is Good, > .7 is Acceptable, > .6 is Questionable, > .5 is Poor, and < .5 is Unacceptable (George & Mallery, 2010). Convergent validity of the WAI has been established as evidenced by strong associations between the WAI and other inventories measuring traits similar to WA. Horvath and
Greenberg found significant correlations to instruments measuring similar constructs of bond, task goal and empathy. High interclass on the client correlations among subscales ranged from $r = .85$ and $r = .89$. Fenton, Cecero, Nich, Frankforter, and Carroll (2001) compared WAI to other instruments measuring therapeutic alliance, client measures consistently intercorrelated at significant levels: WAI client version (WAI-C) to California Psychotherapy Alliance Scale, $r = .31$; and WAI-C to Pennsylvania Helping Alliance Rating, $r = .36$.

Means and standard deviations for the total score of the WAI and subscales are presented in Table 3.

Table 3  
*Means, Standard Deviations, and Cronbach’s Alphas for the WAI*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$M$</th>
<th>$SD$</th>
<th>No. of items</th>
<th>Cronbach’s $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAI total</td>
<td>5.26</td>
<td>0.91</td>
<td>36</td>
<td>.92</td>
</tr>
<tr>
<td>Task</td>
<td>5.24</td>
<td>1.02</td>
<td>12</td>
<td>.84</td>
</tr>
<tr>
<td>Bond</td>
<td>5.26</td>
<td>1.02</td>
<td>12</td>
<td>.84</td>
</tr>
<tr>
<td>Goal</td>
<td>5.42</td>
<td>0.96</td>
<td>12</td>
<td>.64</td>
</tr>
</tbody>
</table>

**Temporal Discounting**

A computer task was used to measure TD (Johnson & Bickel, 2002). This program is an automated version of the double limit laboratory procedure created by Richards et al. (1999). For this study, the 10-15 minute computer-based TD task was administered on a laptop computer at the beginning of treatment (T1) and after five weeks of treatment (T2). Participants completed the task on their own. A research staff member trained in administration of the measure was available if the participant had questions or concerns regarding the use of the program. A brief description of the TD
task follows, but readers may see Appendix 1 for a detailed description. The TD measure was specifically administered by assessors who were trained for administration of the tool.

Means and standard deviations were conducted for TD at T1 and T2 for each of the magnitudes (dollar amounts) prior to the natural log transformations and are presented in Table 3. Means and standard deviations at T1 and T2 for each of the magnitudes after the natural log transformations are presented in Table 4.

Table 4

<table>
<thead>
<tr>
<th>Magnitude</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>$50</td>
<td>.0455</td>
<td>.0542</td>
</tr>
<tr>
<td>$100</td>
<td>.0291</td>
<td>.0426</td>
</tr>
<tr>
<td>$500</td>
<td>.0323</td>
<td>.0630</td>
</tr>
</tbody>
</table>

**Temporal Discounting Task**

The objective of the computer program was to determine the degree to which a participant exhibits TD when presented with a choice between collecting a future hypothetical monetary reward or a lesser amount immediately. Participants were asked to make a choice between a smaller, immediate monetary reward and a larger, delayed hypothetical monetary reward. Participants completed this task three times in a single session for three future hypothetical amounts of $50, $100, and $500 for five delay periods of 1 week, 1 month, 6 months, 1 year, and 5 years (for computational purposes these were measured in days). The monetary amounts and time delays were selected based on previous research.
The researcher began the task by entering the future hypothetical monetary reward of $50. Participants were then presented with two choices for each delay period: take a smaller, reward “NOW” or take a larger, delayed reward of $50 in 1 week. The “NOW” option appeared on the left side of the computer screen and the “FUTURE” amount appeared on the right. For example, the computer might have presented a participant with the choice of receiving $43.89 now or $50 in 1 week. Using the computer mouse, the participant then selected the desired option on the computer screen. Throughout the task, the computer made multiple adjustments or iterations upward and downward based on each participant’s choice. This continued until an indifference point was reached. At the indifference point, the participant settled for a lesser amount of money “now” rather than wait the specified time delay to receive the $50. The indifference indicates that point at which the participant’s choice of a smaller, immediate amount of money was the perceived to be equivalent to the future hypothetical delayed reward amount of $50. When a participant’s indifference points for the hypothetical future amount of $50 was obtained for the five delay periods, the researcher then repeated the process for $100 and $500. When indifference points were determined for all three hypothetical future dollar amounts and all five delay periods, the computer task was complete. The average amount of time to complete the task was approximately 20 to 30 minutes.

For each indifference point, the computer generated a value that is the proportion of each future hypothetical delayed reward that the researcher entered into the computer. Individuals who fail to wait for higher immediate amount and elect to take a lesser immediate amount are deemed more impulsive. Those who tend to wait longer for a
greater amount are considered less impulsive. To illustrate this hypothetically, a person considered less impulsive may have proportions of 0.98, 0.96, 0.97, 0.94 and 0.95 for the amount of $50, for delays of 1 week, 1 month, 6 months, 1 year, and 5 years respectively. For this individual $50 in 1 week is perceived to be worth $49 now (50 X 0.98), in 1 month is worth $48 now (50 X 0.96), in 6 months, is subjectively worth $48.50 now (50 X 0.97), in 1 year is worth $47 now (50 X 0.94), and in 5 years is worth $47.50 now (50 X 0.95). An individual who is comparatively more impulsive may have proportional values of 0.65, 0.56, 0.50, 0.42 and 0.32 for a $50 amount for delays of 1 week, 1 month, 6 months, 1 year, and 5 years respectively as in the previous example. The perceived “now” values would be $32.50, $28.00, $25.00, $21.00 and $16.00 respectively. The reduced perceived “now” amount is regarded as the discounted value. The process by which a participant makes decisions and settles for a lesser subjective amount of money “now” rather than wait the specified time delay to receive the full amount of the future reward, is delay discounting or temporal discounting.

Hyperbolic Discounting

Over the past two decades both hyperbolic and exponential discount functions have been employed to describe how humans make decisions over time (Ainslie, 1975, 1981). The exponential function assumes equal increments of delay produce constant proportional declines in the current reward values (Vuchinich & Simpson, 1998). This model makes the assumption that humans make decisions at a constant rate of discounting over time no matter how distant the future reward may be.

Empirical research over the past two decades has documented that human decision-making as a function of delay appears to be best represented a hyperbolic curve.
over time versus exponential modeling. According to the hyperbolic function, an equal increment in delay will produce a larger decrement in reward value for shorter time delays versus longer time delays (Graves & Ringuest, 2012), primarily because human beings tend to discount at a higher rate in the near term, with declining rates of decay in the more distant future. In other words the preference for the discounted current reward increases at a greater rate in the short term and declines with more distant in the future delays.

Figure 3.1

![Figure 3.1](image)

Figure 3.1 Discounting represented by exponential and hyperbolic curves. The exponential curve is much straighter and does not reflect the rapid rate of discounting initially and the decreasing rate of decay over time as does the hyperbolic curve.

Figure 3.2

\[ V_p = \frac{V}{(1 + kD)} \]

Figure 3.2 In Mazur’s (1987) hyperbolic equation \( k \) is a parameter that represents a constant indicating the rate of discounting or the sensitivity to delay, \( D \). Each participant will have a \( k \) score for a given dollar amount across time delays.
To determine the rates of TD for this study, Mazur's (1987) hyperbolic TD function was used to fit the data. This equation has been used to calculate TD in several previous studies (Baker et al., 2003; Bickel, Yi, Kowal, & Gatchalian, 2008; Johnson & Bickel, 2002; Johnson et al., 2010; Kowal et al., 2007; Stanger et al., 2011; Yi, Buchhalter, Gatchalian, & Bickel, 2007; Yoon et al., 2007). $V$ is the objective undiscounted value of the hypothetical future reward. For this study, $V$ was represented by the future hypothetical dollar amounts of $50, $100, and $500. $D$ is the time delay given in days (Baker et al., 2003). For this study, time delays presented to participants were 1 week, 1 month, 6 months, 1 year and 5 years. $V_p$ is the discount factor or the proportion of the future hypothetical dollar amount obtained at the indifference point. For each participant, a $V_p$ was calculated by the computer for each of hypothetical future dollar amounts of $50, $100, and $500 at each time delay of 1 week, 1 month, 6 months, 1 year and 5 years, thus totaling 5 $V_p$ values per hypothetical future dollar amount per participant or 15 $V_p$s for each session that a participant completed the computer task.

**Calculation of the $k$ Coefficient**

In Mazur's (1987) hyperbolic formula, the $k$ parameter is a slope and denotes the rate of discounting (TD rate) for participants for a single dollar amount ($50, $100 or $500) over all delay periods (1 week to 5 years) (Baker, Johnson, & Bickel, 2003). A $k$ parameter was derived for each participant and dollar amount resulting in a total of 3 $k$ parameters for per participant per session. Higher $k$ values denote a steeper slope and thus a greater rate of discounting relative to lower $k$ values. Conversely, lower rates of
discounting are marked by lower $k$ values. When $k = 0$, no value is lost to delay (Kowal et., 2007; Yoon et al., 2007). In summary, higher $k$ values meant greater TD and lower $k$ values mean lower TD.

Non-linear regression is used to empirically derive $k$. The researcher enters the value of the indifference point ($k$) at each time delay for a specific dollar amount into the quantitative model. Next, a best fit line (or curve) is generated according to those values. From this curve fitting process, a $k$ for each participant for each dollar amount is identified. This is most efficiently and accurately completed with the aid of computer software. In this study, a spreadsheet application in Excel was used to calculate $k$ (Reed, Kaplan, & Brewer, 2012).
Protection of Human Subjects

Procedure for Obtaining Informed Consent

Informed consent for this project was obtained when the participant was initially enrolled in the parent study. The PI and all RAs of the parent study were responsible for obtaining informed consent and adhering to the IRB approved consent process. The RA responsible for the secondary study was responsible for collecting data related to the TD scores. The PI or RA obtained informed consent (i.e. signed, dated and, if applicable, witnessed) from the participant or the participant’s parent of guardian prior to the initiation of any study specific procedures. Consent was obtained from the parent or guardian for prospective participants who are under 18 years of age and directly from participants who are older than 18 years of age.

The PI or RA informed the participant and parent/guardian about how the research team protected his or her confidentiality as well as participants’ freedom to withdraw from the study at any time. The PI or RA presented the research participant and parent/guardian with ample time and adequate opportunity to read and discuss the entire informed consent form before it is signed. All questions were answered to the satisfaction of the participant and parent/guardian. The PI/RA obtaining consent signed and dated the IRB approved written informed consent form on the same day as the participant. The PI or RA then gave a copy of the signed informed consent form to the participant. The PI or RA the documented the consent in the screening and enrollment log. The original consent form remained in the participant’s research record.
Procedure for Obtaining Assent

As was the case with consent, the assent process took place as the participant was enrolled in the parent study. Informed consent was obtained from the parent of guardian of participants who was under 18 years of age. The PI or RA allowed the participant adequate opportunity to read the entire assent form before it was signed. This required that the participant discuss the study with family prior to signing. All questions were answered to the satisfaction of the participant. The PI or RA interviewed the participant and assessed and confirmed the participant’s comprehension of the assent form and assent process. If adequate comprehension was affirmed, then participant was invited to sign the assent form. The PI or RA signed and dated the IRB approved written assent form on the same day as the participant. The participant was given a copy of the signed assent form to the participant. The PI or RA documented the assent in the screening and enrollment log. The original assent form was maintained in the subject’s research record.

Statistical Analysis

Hypotheses were tested using SPSS 21® statistical analysis software.

Hypothesis 1: Age will be inversely related to TD.

Analysis: TD was regressed on age using linear regression analysis. A regression model was employed because linear regression can identify the relationship between one or more independent variables and a dependent variable. Age was defined by three dummy-coded variables: 14 years vs. 16 years, 15 years vs. 16 years, 17 years vs. 16 years. Sixteen was randomly selected by default as the reference group, being the mean age of the total sample. The assumptions of regression were tested and mathematical
corrections were performed as required. If the relationship was significant then it could be said that the independent variable predicted the dependent variable (Keith, 2006).

**Hypothesis 2**: TD will be inversely related to alliance.

*Analysis*: Total alliance scores were regressed on TD using linear regression analysis.

**Hypothesis 3**: TD will be inversely related to retention in the first 5 weeks of therapy.

*Analysis*: Retention in the first 5 weeks of therapy was regressed on TD using logistic regression. Logistic regression is used for analyzing categorical dependent variables (Keith, 2006). In this case retention was binary: 0 = not retained; 1 = retained.

**Hypothesis 4**: TD will be inversely related to the number of therapy sessions attended in the first 8 weeks of therapy.

*Analysis*: The number of treatment sessions was regressed on TD using linear regression analysis.

**Hypothesis 5**: TD decreases after 5 weeks of therapy.

*Analysis*: Changes in TD (prior to therapy and after 5 weeks of therapy) were analyzed using repeated measures ANOVA. A repeated measures ANOVA is used when the dependent variable is measured more than once (Gamst, Meyers, & Guarino, 2008).
Chapter 4

Results

Assumptions

Prior to conducting the linear regressions, data were assessed to be certain they met the assumptions of normality and homogeneity of variance. An important assumption of normality is that the distribution is symmetrical around the mean. Normality was assessed by examining the values of skew and kurtosis. To meet the assumptions, skewness must be within $-2 \leq x \leq 2$ and kurtosis must be $-7 \leq x \leq 7$ (Kline, 2011). The TD distributions were highly positively skewed, therefore the values were transformed using the natural logarithm, $\ln(k)$. After data were transformed, the assumption of normality was met. Homogeneity of variance was assessed with the examination of residuals and scatterplots. In a normal distribution, homogeneity of variance exists when variances of a distribution are equal (Kline). This assumption was met. Alliance was measured as a dichotomous variable using logistic regression. Normality is not an assumption of logistic regression, and data transformation was not required. Normality of the scores for the subjects participating within the first 8 weeks of therapy was assessed by examining the values of skew and kurtosis of the natural log values. To meet the assumptions, skew must be within $-2 \leq x \leq 2$ and kurtosis must be $-7 \leq x \leq 7$ (Kline). The assumption of normality was met. Homogeneity of variance was assessed with the examination of residuals scatterplots In a normal distribution, homogeneity of variance exists when variances of a distribution are equal (Kline). This assumption was met.
Prior to conducting the linear regressions for alliance, the assumptions of normality and homogeneity of variance were assessed. Normality was assessed by examining the values of skew and kurtosis. To meet the assumptions, skew must be within \(-2 \leq x \leq 2\) and kurtosis must be \(-7 \leq x \leq 7\) (Kline). The assumption of normality was met. Homogeneity of variance was assessed with the examination of residuals scatterplots and the assumption was met.

**Analysis**

Data for 55 participants were entered into SPSS 21.0. Data were screened for accuracy and outliers. Frequency distributions were conducted on the alliance responses to ensure that the responses were within the possible range; no cases were removed. The presence of outliers was tested by examining standardized values (z scores). Z scores were created for the continuous variables and cases were examined for values more than 3.29 standard deviations away from the mean (Tabachnick & Fidell, 2012). Seven outliers were found in the data; no additional transformations were conducted on those data points as the natural log was used to normalize data. Data analysis was conducted on 55 cases.

**Hypothesis Tests**

*Hypothesis 1: Age will be inversely related to TD.*

To examine the first hypothesis determining if age predicts TD, three linear regressions were conducted; one regression was conducted for each dollar amount.

\>$50. The overall linear regression model was not significant, F(1, 53) = 0.43, p = .516.

\>$100. The overall linear regression was not significant, F(1, 53) = 0.30, p = .585.
$500. The overall linear regression was not significant, $F(1, 53) = 0.14, p = .713.$

Hypothesis 2: TD will be inversely related to alliance.

Three linear regressions were used for each dollar amount.

$50. The overall linear regression was not significant, $F(1, 41) = 1.07, p = .306.$
TD did not predict alliance, $b = 0.08, SE = 0.07, p = .306.$

$100. The overall linear regression was not significant, $F(1, 41) = 0.76, p = .388.$
TD did not predict alliance, $b = 0.07, SE = 0.08, p = .388.$

$500. The overall linear regression was not significant, $F(1, 41) = 0.95, p = .336.$
TD did not predict alliance, $b = 0.06, SE = 0.06, p = .336.$

Hypothesis 3: TD will be inversely related to retention in the first 5 weeks of therapy.

Three logistic regressions were conducted; one regression for each dollar amount at T1. The logistic regression overcomes many of the assumptions of the linear regression, including linearity and homoscedasticity. The major assumption of the logistic regression is that the outcome variable is dichotomous, which it is (for example, remained in treatment vs. did not).

$50. The overall logistic regression was not significant, $\chi^2(1) = 0.30, p = .587.$ TD at T1 did not predict retention, $b = 0.10, SE = 0.18, p = .582.$

$100. The overall logistic regression was not significant, $\chi^2(1) = 0.128, p = .728.$
TD did not predict retention, $b = 0.06, SE = 0.18, p = .727.$

$500. The overall logistic regression was not significant, $\chi^2(1) = 0.11, p = .746.$
TD did not predict retention, $b = 0.05, SE = 0.18, p = .747.$
Hypothesis 4: *TD will be inversely related to the number of therapy sessions in the first 8 weeks of therapy.*

Three separate linear regressions were used for each dollar amount.

$50. The overall linear regression was not significant, $F(1, 45) = 0.15, p = .696$. TD did not predict number of sessions, $b = -0.13, SE = -0.13, p = .696$.

$100. The overall linear regression was not significant, $F(1, 45) < 0.01, p = .984$. TD did not predict number of sessions, $b = -0.01, SE = 0.30, p = .984$.

$500. The overall linear regression was not significant, $F(1, 45) = 0.48, p = .490$. TD did not predict number of sessions, $b = 0.48, SE = 0.24, p = .490$.

*Hypothesis 5:* TD decreases after 5 weeks of therapy.

Three separate repeated measures ANOVA were used for each dollar amount. Participants who were not retained after 5 weeks of therapy were eliminated from this analysis using listwise deletion.

$50. ANOVA revealed no significant change in TD from T1 to T2, $F(1, 44) = 2.16, p = .149$.

$100. ANOVA revealed no significant change in TD from T1 to T2, F(1, 44) = 0.02, p = .891$.

$500. ANOVA revealed no significant change in TD from T1 to T2, F(1, 44) = 0.31, p = .583$.

Follow-up analysis: Three additional mixed ANOVA were used to examine time x intervention (CIFTA vs. TFT) effects on TD.

Additionally, three one-between, one-within ANOVAs were conducted to determine if there were differences on TD by time and types of treatment (Culturally
Informed Flexible Traditional Family Therapy vs. Traditional Family Therapy). One ANOVA was conducted for each magnitude. Prior to analysis, the assumption of homogeneity of variance/covariance matrices was assessed. The assumption of homogeneity of variance was assessed with Levene’s test (Pallant, 2010). Levene’s test was not significant at any dollar amount indicating the assumption was met. Homogeneity of covariance was assessed with Box’s M tests (Pallant, 2010). The tests were not significant, indicating the assumption was met.

The result of the ANOVA conducted at magnitude $50 was not significant, $F(1, 43) = 1.08, p = .305$, indicating there were not simultaneous differences on time and treatment type. The result of the ANOVA conducted at magnitude $100 was not significant, $F(1, 43) = 0.24, p = .630$, indicating there were not simultaneous differences on time and treatment type. The result of the ANOVA conducted at magnitude $500 was not significant, $F(1, 43) = 0.06, p = .806$, indicating there were not simultaneous differences on time and treatment type.
CHAPTER 5

Discussion

This study was designed to investigate relationships among impulsivity measured through Temporal Discounting (TD), age, working alliance, retention, number of sessions in which subjects participated in therapy 8 weeks after enrollment (dosage), and the change TD from T1 to T2 in a sample of adolescents receiving outpatient substance abuse treatment. Data analyses, including the calculation of $k$ values to determine hyperbolic discounting rates, linear regression, logistic regression and ANOVAs, were conducted to test the relationship of TD to age, working alliance, treatment retention, dosage, and change in TD from T1 to T2. Jessor’s (1991) Problem Behavior Theory was used to understand risk factors and substance abuse among adolescents.

Results of the analyses conducted did not support the hypothesized relationship between age and TD in the sample of adolescent substance users receiving therapy. Likewise TD was not predictive of treatment retention, WA, or the number of sessions attended by participants 8 weeks after enrollment. After 5 weeks of therapy, TD did not significantly change from baseline.

Comparison of TD across studies is difficult because researchers frequently use differing magnitudes and periods of delay, also because individual level $k$ values are left unreported in the literature. For a magnitude of $100, this study obtained an average \( \ln(k) \) of -4.64 with a SD of 1.91 Using a magnitude of $100 in a group of adolescents who use substances, Stanger et al., (2011) obtained a similar \( \ln(k) \) of -3.86 with a SD of 2.50. In a sample of six healthy volunteers, Johnson & Bickel (2002), found a mean $k$ value of 0.02438 for $100. For the magnitude of $100 in this study, the mean of $k$ for this was
In a sample of 68 healthy college students, Green, Myerson & Ostaszewski (1999) found a mean $k$ of 0.167 for a magnitude of $500, while the mean of $k$ for this study was 0.1190. Various researchers of TD select an array of magnitudes ranging from $10 to $10,000 and time delays of 1 hour to 10 years. Because magnitude influences the choices that individuals make, it is difficult to compare TD scores across studies. This emphasizes the need for studies that are consistent in magnitudes of the delayed rewards as well as the time delays.

**Relationship between TD and Age**

This study found no relationship between TD and age. Although results of other studies showed that age was related to TD, age ranges in the studies were much broader (Green et al., 2006, 2009; Smith & Boettiger, 2012; Reimers et al, 2009; Scheres et al., 2006; Whelan & McHugh, 2009) sometimes ranging from elementary school age to 65 years of age. In this study, participants ranged from 14 to 17 years of age. The use of a restricted range makes it difficult from a statistical perspective to derive meaningful differences. A wider range of values typically makes such analyses more gainful in terms of detecting differences related to age. It is possible that this sample had characteristics that made them more alike than different, especially so among adolescents (Landes, Christensen, & Bickel, 2012). Developmental and neuroscientist research supports the assertion that adolescents are more impulsive by nature (Wahlstrom, White, & Luciana, 2010) and age-related sources of variation in brain structure and function are relatively small in magnitude (Wahlstrom, Collins, White, & Luciana, 2010) and continue well into young adulthood (Doremus-Fitzwater, Varlinskaya, & Spear, 2010; Landes et al.). So, from a developmental perspective, this group of adolescents could reasonably be of the
same developmental age but differ slightly in chronological age. In future research, studies that assess both chronological and developmental age could be conducted to help understand this relationship and a wider range of ages should be included.

Also, this convenience sample was drawn from adolescents who were diagnosed with a substance abuse disorder and were currently receiving treatment. A growing body of literature has identified TD as an important component in the continued use of substances (Bickel et al., 2007). Without a similar non-clinical group of adolescents, it is difficult to know if age was a modifying variable between substance abuse among adolescents who use drugs and those who do not. The addition of a non-clinical group for comparison would be helpful for future studies.

**Relationship between TD and Treatment Retention**

In this study no relationship was found between baseline TD scores and treatment retention at 5 weeks and the number of treatment sessions completed at 8 weeks. Of the 55 participants completing the computer discounting task at T1, forty-four (80%) remained in the program after 5 weeks. Although TD did not predict retention at 5 weeks or the number of sessions participants attended measured after 8 weeks, there may be other variables that could predict retention or drop-out.

To date most literature on TD has been limited to understanding the variable in relationship to severity of addiction, severity and amount of drug use, and how substance abusers differ from non-substance abusing controls. A novel aim of this study was to investigate the relationship of TD to treatment retention at 5 weeks and the number of sessions completed at 8 weeks. In a 4 week smoking cessation program (4 weeks of treatment was treatment end), participants not achieving abstinence (non-quitters) had
higher TD scores than quitters. The findings of this study are contrary to the published study. No other discoverable research exists related to other forms of substance use and TD as a predictor of treatment.

It can be argued that the perception of TD as it is concerned with treatment retention is not yet well understood. Studies using measures of impulsivity other than TD have found relationships to retention in substance abuse treatment (Bankston et al., 2009; Eysenck, Pearson, Easterling, & Allsop, 1985; Moeller et al., 2001; Patkar et al., 2004; Krishnan-Sarin et al., 2007). In this study, many of the adolescents were court mandated to treatment, and although the adolescents were free to move to another treatment setting, having been mandated may be partly responsible for the high rates of retention and possibly the masking of retention effects. Considering the empirical evidence which suggests impulsivity is a multidimensional concept and that the recognition that many measures of impulsivity have not correlated with TD in the past, further research into understanding the relationship of TD to treatment retention and other treatment outcome measures is warranted.

**TD and Culture**

While all participants in this study were adolescents of Hispanic descent, some were born in the United States and some were born in Latin American or the Caribbean. For this study, there was no intent to analyze the differences in TD and alliance between these two groups. Because studies suggest that non-Hispanic cultures in the United States differ in the degrees of impulsivity (Marin & Marin, 1991, Zea-Belgrave, Garcia & Quezada, 1997), more specifically, TD (Baumann Neves, 2009), future research is needed to understand influences on TD and alliance. Besides culture, differences in
impulsivity related behaviors and decision-making may be explained by sociopolitical and economic factors that explain differences (Baumann Neves, 2009). For example, Latin American countries have more history of high inflation than the United States. More specifically, data from the Economic Commission for Latin America and the Caribbean (ECLAC) shows that Argentina, Bolivia, Mexico and Peru had inflation rates as high as 4,924% per year between 1991 and 1998 (Stallings & Perez, 2000), while the inflation rate in the United States over the same time period was 4.2% (United Nations, 1999).

**TD and Working Alliance**

WA is thought to be a mechanism that facilitates progress in psychotherapy (Bordin, 1979). In this study, it was theorized that TD could be a variable that might interrupt agreement on tasks of therapy, the agreement on goals, and the bond between therapist and client, and that impulsivity, measured by TD, would have an inverse relationship with WA. After analysis of this hypothesis, no significant relationship was found between TD and WA. No known published research has previously explored the relationship between WA and TD. Although measures of emotional distress have been known to predict WA, perhaps impulsivity as measured by TD is unrelated to emotional distress and therefore not a risk factor associated with WA. From this perspective, TD could be viewed as a decision-making style that has no bearing on task, bond, or goals. Because the WA scores were measured at 6 weeks, it is possible that the adolescents were in the introductory phase of therapy and were not yet able to develop goals, task, and bonds with the therapist. It is also conceivable that the substance abuse therapists were so experienced in working with this population that they learned how to maintain a high
level of working alliance despite TD. Nevertheless, measures of WA beyond 6 weeks, feasibly at termination of therapy and beyond, would have helped to make apparent whether within group differences existed among individuals who eventually managed to set goals, plan, and bond and those who did not.

**Change in TD after 5 Weeks of Therapy**

This study examined whether TD scores changed after 5 of therapy. This hypothesis was primarily an exploratory analysis because there was no reason to hypothesize that an effect would be found. For all three magnitudes (dollar amounts), no significant changes in TD were found. This corroborates the findings of Ohmura, Takahashi, Kitamura, and Wehr, (2006), Simpson and Vuchinich (2007), and Yoon et al. (2007) who found that the rate of discounting was not altered as a result of time. In other words, high discounters remained high discounters each time they were measured. These studies, however, differed from the current study in that no interventions were performed between the intervals in which TD scores were obtained. Unlike the current study, the studies could show that time alone did not likely influence significant changes in TD.

Only two known published studies examined whether TD changed from baseline when an intervention was used (Bickel et al., 2011; Landes et al., 2012) and both found significant changes in TD from baseline. The findings from the two studies are contrary to the findings from the current study in which no significant difference was found between TD scores at baseline and TD scores after 5 weeks therapy. A possible explanation is that 5 weeks after baseline is too short of a time between T1 and T2 to appreciate any changes in TD. Standardly the treatment phase is recommended to be 16 weeks. In the initial stages of therapy, adolescents may feel a significant amount of
anxiety, distress and ambivalence surrounding their drug use. This may occur because they are removing a coping mechanism, i.e. their drug use, or, there may be confronting additional issues that they had not tackled prior to entering treatment. Consequently, distress and anxiety may actually increase in the early stages of treatment; impulsivity may remain high; and subsequent resolution to emotional and familial discord may not occur until later in treatment. Another possible explanation is that TD is a trait, a fixed component of personality, versus a state that varies over time and context. In this exploratory study, the substance abuse treatment interventions, neither Culturally Informed Flexible Family Therapy nor Traditional Family Therapy, were expressly designed to address, modify, or reduce impulsivity or TD specifically. So it is quite possible the substance abuse treatment intervention did not capture underlying modifiable components of TD or impulsivity.

**Strengths and Limitations**

Insignificant research findings are always subject to alternative interpretations and should not be completely disregarded. The sample in this study was comprised of urban, Hispanic, primarily male participants already in treatment in Southeastern Florida. A strength is that this research studied a sample of real substance abusing adolescents. The results can be generalized to a specific difficult-to-reach population whom we wish to understand, rather than using easier to reach samples like college students or young adults to make inferences about adolescents.

The computerized TD task was strength of this study. The instrument was administered without influence from the investigator and was easy for the participant to perform without assistance. The task quantified decision-making as it took place and did
not rely on reflection or self-evaluation. The results were automatically calculated and transferred to SPSS decreasing any error in data entry.

Although this is a unique population for which the study of impulsivity has many clear implications, the generalizability of results comes into question. It is unclear in what ways these findings apply to other groups in other geographical areas for participants who do and do not use substances (Lejuez, Aklin, Bornovalova, & Moolchan, 2005). Although demographically similar, the substance abuse was likely heterogeneous with regards to substances of choice, length of substance abuse, and severity of condition. Grouping participants on severity of use, drug(s) of choice, frequency of use may provide somewhat different relationships and therefore is worthy of investigation (Vuchinich & Simpson, 1998).

In research, convenience samples offer several advantages. Convenience samples are inexpensive, accessible, and require less time than other types of samples (Burns & Grove, 1997). Alternatively, the disadvantage of convenience a sample is that it provides little opportunity to control for biases. As subjects are recruited into a study from an intentional setting and with predetermined characteristics, the results of the study may not be representative of the population. Consequently, the generalizability of the research findings may be limited. However, convenience sampling is a useful method and is commonly used in behavior studies (Burns & Grove).

The sample characteristics of this convenience sample are noteworthy issue. The limited number of girls in the study, for example, precluded any analysis of whether gender influenced any of the measures. Similarly, other variables like drug of choice, socioeconomic status, and acculturation could be of interest for investigating
interrelationships of the measures of TD, WAI, and retention. Larger scale studies are needed to either replicate or refute these findings.

An additional study limitation was that the current study did not address the many environmental and social conditions surrounding participants. It is possible that adolescents interact differently with their environments leading to differences TD scores. It is possible, for example, that individuals with higher TD scores live in environments of scarcity or deprivation, where the “take it now because you may not get it later” socialization and learning took place. An index of TD has been found to reflect situational dynamics of the environment. For example, individuals living in Poland’s wildly inflated economy of the early 1990s, became accustomed to rapid decline in the value of money and tended to have higher \( k \) values than individuals living in the less volatile economy of the United States (Ostaszewski, Green, & Myerson, 1998). In another study involving only participants from the United States, individuals with lower annual incomes showed more pronounced TD than individuals with higher incomes (Green et al., 1996). These studies support the contention that, differences in socioeconomic status, community resources, and social supports need to be evaluated as confounding variables between TD and clinical outcomes.

Although this study made an effort to examine the relationship between the impulsivity measure of TD with other variables, other measures of impulsivity were not included (Thompson et al., 2006). Because the current study only assessed TD, which focuses on the discounting of future reward, it is difficult to speculate on the generalizability of the results across other dimensions of impulsivity (e.g. behavioral inhibition, developmental, sensation seeking, and self-control) (Everden, 1999). To
understand the relationship of other measures of impulsivity to working alliance, retention, treatment outcome, other forms of impulsivity may require further study as well (Thompson et al.).

Additionally, because some of the present findings are based on cross-sectional data, one must be cautious of drawing conclusions about patterns and development of substance abuse and TD over time. For example it is possible that individuals’ TD scores increase after actual drug use. If higher TD follows rather than precedes substance abuse, it would still be important to evaluate TD as an important factor in the perpetuation of substance abuse. This study only looked at TD scores in subjects who were apt to cease or reduce substance abuse. Disentangling this issue would appear to require longitudinal studies (Vuchinich & Simpson, 1998).

In this study, there is a component of decision-making for which participants may have little experience. Most participants have extensive experience waiting a few days or weeks for an allowance or a paycheck, but may have little experience with longer delays for monetary rewards. For example, most high school-age adolescents have no experience with savings accounts in which funds cannot be withdrawn before a multiyear delay interval has elapsed (e.g. certificate of deposit) (Stanger et al., 2011). On the other hand, it may not be unrealistic for adolescents to reflect on large amounts considering at least some of them may have employment that pays amounts used in the experiment (Green, Myerson, Macaux, 2005), or may be contemplating going to university and paying high tuition bills. The nature of this component in the study was not addressed or controlled.
One may also question whether the results of this study using hypothetical rewards would be the same as for discounting using real rewards (real money). Some research found that estimated discounting parameters from hypothetical and real rewards to be highly and positively correlated and not different in activated brain regions (Bickel, Pitcock, Yi, & Angtuaco, 2009; Johnson & Bickel, 2002; Madden, Begotka, Raiff, Kastern, 2003). Nonetheless, hypothetical amounts of money were used in this study and may vary from real rewards. Positive and negative feedback are crucial elements in acquiring and altering stimulus-reward associations of decision-making. The use of hypothetical money might have guided decision-making differently from actual money.

This study examined impulsivity in substance abusing adolescents who were in treatment. A limitation of this study is the lack of a control group, namely a sample of adolescent substance abusers who were not in treatment for substance abuse. Usual care standards for the treatment of a substance abusing control group make it difficult to consider how to construct a control group that would not receive any form of intervention (Thompson et al., 2006). Furthermore, because the TD measure does not differentiate impulsive decision-making in and out of the context of substance use, the relative contribution of impulsivity’s influence on substance use and conversely the influence of drug use on impulsivity would have been obscured (Lejuez et al., 2005).

Results are also difficult to compare with published studies because such studies vary in the magnitude (dollar amounts) and across different future time frames. This study of TD, consistent with existing discounting literature, assesses discounting over a single commodity, namely money. It may be of greater clinical interest to assess cross-
commodity, allowing for the comparison of choices, for example, between immediate drug rewards and delayed health or money related rewards (Stanger et al., 2011).

Impulsivity may be present in the general population as a personality trait. It has also been reported as symptom of psychiatric disorders, including antisocial personality disorders and as one of the diagnostic criteria for borderline personality disorder. It is central to attention ADHD disorder and bipolar disorders (Moeller et al., 2001; Swann et al., 2002). Higher rates of TD have been identified in some studies of ADHD (Barkley, 1997; Barkley, Edwards, Laneri, Fletcher, & Metevia, 2001; Critchfield & Kollins, 2001; Demurie, Roeyers, Baeyens & Sonuga-Barke, 2012). The presence of impulsivity-related psychopathology was not assessed. Further studies should include and/or control for the presence of impulsivity-related psychopathology and determine if such disorders influence substance abuse, WAI, and treatment retention.

**Implications for Future Research**

Despite the non-significant findings, impulsivity and more specifically TD are important and relevant variables in their own right and for enhancing the understanding of substance abuse and substance abuse treatment. Multiple studies have argued for more sophisticated measurements of impulsivity that accommodate its multidimensional nature (Everden, 1999). The future development of a sound conceptual model to explain the relationship of TD to substance abuse, treatment, retention, and other substance abuse variables will require the examination of several additional concepts and constructs in a formalized and comprehensive manner. This effort should further investigate the interactive role of drug choice, severity of drug use, and TD and include a more comprehensive assessment of relevant variables across, personality, developmental,
psychopathology, probability, demographic and environmental domains (Lejuez et al, 2005).

Most importantly, there is great need to develop the clinical relevance of this type of work including contributions for the development of targeted prevention and treatment efforts that focus on drug use and abuse (Lejuez et al, 2005). The role of impulsivity, as measured by other instruments besides TD, has proven to be important (Brackston et al., 2009). Novel and preliminary research has shown that working memory training decreases TD, demonstrating that a neurocognitive intervention can decrease impulsivity (Bickel, Yi, Landes, Hill, & Baxter, 2011). More studies that examine TD and substance abuse variables are needed. Whether lower rates of TD influence drug choice, severity of drug use, WA, treatment choice and treatment retention, as well as covariates surrounding substance abuse, remains to be explored.
References


Appendix 1

TD Computer Task

Before initiation of the computer task, the researcher sets the computer for dollar amounts with the corresponding delays. For this study, the future dollar amounts (magnitudes) were $50, $100, and $500. The timeframes (delays) were 1 week, 1 month, 6 months, 1 year, and 5 years. Participants were asked the following: “you will be asked to decide between a smaller dollar amount NOW and greater amount at a designated timeframe in the FUTURE.” On the left side of the computer screen, a command button displayed an immediate reward: “Receive $[amount] right now”, and on the right side of the screen, a command button displayed a delayed reward: “Wait [delay] and then receive $[amount]”. For example with a magnitude of $100 and a delay of 1 year, the screen would read: “Receive $10.50 now or (2) “Wait 1 year and then receive $100.” With a single click of the left mouse button while the cursor arrow is over a command button, the participant selected selection an option. After a three second delay, the participant then pressed the space bar to confirm an answer. Responses were then recorded by the computer. In the event that a participant had any problems registering responses or using the computer equipment, the facilitator was there to provide guidance. Completion of the computer task took approximately 15 minutes (Bickel et al., 2002).

The purpose of the computer program is to calculate each participant’s indifference point - the relative dollar amount where the immediate reward is subjectively equivalent to the future reward - for each magnitude and delay (Bickel et al., 2008). The computer program’s initial choice for the immediate reward is randomly picked from within a range of possible values: a lower limit of zero and an upper limit with a value
equal to the larger delayed reward. As the participant responds, the computer program adjustments, and through a series of iterations, the upper and lower limits gradually converge until the program’s derives at a “best guess” for the location of the indifference point. To protect against a single choice selection controlling the movement of the limits (and thus potentially converging on an unconfirmed indifference point), the computer program buffers the effect of an individual choice. The procedure then moves on to determine the next indifference point in the sequence (Johnson & Bickel, 2002). The indifference points are then input into the discounting calculator to derive at k value which is the TD variable.
Relationship of Temporal Discounting to the Theory of Problem Behavior

PROTECTIVE FACTORS
- Working Alliance
- Family Therapy

RISK FACTORS
- Impulsivity
- Temporal Discounting

HEALTH COMPROMISING OUTCOMES
- Tobacco Abuse
- Substance Abuse
- Drunk Driving
- Early Sexual Activity
- Poor School Performance
- Family Discord
- Delinquency
### Table 1
Comparison of substance use rates by ethnicity and gender
Youth Risk Behavior Survey, 2011

<table>
<thead>
<tr>
<th>Substance Used</th>
<th>All Students</th>
<th>Hispanic Male</th>
<th>White Male</th>
<th>Black Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarettes (Ever Smoked)</td>
<td>44.7%</td>
<td>51.5%</td>
<td>45.6%</td>
<td>40.0%</td>
</tr>
<tr>
<td>Smoke Daily</td>
<td>10.2%</td>
<td>9.0%</td>
<td>12.5%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Current Cigarette Use</td>
<td>18.1%</td>
<td>19.5%</td>
<td>21.5%</td>
<td>13.7%</td>
</tr>
<tr>
<td>Alcohol (Ever used)</td>
<td>70.8%</td>
<td>72.4%</td>
<td>72.3%</td>
<td>63.5%</td>
</tr>
<tr>
<td>Alcohol (Current use)</td>
<td>38.7%</td>
<td>42.1%</td>
<td>41.6%</td>
<td>29.5%</td>
</tr>
<tr>
<td>Alcohol (Binge Drinking)</td>
<td>21.9%</td>
<td>25.9%</td>
<td>26.1%</td>
<td>14.5%</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>3.8%</td>
<td>4.0%</td>
<td>3.4%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Marijuana (Ever used)</td>
<td>39.9%</td>
<td>45.0%</td>
<td>40.3%</td>
<td>48.3%</td>
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<tr>
<td>Marijuana (Current use)</td>
<td>23.1%</td>
<td>27.0%</td>
<td>24.4%</td>
<td>29.1%</td>
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<tr>
<td>Inhalants</td>
<td>11.4%</td>
<td>13.1%</td>
<td>10.7%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Heroin</td>
<td>2.9%</td>
<td>4.0%</td>
<td>3.4%</td>
<td>4.3%</td>
</tr>
<tr>
<td>MDMA (Ecstasy)</td>
<td>8.2%</td>
<td>12.6%</td>
<td>8.7%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Hallucinogenics</td>
<td>9.1%</td>
<td>12.2%</td>
<td>11.6%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Cocaine (Ever used)</td>
<td>6.8%</td>
<td>11.9%</td>
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<tr>
<td>Cocaine (Current use)</td>
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<td>7.5%</td>
<td>3.3%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Prescription Drugs</td>
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<td>23.6%</td>
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<tr>
<td>Injected Drugs</td>
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<td>3.5%</td>
<td>2.3%</td>
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