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By
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Task Persistence as a Predictor of Substance Abuse Treatment Outcomes
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Chapter V

Dissertation

Abstract

Substance abuse is associated with poor treatment retention and high relapse. However, positive substance abuse treatment outcomes are associated with time spent in treatment and treatment completion. As such, it is important to identify person variables associated with entering and completing treatment so those at risk for failure can be identified early and provided with additional supports. The current study examined the utility of a behavioral measure of task persistence—the Mirror-Tracing Persistence Task (MTPT)—to predict entering 28-day residential substance abuse treatment, completing treatment, and the number of completed days in treatment. The sample ($N = 101$) was comprised of individuals completing medically supervised detoxification; the majority (78%) were opioid dependent. The predictive power of the MTPT was tested in isolation and in the context of affective functioning. Furthermore, the relations between the theoretical construct of learned industriousness, task persistence and treatment outcomes were empirically tested. Results indicated that task persistence was significantly related to entering treatment but this relation was modest. Task persistence was not related to completing treatment or number of days of treatment completed. Counter to expectations, affective functioning and learned industriousness were not related to task persistence or to the primary treatment outcomes.
Task Persistence as a Predictor of Substance Abuse Treatment Outcomes

Substance abuse is a common problem in the United States, with an estimated 22.2 million people age 12 years and older meeting criteria for substance dependence or abuse (Substance Abuse and Mental Health Services Administration [SAMHSA], 2013). Substance use disorders are associated with multiple negative societal consequences that impact both the addict and surrounding community, such as increased crime (Newcomb, Glaif, & Carmona, 2001), homelessness (Mallett, Rosenthal, & Keys, 2005), unemployment (Henkel, 2011), and increased engagement in high-risk sexual behaviors (Tapert, Aarons, Sedlar, & Brown, 2001) and are considered a major public health crisis.

Although use levels in many categories of drug have remained largely stable, this is not true for opioid use which has markedly increased and reached epidemic proportions (Alexander, Frettanoli, & Gelen, 2015). Rates of opioid use/abuse have increased over threefold since 1990 (Ling, Mooney, & Hillhouse, 2011) and include both diverted prescription opioid analgesics (pain medications) and heroin. Concomitant with recent increased use and abuse of opioids, the need for treatment has intensified and admissions for treatment of opioid abuse and dependence increased 400% from 1998 to 2008 (SAMHSA, 2010). Many urban treatment centers have experienced a transformation of their clientele from a majority seeking services for alcohol and cocaine/crack dependence to one seeking treatment for opioid abuse (personal communication, S. Walkenhorst, 2013).

Treatment Approaches

A variety of treatment options have been developed which provide different levels of care (National Institute on Drug Abuse, 2008). Treatment programs vary in location of
treatment (i.e., hospital, specialized clinic), intensity of treatment, and duration (Williams & Chang, 2000). However, although approximately 2.3 million people ages 12 years or older enter substance abuse treatment programs, only a fraction of those people who enter complete treatment (SAMHSA, 2012). Premature termination, or failure to complete a course of treatment, is the most common outcome as estimates show only 40-45% of individuals complete any given treatment program (Ravndal, Vaglum, & Lauritzen, 2005; SAMHSA, 2010). This low completion rate is particularly troubling as a primary predictor of treatment success is treatment duration, and patients who stay in treatment longer, regardless of treatment modality, have better outcomes (Finney & Moos, 1998; Hubbard, Craddock, Flynn, Anderson, & Etheridge, 1997; Simpson, Joe, & Rowan-Szal, 1997). The high premature termination rate associated with substance abuse treatment indicates that many individuals do not receive adequate treatment and are at very high risk for continued substance use. Therefore, a primary focus of substance abuse research should be identifying and understanding easily assessed person-factors related to retention. By identifying those individuals at most risk for premature treatment termination, programs can develop targeted preventative interventions.

**Substance Abuse and Affective Distress**

Population and laboratory studies have consistently identified a strong linkage between substance abuse and affective functioning. The relations between affect and substance abuse are illustrated through two complementary lines of research, one empirical and the other theoretical. Empirical studies have focused on how negative emotional states are a marker of high-risk for substance abuse relapse and treatment dropout (Flynn, Walton, Curran, Blow, & Knutzen, 2004; Hodgins, el-Guebaly, &
Armstrong, 1995; Joe, Simpson, & Broome, 1999; Roffman, Klepsch, Wertz, Simpson, & Stephens, 1993) and are related to poor treatment outcomes (McLellan et al., 1994; Moos, Moos, & Finney, 2001). Additional evidence of the relation between substance use and negative affect/emotional distress is seen in the high comorbidity that exists between substance use disorders and anxiety, depression, and other psychiatric disorders (Courbasson, Endler, & Kocovski, 2002; Kessler, 2004). A recent, large scale, comorbidity meta-analysis found that individuals with substance abuse disorders were 2.1 times more likely to have a formal anxiety disorder and 3.1 times more likely to meet criteria for having major depressive disorder compared to individuals without a substance abuse disorder (Lai, Cleary, Sitharthan, & Hunt, 2015). Estimates of the 12-month prevalence of comorbid mental and substance abuse disorders range from 26.2% to 29.5% in those who carry a mental illness diagnosis (Grant, et al., 2004; Kessler, 2005).

An associated feature of negative affective states—whether or not they meet diagnostic thresholds for a formal disorder—is psychological distress. Psychological distress has been operationalized as the result of being unable to adequately cope with an aversive state and retain physiological and psychological homeostasis (Carstens & Moberg, 2000). The evidence for a relation between psychological distress and substance use is strong, particularly in regards to treatment outcomes. Individuals entering substance abuse treatment generally report high levels of negative affect and psychological distress—levels that exceed normative population values (Hoxmark, Nivison, & Wynn, 2010). Although prominent features of those seeking treatment, negative affect and psychological distress have not emerged as motivating factors as they do not facilitate or promote treatment entry; rather, when faced with the prospect of
cessation those with higher levels of distress are less likely to engage in treatment (Hser, Maglion, Polinsky, & Anglin, 1998). This suggests that the incentive value of drug use is heightened by affective distress. Consistent with this conceptualization, findings suggest that once in treatment, greater negative affect and psychological distress is associated with greater self-reported temptation to relapse to drug use (Flynn et al., 2004; Sander & Jux, 2006; Velasquez, Carbonari, & DiClemente, 1999).

Theoretical formulations have focused on the underlying psychological mechanisms that may account for the empirical findings regarding affective distress and substance abuse. This research has postulated that negative affect, and the negative reinforcement afforded by drug use, are important determinants in both routine self-administration and in relapse (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). Within this conceptualization, individuals addicted to a substance use the substance to escape or avoid aversive emotional states and negative affect. This is viewed as a learned process and conditioned responses develop to interoceptive cues associated with incipient negative affect. At early stages, the negative affect is prompted by the withdrawal associated with the individual’s return to homeostasis, prompts urges, and cravings to use, and is eliminated with the reintroduction of drug by the organism. However, over time, the negative reinforcement value of drug becomes generalized to any situation that triggers a negative affective response and craving occurs independent of acute withdrawal; with repeated administrations, the individual learns that the substance ameliorates aversive affective states leading to increased reliance on the substance when experiencing such states. Importantly, in the seasoned user, the negative affective state does not need to be fully realized for the process to occur and there may not be external
signs of affective distress during routine self-administration. However, when routine administration is disrupted—as during cessation—underlying negative affect becomes manifest, and the degree of the affective reaction is predicted to be tightly associated with the desire to reinitiate drug use and relapse potential. Within this model, sensitively indexing affective functioning could lead to identifying those at most risk for relapse during a quit attempt.

**Distress Tolerance**

Although negative affect and emotional distress are common among individuals entering substance abuse treatment, how individuals react to distress differs. The individual difference factor of willingness to endure discomfort, often called *distress tolerance*, appears more important than the absolute intensity of experienced distress (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; Richards, Daughters, Bornovalova, Brown, & Lejuez, 2011). Some individuals are able to manage very intense emotional and psychological discomfort, whereas others find even mild emotional dysregulation intolerable. These differences in the capacity to manage and handle distress have been associated with both the natural course of substance use and with substance abuse treatment outcomes, with those who have lower distress tolerance showing less willingness to persist in treatment as treatment requires the individual to overcome negative physical and, more importantly, psychological states without the aid of substances (Simons & Gaher, 2005); individuals with low distress tolerance perceive themselves as unable to abide or absorb unpleasant states (McHugh & Otto, 2012) and therefore are more likely to attempt to escape, give up, or change the situation (Lynch & Mizon, 2011).
Within the context of substance abuse treatment outcomes, individuals low in distress tolerance are more likely to leave substance abuse treatment prematurely (Daughters et al., 2005a) and to relapse following treatment discharge (Brandon et al., 2003; Daughters, Lejuez, Kahler, Strong, & Brown, 2005b; Quinn, Brandon, & Copeland, 1996). The predictive power of distress tolerance has been evidenced across categories of drug and lower distress tolerance has been related to shorter duration of abstinence for smokers (Brandon et al., 2003), illicit drug users (Daughters et al., 2005a), and alcohol abusers (Cannon, Keefe, & Clark, 1997) following a successful quit attempt. There may be a learned component to distress tolerance as research has suggested that individuals with high distress tolerance more effectively manage affective challenge in part due to possessing more diversified and effective coping strategies, such as pursuing supports following treatment (Cloninger, Przybeck, Svrakic, & Wetzel, 1994). Given that individuals with lower distress tolerance have shown both less resilience in the face of emotional discomfort and a less developed coping repertoire, assessing distress tolerance at treatment entry may help treatment retention and reduce post-treatment relapse by identifying those in need of additional supports.

**Learned Industriousness Theory**

One possible explanatory theory of how distress tolerance may be, at least in part, a leaned behavior is *learned industriousness*. The general theory of learned industriousness, proposed by Eisenberger (1992), posits that individuals possess differing degrees of persistence depending on their individual reinforcement histories. Individuals who have been rewarded for effortful persistence in the past will likely demonstrate higher persistence in the present, compared to those who have not been rewarded for
continued effort. Furthermore, among individuals who are reinforced for high-effort tasks, effort itself becomes a source of secondary reward, and the willingness to persevere subsequently generalizes to performance across tasks and endeavors (Eisenberger, Kuhlman, & Cotterell, 1992). Applied to distress tolerance and substance abuse treatment, those with a prior history of reinforcement for effortful persistence should be more likely to persist in face of psychological discomfort and remain in treatment.

Task Persistence

Accurately assessing individuals’ distress tolerance presents considerable challenge. Although there is intuitive appeal in using self-report measures to index distress tolerance—as the individual is the expert on him or herself—this may give rise to faulty results. First, individuals may lack insight into their own affective states and may over (or under) estimate their capacity to deal with challenge; second, individuals may not be willing to share this information even if it is accessible to them. Therefore, there appears to be considerable wisdom in utilizing behavioral methods, as opposed to self-report, to assess distress tolerance. Such methods provide the advantage of not relying on individuals’ ability (and willingness) to report on their internal world (Fals-Stewart, Lucente, Shanahan, & Brown, 1995; Steinberg et al., 2012) and produce clearly operationalized, quantitative outcomes that remove the error introduced by subjective self-appraisal. To this end, task persistence has been conceptualized as a primary behavioral manifestation of distress tolerance. Task persistence is defined as continued effortful behavior toward a specified goal despite frustration (Steinberg et al., 2007; Steinberg, Williams, Gandhi, Foulds, & Brandon, 2010). Individuals low in task
persistence give up easily when faced with a challenging task, whereas individuals high in task persistence keep trying.

A variety of behavioral task persistence measures have been developed that use different modalities and take different forms. For example, some tap into sustained cognitive effort (e.g., anagram persistence task; APT) whereas others focus on motor behavior (e.g., mirror-tracing persistence task; MTPT). Studies on the ability of such behavioral task persistence measures to predict premature substance abuse treatment termination and/or to relapse have produced promising results, with the MTPT showing the most consistent relations with substance use patterns and substance abuse treatment outcomes (Brandon et al., 2003; Daughters et al., 2005a; Quinn et al., 1996).

The MTPT captures persistence via an increasingly difficult task that demands a high degree of motor control (McHugh & Otto, 2011); the MTPT requires individuals to accurately trace the inverted outlines of geometric figures by viewing them in a mirror (Zvolensky, Leyro, Bernstein, & Vujanovic, 2011). The utility of the MTPT in predicting a number of substance abuse treatment outcomes has been supported by a growing body of literature focused on a variety of different categories of drug. For example, Daughters et al. (2005a) found the MTPT was significantly related to premature residential substance abuse treatment termination in a sample of heterogeneous drug/alcohol dependent individuals; specifically, less persistence on the MTPT was associated with failure to complete treatment; Steinberg et al. (2012) used the MTPT to prospectively predict smoking abstinence among nicotine dependent individuals attempting cessation and found smokers higher in task persistence showed more quit success. Brandon et al. (2003) utilized the MTPT to predict relapse following smoking cessation treatment and
found the MTPT was a significant predictor of continuous abstinence as increased MTPT persistence was associated with sustained cessation. However, the predictive power of MTPT has not been assessed in relation to opioid dependence or to predict treatment entry.

**Present Study**

Taken together, prior research documents the importance of negative affect and distress tolerance in drug use and cessation. Efforts to identify reliable and valid measures of how these constructs may intersect support the use of the MTPT, a behavioral task persistence measure (Brandon et al., 2003; Daughters et al., 2005a; Quinn et al., 1996). Although the MTPT has shown the ability to predict a variety of dependence-related outcomes, including premature termination of treatment and relapse (Brandon et al., 2003; Steinberg et al., 2012), the ability of the MTPT to predict the decision to enter formal treatment has not been tested. Given the past finding that higher levels of negative affect predict the decision to not pursue treatment (Hser, Maglion, Polinsky, & Anglin, 1998), the MTPT may prove to be a valuable tool in this regard. This is especially true in the context of abstinence-oriented residential treatment for opioid (and other drug) dependence as such programs typically begin with a separate detoxification period. Once detoxification is completed, individuals must make the decision about whether to commit to additional treatment or choose to view detoxification as sufficient and an end in itself. Given the robust relation between length of treatment and successful abstinence, forgoing formal treatment after detoxification markedly increases the risk of relapse to substance use. If, as the data suggests, higher negative affect and lower distress tolerance reduce individuals’ inclination to pursue
additional treatment—whether due to conscious or unconscious processes— the MTPT may be particularly effective at identifying those who are less likely to pursue treatment. Once identified, interventions aimed at increasing such individuals’ interest in formal treatment (e.g., motivational strategies) could be provided. However, to merit the time and training demands of administering the MTPT, it must demonstrate that it has predictive power beyond self-report measures of affect and easily collected demographic information. The current study set out to empirically test the utility of the MTPT in these ways.

Specifically, the current study used the MTPT in a sample of primarily opioid dependent individuals finishing a 7-day detoxification program to test the following three hypotheses: 1) the MTPT will predict the decision to enter a 28-day residential treatment program following detoxification, with higher persistence being related to increased program enrollment; 2) the MTPT will predict completing the 28-day residential treatment program, with higher persistence being related to increased likelihood of completing the program and 3) the MTPT will predict the number of days spent in the 28-day residential treatment program, with higher persistence being related to more days in treatment. The robustness of the MTPT will be tested by assessing if it can outperform self-report measures of affect in regards to the three outcomes and by determining if the MTPT provides incremental predictive power over demographic factors associated with outcome. Finally, whether there is a learned component to task persistence will be investigated by assessing the relation between the MTPT and a measure of learned industriousness.
Method

Participants

One hundred and twenty-one participants from a Midwestern substance abuse treatment center (hereafter referred to as the Center) were recruited for the current study. A total of 202 individuals were approached but 81 declined to participate, resulting in a 60% participation rate. Twenty participants discontinued the study after consenting but prior to completing all study measures. As a result, the final sample contained 101 participants. The age of participants ranged from 18 to 65 years old, with an average age of 35.53 years ($SD = 10.27$). There were more men (57%) than women (43%) but this difference was not significant, $\chi^2 (1, N = 101) = 2.23, p = .136$. The sample consisted of 89 participants who identified as White (88.1%), 11 as Black (10.9%), and 1 as multiracial (1.0%). The majority (71.2%) graduated from high school. The majority of the sample (63%) was unemployed at the time of participation.

Measures

**Mirror-Tracing Persistence Task (MTPT).** The MTPT is a motor task that measures task persistence in the face of frustration and challenge. The MTPT requires participants to trace eight geometric figures while observing their own hand movements in a mirror (Brandon et al., 2003). The current study used the same procedure utilized by Brandon et al. and Quinn et al. (1996). The first and last geometric figures are designed to be relatively easy to trace, whereas the second through seventh shapes are challenging, difficult to trace, and intended to induce frustration.

The experimenter presents the MTPT as a motor task that requires the participant to complete tracing each design before progressing to the next figure (Brandon et al.,
Participants are seated in front of an apparatus that includes a mirror, which blocks their view of the target design and their paper. However, both their paper and the target design are visible in the mirror. Participants are instructed to trace the figure accurately and informed that they should start over if they make a mistake and wish to keep trying. Once they start, they are not allowed to lift their pen off the paper. If they go off the tracing line or lift their pen, the examiner stops them and they are given the option to start over again. Participants are timed and allowed a maximum of 5 mins on each design; they may start as many times as they wish/need within the 5-min period. They are instructed to move onto the next figure if they successfully trace the figure, give up trying, or the 5 mins have elapsed. The time spent on each design is recorded. The dependent variable is the average time spent on all uncompleted drawings prior to the participant stopping. The MTPT performed well in the current study, with $\alpha = .91$ across shapes.

**The Positive and Negative Affect Schedule (PANAS).** The PANAS was used to assess negative affect (Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item, paper-and-pencil, self-report adjective checklist that is divided into two subscales: Positive Affect and Negative Affect. Participants use a 5-point Likert-type scale ($1 = very slightly or not at all; 5 = very much$) to rate the extent to which they experienced each mood state during a specified period of time (e.g., right now, past week, etc.). The version used in this study focused on the participant’s current (e.g., right now) affect. A sample Negative Affect item is “distressed;” a sample Positive Affect item is “determined.” Total scores on the N-PANAS can range from 10 – 50. Only the Negative Affect subscale (N-PANAS) was used in the current study; it was administered twice. In
the current study, the N-PANAS performed well at both time points: N-PANAS-1 $\alpha = .86$ and N-PANAS-2 $\alpha = .86$.

**Center for Epidemiological Studies Depression Scale (CES-D).** The CES-D is a 20-item, self-report measure that assesses major dimensions of depression, including depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance (Radoff, 1977). The CES-D was used to assess for overall level of depression. It takes approximately 5 mins to complete and is designed for use within the general population. The CES-D is scored on a 4-point scale ranging from 0 (*rarely or not at all*) to 3 (*most or all of the time*). Scores are summed to yield a total score, ranging from 0 to 60. Scores of 16 or higher reflect high levels of depressive symptoms. The CES-D has shown good overall concurrent validity and good construct validity. The internal consistency for the current study was good, $\alpha = .87$.

**Clinical Institute Withdrawal Assessment for Alcohol (CIWA-Ar).** The Center utilizes a family of measures based on the CIWA-Ar (Sullivan, Sykora, Schneiderman, Claudio, & Sellers, 1989) to capture withdrawal intensity. Substance specific CIWA scales were used to measure the intensity of physical withdrawal. The CIWA scales are used to assess withdrawal symptoms. Each specific scale targets the withdrawal symptoms associated with a particular category of drug. The most commonly used (and most studied) is the CIWA-Ar, which targets alcohol withdrawal. The CIWA-Ar measures the severity of alcohol withdrawal by assessing the following 10 symptoms: 1) Nausea and vomiting; 2) Tremor; 3) Paroxysmal sweats; 4) Visual disturbances; 5) Agitation; 6) Tactile disturbances; 7) Headache, fullness in head; 8) Auditory
disturbances; 9) Anxiety; and 10) Orientation and clouding of sensorium. All items are
rated on a 7–point scale (0 = absent to 7 = extreme), except orientation, which uses a 4-
point scale (0 = oriented to 4 = disoriented for place and/or person). Scores are summed
to yield a total CIWA-Ar score, ranging from 0 - 67 (Sullivan et al., 1989). The CIWA-
Ar is considered the gold standard for measuring the severity of alcohol withdrawal
symptoms and is often used as the standard against which other withdrawal scales are
compared (Pittman et al., 2007). The CIWA-Ar has been shown to be brief and effective
in both clinical and research settings (Reoux & Oreskovich, 2006). The CIWA-Ar
demonstrates good inter-rater reliability ($r = .8$), and is highly related to the original, 30
item, CIWA-A ($r = .98$) (Sullivan et al., 1989) from which it was derived. Reliability in
the current sample could not be calculated as only summary scores were provided and
used by the Center to track withdrawal symptoms.

**The Clinical Opiate Withdrawal Scale (COWS).** The Center utilizes a measure
based on the COWS (Wesson & Ling, 2003). Similar in structure to the CIWA-Ar, the
COWS targets narcotic/opioid withdrawal, assesses the primary symptoms of opioid
withdrawal; these symptoms are broken down into the following six domains: 1) Blood
pressure, rated 0 ($< 121/81 – 128/90$) to 4 ($> 200/110$); 2) Pulse and respirations, rated 0
($< 90$) to 4 ($> 140$); 3) Anxiety, rated 0 (*no anxiety reported*) to 3 (*panic*); 4) Physical
findings, rated 0 (*no symptoms*) to 4 (*flushing/severe yawning*); 5) Nausea-vomiting,
rated 0 (*occasional nausea*) to 4 (*unable to eat*); and 6) Diaphoresis, rated 0 (*sweaty
palms*) to 4 (*gross diaphoresis*). Domain scores are summed to produce a total score. The
total score ranges from 0 to 23, with higher scores indicating more severe withdrawal
symptoms. The COWS demonstrates good inter-rater reliability ($r = .78$), and is highly
related to another measure of opiate withdrawal, the Clinical Institute Narcotic Scale ($r = .85$) (Tompkins et al., 2009). Reliability in the current sample could not be calculated as only summary scores were available and used by the Center to track withdrawal symptoms.

**The Task Approach (TA).** The TA was used to capture learned industriousness. The TA is a 16-item measure created for this study to examine histories of reinforcement for effort. The questions were theoretically derived, based on the Eisenberger’s (1992) *Theory of Learned Industriousness*. Currently no known measure exists to assess learned industriousness. Items are rated using a 7-point Likert-type scale (1 = strongly disagree; 7 = strongly agree). Sample items include: “In my family trying hard was more important than whether I succeeded or not” and “Sometimes the best solution to a difficult problem is to walk away from it.” Total scores can range from 0 to 112, with higher scores indicating more learned industriousness (7 items are reverse scored); Prior to this study, the TA was piloted on a convenience sample of 31 undergraduate students enrolled in an upper-level, required, psychology course and demonstrated acceptable internal consistency ($\alpha = .73$). The TA showed good internal consistency in the sample, $\alpha = .80$.

**Post-detoxification Status.** Each patient’s decision about whether to enter the residential program or discharge to the community without additional treatment after detoxification was extracted through review of the patient’s clinical chart. For patients who opted to enter the 28-day residential program, the number of treatment days completed was extracted from the clinical record.
Procedure

Prior to initiating study procedures, the study was reviewed and approved by the sponsoring university’s Institutional Review Board (see Appendix A). Patients admitted to the Center for detoxification were recruited. Specifically, patients in the final stages of detoxification who were alert, ambulatory, and using the common areas were approached by research assistants during leisure time while in a recreation room. Following completion of the informed consent process, the participants completed, in order, the CES-D, N-PANAS-1, TA, and the MTPT. The order of administration of all baseline measures was held constant to avoid contamination of the affect measures by the MTPT, which is designed to evoke frustration. The N-PANAS was administered a second time, immediately following completion of the MTPT. The N-PANAS-1 was used to capture baseline (tonic) affect and the N-PANAS-2 to capture affective changes and state affect following the MTPT. Participant demographic information and substance use history were extracted from the Center’s files following participant enrollment. All patients who complete detoxification at the Center are encouraged to enter the on-site 28-day residential treatment program. The participants’ decision about whether to enter the Center’s 28-day residential treatment following detoxification was extracted from the Center’s files, as were the number of treatment days completed for those who entered treatment.

Results

All data was visually and statistically assessed for normalcy prior to analyses; no deviations requiring transformation were identified. Multivariate outlier analyses, including calculation of the Mahalanobis distance, Cook’s distance and centered leverage
values, were conducted (Tabachnick & Fidell, 2001). No outliers were identified and the entire data set was retained for analyses.

**Design**

Regression equations were utilized to predict substance abuse treatment outcomes. Logistic regression was used for the dichotomous outcome variables: treatment entry (entered treatment/did not enter treatment) and treatment completion (completed treatment/did not complete treatment). Multiple linear regression was used to predict days in treatment.

**Substance Use History**

The majority of the sample was seeking treatment for heroin dependence (70.3%); followed by alcohol (16.8%), other opioids/synthetics (7.9%), and cocaine/crack (5.0%). Polysubstance abuse was frequent as 63 participants (62.4%) endorsed a history of abusing multiple drugs (See Table 1).

**Mental Health and Substance Abuse Treatment**

The sample included 32 participants (31.7%) who reported a history of psychological or psychiatric treatment. Of those, 14 (13.9%) had been hospitalized for mental health concerns, and 26 (25.8%) had been treated in an outpatient setting. A supermajority of the sample, 70 (69.3%) reported past treatment for substance abuse. Of those with previous treatment, 27 (26.7%) had participated in detoxification, 44 (43.6%) had participated in residential treatment, 14 (13.9%) had previous outpatient treatment and 1 (1%) reported treatment in a hospital setting. Of the 70 who had previous substance abuse treatment, 46 (65.7%) reported having successfully completed the treatment.
CIWA/COWS Measures

The mean score for the CIWA/COWS nurse-administered measures was 6.26 (range 0 – 12; $SD = 4.03$), indicating moderate withdrawal symptoms. Results indicated that withdrawal was negatively related to entering treatment ($b = -.122, p < .05$, $Wald \chi^2 = 5.228; O.R. = .886$ (C.I. .798 - .983)), completing treatment ($b = -.227, p < .05$, $Wald \chi^2 = 6.524; O.R. = .797$ (C.I. .670 - .949)), and the number of days of treatment completed ($b = - .955, t(51) = -2.599, p < .05$).

Performance on the MTPT

The mean time spent persisting on the MTPT was 91.72 seconds ($SD = 60.54$).

Self-Report Measures

On the CES-D, 91 (90.1%) participants exceeded the recommended clinical cutoff of 16, which is indicative of high depressive symptoms. In addition to high levels of depression, the sample showed high negative affect on the N-PANAS and high learned industriousness on the TA. (See Table 2). As expected the affect measures were highly correlated. Counter to expectations, N-PANAS-2 scores were significantly lower than N-PANAS-1 scores (N-PANAS-1 $M = 30.1$; N-PANAS-2 $M = 26.7$, $t(100) = 4.6, p < .001$). The relations between the self-report measures are contained in Table 3.

Primary Hypotheses

**H1a:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with the decision to enter 28-day residential substance abuse treatment following completion of detoxification. The hypothesis was supported. Results indicated that the MTPT was a significant predictor of entering 28-day treatment, $b = .008, p < .05$, $Wald \chi^2 = 3.987; O.R. = 1.008$ (C.I. 1.000 - 1.015). The effect was significant, but
modest and indicated that for each additional second a person persisted on the MTPT, he/she was 1.008 times more likely to enter 28-day treatment.

**H1b:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with completion of 28-day residential substance abuse treatment among those who entered. The hypothesis was not supported. Results indicated that the MTPT was not a significant predictor of completing 28-day treatment, $b = .003, p = .596$, Wald $\chi^2 = .281$; $O.R. = 1.003$ (C.I. .993 - 1.012).

**H1c:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with total days completed of a 28-day residential substance abuse treatment. The hypothesis was not supported. Results indicated that the MTPT was not a significant predictor of the number of days of treatment completed, $b = .010, t(51) = .422$, $p = .675$.

**Follow-up Analyses**

Follow-up analyses tested the robustness of the primary outcomes by controlling for all demographic and background factors associated with outcome. To identify associated background variables, the following process was used for the three outcomes: Categorical background variables were collapsed into dichotomous variables (See Table 4). Next, all variables were analyzed on a univariate level to determine their association with each treatment outcome. Variables that showed a significant univariate relation with an outcome were used as control variables for that outcome and entered as a set on the first step of the equation testing the robustness of the MTPT. MTPT was entered on the second step to determine if the MTPT could account for unique variance in treatment outcomes after controlling for significant demographic and background variables.
**FA1a:** It was hypothesized that time spent on the MTPT would predict decision to enter a 28-day residential substance abuse treatment program after controlling for significant background variables. Screening analyses indicated that only previous substance abuse treatment completion was a significant predictor of entering 28-day treatment (See Table 5). The hypothesis was not supported. Results indicated that the MTPT was not predictive of entering treatment once accounting for completing prior treatment, $b = .007$, $Wald \chi^2 = 2.206$, $p = .137$; $O.R = 1.007$ (C.I. .998 – 1.017).

**FA1b:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with completion of 28-day residential substance abuse treatment after accounting for significant background variables. Screening analyses indicated higher education and no previous mental health treatment history were significant predictors of completing 28-day treatment (See Table 6). The hypothesis was not supported. Results indicated that the MTPT was not predictive of treatment completion after accounting for education and prior mental health treatment, $b = .001$, $Wald \chi^2 = .018$, $p = .892$; $O.R = 1.001$ (C.I. .989 - 1.013).

**FA1c:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with total days completed of a 28-day residential substance abuse treatment program after accounting for significant background variables. Screening analyses indicated increased age and alcohol use were significant predictors of the days of treatment completed (Table 7). The hypothesis was not supported. Results indicated that the MTPT was not predictive of days of treatment completed once accounting for the effects of age and alcohol use, $b = .002$, $t(49) = .074$, $p = .941$. 
Secondary Hypotheses

The ability of the MTPT to account for unique variance in treatment outcomes after controlling for the influence of affective functioning was assessed. In all tests, the N-PANAS-1 and CES-D were entered on the first step of the regression equations and the MTPT on the second step.

**SH1a:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with 28-day residential substance abuse treatment entry after accounting for the influence of negative affect. The hypothesis was not supported. Results indicated that time spent on the MTPT was not predictive of entering 28-day treatment once accounting for negative affect, $b = .007$, $Wald \chi^2 = 3.708$, $p = .054$. $O.R = 1.007$ (C.I. 1.000 – 1.015) (See Table 8 for the full model).

**SH1b:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with 28-day residential substance abuse treatment completion after accounting for the influence of negative affect. The hypothesis was not supported. Results indicated that time spent on the MTPT was not predictive of completing 28-day treatment once accounting for negative affect, $b = .002$, $Wald \chi^2 = .212$, $p = .645$. $O.R = 1.002$ (C.I. .992 – 1.012) (See Table 9 for the full model).

**SH1c:** It was hypothesized that time spent on the MTPT would show a significant, positive relation with total days completed of a 28-day residential substance abuse treatment after accounting for the influence of negative affect. The hypothesis was not supported. Results indicated that time spent on the MTPT was not predictive of the number of days of completed treatment once accounting for negative affect, $b = .006$, $t(49) = .265$, $p = .792$ (See Table 10 for the full model).
Analyses for Exploratory Hypotheses

Additional exploratory analyses were planned to investigate if the construct of learned industriousness (LI), as measured by the Task Approach measure, could account for, or mediate, the hypothesized relations between MTPT and treatment outcomes. In order to assess for mediation, the relations between LI, MTPT and the three outcomes needed to be established as follows:

**EH1:** It was hypothesized that learned industriousness would show a significant, positive univariate relation with MTPT performance. This relationship was not established, as LI did not show a positive relation with MTPT performance, $b = .027, p = .225$.

**EH2:** It was hypothesized that learned industriousness would show significant relations with the three treatment outcome variables. Results indicated that LI did not show a significant relation to any of the three outcome variables. Specifically, LI did not predict for entering 28-day treatment, $b = .001, \text{Wald } \chi^2 = .008, p = .928$; $O.R. = 1.001$ (C.I. .972 - 1.032), completing 28-day treatment, $b = -.010, \text{Wald } \chi^2 = .149, p = .700$; $O.R. = .991$ (C.I. .944 - 1.040), nor the number of days of treatment completed, $b = -.015, t(51) = -.125, p = .901$.

As the required relations did not emerge, the mediational analyses were not conducted.

A second set of exploratory analyses were planned to investigate if TA would mediate the hypothesized relationship between negative affect and treatment outcomes. Results failed to find any significant relations. As illustrated in Tables 8 - 10, counter to
predictions, the negative affect variables were unrelated to all three outcomes. When the effect of TA was tested in the full model, no significant effects were found.

Discussion

The current study examined the relations between the willingness to persist when faced with difficulty and substance abuse treatment outcomes. Specifically, the ability of a behavioral measure of task persistence—the MTPT—to predict three treatment outcomes in a community sample of primarily opioid dependent individuals completing medically supervised detoxification was assessed. The three outcomes were: 1) the decision to enter a 28-day residential substance abuse treatment; 2) successful completion of 28-day residential substance abuse treatment; and 3) the total number of days of residential substance abuse treatment completed. It was hypothesized that higher persistence would be related to increased treatment entry, increased treatment completion and spending more days in treatment. Additionally, the underlying mechanisms of the hypothesized relations were explored by examining the influence of affective functioning and prior reinforcement history.

Primary Hypotheses

The hypothesis that the MTPT performance would be related to treatment entry was supported. When tested in isolation, the MTPT was predictive of the decision to enter formal treatment as individuals who persisted longer on the MTPT were significantly more likely than those who gave up sooner to enter 28-day treatment after completing the detoxification process. This finding is consistent with previous research showing the MTPT was able to predict the decision to enter formal smoking cessation/nicotine dependence treatment (Brandon et al., 2003). As such, it extends
previous research findings by showing that the MTPT has predictive power within a heterogeneous (although primarily opioid dependent) sample of substance dependent individuals. This study conceptualized the MTPT as a behavioral measure of distress tolerance and an analogue of the willingness to tolerate uncomfortable affective states in the pursuit of a larger goal. In other words, the same processes that supported “sticking” with the MTPT are felt likely to undergird the decision to “stick” with treatment. However, it should be emphasized that although the MTPT was significantly related to the decision to enter treatment, the relation was quite modest ($OR = 1.008$). Additionally, counter to expectations, completing the MTPT did not lead to increases in state negative affect as seen by a significant decline in self-rated negative affect.

The limited nature of the relation between the MTPT and the decision to enter treatment is illustrated by the results of including baseline affective functioning into tests of the MTPT. Once accounting for the influence of pre-MTPT negative affect, the predictive power of the MTPT diminished and became marginally significant ($p = .054$). This result was different from that seen in prior studies. These prior studies also tested the MTPT after controlling for depression and negative affect due to the strong relation between negative affect and treatment outcome and found that the MTPT showed incremental predictive power (Brandon et al., 2003; Daughters et al., 2005a). For example, Brandon et al., found the MTPT predicted both entering treatment for nicotine dependence and sustained abstinence after controlling for negative affect. However, these findings were in a nicotine dependent sample and may not generalize to alcohol and drug abuse samples. One factor that could influence the lack of significant findings is that participants in the current study had high levels of baseline negative affect (N-PANAS-1
M = 30.1), and high rates of depression (CES-D M = 30.75). Examination of the
distribution of CES-D scores indicated that approximately 90% of participants passed the
threshold indicating mild depression, and 78% passed the threshold suggesting possible
major depression. In direct comparison, a study focused on nicotine dependence that
used these same affect measures found much lower values—N-PANAS = 16.9 and CES-
D = 8.83 (Abrantes et al., 2008)—again suggesting that results may be substance specific.
Although much higher than seen in outpatient nicotine dependent samples, the high rates
of depression and negative affect in the current study are consistent with the negative
reinforcement model of drug dependence, which argues that a prime reason individuals
use substances is to cope with negative affect and/or comorbid mental illness (Baker et
al., 2004). The marked negative affect seen in the current sample also gives rise to the
question—was the limited predictive power of the MTPT due to the MTPT adding little
incremental validity to the prediction of entering treatment over affective distress?
Examination of the pattern of results does not support this idea; first, the negative affect
items were unrelated to treatment entry and the MTPT showed minimal univariate
relation with either the N-PANAS-1 (r = -.124 p = .213) or the CES-D (r = -.018, p =
.857). Both results were unexpected as the MTPT has shown a modest, but significant,
relation to negative affect (Daughters et al., 2005a) and negative affect and depression
have shown robust relations to treatment entry (Hser, Maglion, Polinsky, & Anglin,
1998). However, in the current sample, the MTPT and the affect measures were unrelated
and indexing different underlying constructs. This is further illustrated by the finding
that state negative affect was significantly lower after completing the MTPT. This
suggests that the MTPT did not generate increased distress but, rather, may have served
as a distractor and provided a measure of relief. This finding calls into question the validity of the MTPT as an index of distress tolerance in the context of high baseline negative affect.

The MTPT also ceased to be a significant predictor of treatment entry when examined in the context of prior treatment. Although history of prior treatment was not related to the decision to enter treatment, history of completing a prior substance abuse treatment program was related to entering treatment. This finding is consistent with the data showing that multiple attempts are typically required to attain successful outcomes for substance abuse treatment (Comiskey & Stapleton, 2010) and suggests that having had a prior success experience generates more optimism about a future success experience.

The hypotheses that MTPT performance would be related to completing treatment and days of treatment completed were not supported. This was counter to predictions and in contrast to past findings that have found a significant relation between MTPT performance and treatment completion (Brandon et al., 2003; Daughters et al., 2005a). It should be noted that almost half of the sample \((n = 48; 47.5\%)\) opted to not enter treatment, thereby significantly reducing predictive power. However, in addition to reduced power, there are other potential explanations for the lack of significant findings. First, unassessed variables reflecting factors not associated with motivation or treatment commitment \textit{per se} could have impacted the results. For instance, by definition a 28-day residential program is of longer duration than a 7-day detoxification and some participants may not have been able to enter treatment due to occupational demands or family obligations. Alternately, some participants who did not enter treatment at the
Center may have pursued treatment at other sites. Anecdotally, one of the directors of the Center mentioned that some people opt not to enter, or prematurely leave, the 28-day treatment program in order to enter other treatment centers due to location or finances. As such, some people could have been effectively misclassified. Although this study adopted the most conservative approach and classified only those who entered or completed treatment at the Center as successes, more information about participants’ reasoning and status may have been beneficial.

**Past Reinforcement**

Along with examining the predictive power of the MTPT, this study investigated a proposed underlying mechanism: the construct of *Learned Industriousness* (LI). It was anticipated that LI would be positively related to both MTPT performance and treatment outcomes. However, results did not establish a relation between LI and MTPT performance or treatment outcomes. Counter to predictions, the TA and MTPT did not index the same construct as they showed no shared variance, $r^2 = .01, p = .225$. These results suggest that learned industriousness does not serve as a theoretical link between task persistence and substance abuse outcomes. Previous to this study, LI had been advanced as a theoretical explanation for the relation between task persistence and substance abuse treatment outcomes but had not been empirically assessed (Quinn et al., 1996). It is possible that the measure of LI used in this study did not actually capture LI. However, no extant measure of LI could be found and the measure developed for this study was theoretically derived and demonstrated good reliability/internal consistency. Although the construct validity of the measure is not known, and it is possible that the lack of relation is due to poor validity, it is equally possible that the null finding is due to
the relation between LI and task persistence not being as strong as theorized. The current study also does not support the idea that a previous history of persistence influences the decision to enter or complete treatment as LI was unrelated to all the treatment outcomes. However, in keeping with Eisenberger’s theory (1992), the current study assessed LI by focusing on early learning history and childhood reward for persistence rather than more recent persistence. It is possible that early learning history is not as important as a more recent history of success based on persistence. Furthermore, persistence may be domain specific and reinforcement for persisting in a similar situation may be more important and salient than reinforcement for persistence in general. This idea is consistent with the finding that previous substance abuse treatment completion (but not prior treatment entry) was a significant predictor of entering treatment in the current sample.

**Participant Factors**

The limited findings should also be viewed in light of the sample composition. First, and perhaps most notably, the current sample differed from past samples in the absolute level of persistence demonstrated on the MTPT. Specifically, the level of persistence shown by this sample was significantly lower than seen in prior studies. The mean time persisting on the MTPT by participants in the current study was 91.72 seconds; this is significantly less than that of a heterogeneous (but primarily crack/cocaine) sample ($M = 197.1$ seconds; $t(221) = 9.57, p < .01$; Daughters et al., 2005a) and that of a nicotine dependent sample ($M = 179.19$ seconds; $t(243) = 8.21, p < .01$; Brandon et al., 2003). This result was unexpected and may have limited the predictive power of the MTPT due to restriction of range. The significantly lower overall persistence of the current sample may have made it difficult for the MTPT to distinguish
between those with higher and lower distress tolerance. These results suggest the entire
developed between those with higher and lower distress tolerance and, as a whole, sought to quickly exit an
unpleasant experience. As a cardinal feature of withdrawal for all substances is negative
affect (Baker, et al., 2004), it is possible that the transient increase experienced during the
detoxification process served to mask individual differences in affective vulnerability.
Therefore, the MTPT may not have been predictive in this sample as no one had enough
reserve to tolerate additional bad feelings. Although all participants had exited the most
severe portion of withdrawal, as they were ambulatory, in a common area and
volunteered for the study, their withdrawal process was not completed and the sample, as
a whole, evidenced moderate levels of withdrawal as reflected in the nurse ratings.
Withdrawal severity showed a significant negative relation with treatment entry
\( (b = -.122, p = .022) \); this finding is consistent with poor distress tolerance serving as a
barrier to pursuing treatment. Individuals who had more sustained withdrawal were less
likely to enter treatment. Although it is intuitively appealing to link more intense
withdrawal to increased desire for treatment, as treatment can ameliorate suffering by
providing structure and comfort, the results do not support this pattern. Instead, those
who were feeling more withdrawal were more likely to opt to decline treatment and
directly return to the community. Although the present data are silent on the
consequences of this decision, the strong relation between length of treatment and
successful outcomes suggest less favorable outcomes.

How withdrawal may influence MTPT performance remains unclear. It was not a
direct effect as withdrawal severity was unrelated to MTPT performance \( (r = .05; p = .60) \) and MTPT performance remained a significant predictor of entering treatment after
controlling for withdrawal severity. Additionally, although significant, positive, correlations emerged between withdrawal (CIWA/COWS scores) and the N-PANAS-1 ($r = .246, p = .013$) and CES-D ($r = .268, p = .007$), the relations were more modest in nature; also, as noted, negative affect significantly decreased following the MTPT task. As such, it may be that non-affective factors associated with withdrawal (tremor, fatigue, physical discomfort) contributed to the limited persistence. As no previous studies have utilized the MTPT with people who are just exiting withdrawal there is no sample with which to compare the current results. An additional factor to consider is that, although our sample showed markedly low persistence, it only included volunteers and approximately 40% of those approached declined. It is possible that those who declined to participate did so due to greater subjective distress and would have showed even lower levels of persistence. Given the number who declined, it is unknown if/how the range was affected and if more variability in task persistence would have resulted in more robust results.

A second sample factor that deserves consideration is the current sample included mostly opioid abusers; over 70% entered treatment for heroin, with an additional approximately 8% seeking treatment for non-heroin opioids and fully synthetic opioids. In a previous study assessing the relation of the MTPT and treatment completion, the sample included only about 28% heroin users (Daughters et al., 2005a). Other studies utilizing the MTPT have focused exclusively on nicotine dependence (Brandon et al.; Quinn, Brandon, & Copeland, 1996). Therefore, the results of the current study may reflect differences in those who abuse opioids compared to other substances and the unique nature of opioid abuse. Opioid abuse is a chronic disorder with frequent relapse.
(Scherbaum & Specka, 2008); many users experience periods of sustained abstinence before relapsing once again to drug use (Hser, Hoffman, Gerlla, & Anglin, 2001). In the current study, there was a negative correlation between heroin dependence and MTPT performance ($r = -.25$, $p = .01$), indicating that heroin addicts persisted less on the MTPT when compared to other drug users. Therefore, it is possible that the MTPT does not have the same sensitivity for predicting treatment outcomes for opioid abuse as it does for other substance abuse categories. In support of this idea, when the predictive power of the MTPT was assessed in only those presenting for heroin treatment, it was no longer related to treatment entry ($b = .007; p = .19$)—although these findings should be viewed in the context of reduced power. Finally, history of polysubstance abuse was the norm in the current sample as 63 (62%) endorsed a history of abusing multiple drugs. This is markedly higher than the 24% rate of polysubstance abuse reported in the only known study of the MTPT in a heterogeneous drug sample that collected such information (Daughters et al., 2005b).

**Limitations and Future Directions**

There are several limitations to the current study that merit consideration. First the majority of the sample identified as White and the results may not generalize to more diverse populations. Second, as noted, there was no opportunity to follow-up with those who 1) opted to not enter treatment or 2) chose to leave 28-day treatment early. It is unknown why individuals did not enter the residential treatment program or left prior to completion. As discussed earlier, it is likely that some did not enter or complete treatment due to reasons unrelated to their commitment to treatment per se (e.g., opted for different treatment program; financial and employment considerations). As such, some individuals
may have been effectively misclassified in the analyses, possibly attenuating the relation of MTPT to treatment outcomes. Third, this study relied on a volunteer sample and individuals who self-selected out may have done so due to poor distress tolerance and seeing the demands of the study as more than they could manage. Finally, the measure designed for the current study to assess learned industriousness may not have captured the construct as intended. However, there are no known measures of LI available to use in determining convergent and discriminant validity or that can serve as the basis of comparison in terms of psychometric properties. Developing a more robust measure through additional analyses of psychometric properties may produce different results.

Despite the limitations of this study and the modest results, the information obtained from this study has use for guiding future research. The results of the current study, which included a primarily opioid dependent sample, differed significantly from previous studies with drug and alcohol dependent (Daughters et al., 2005a) and nicotine dependent (Brandon et al., 2003) individuals. Therefore, it is essential to conduct additional research in opioid dependent samples to determine if reliable predictors of treatment outcome for other classes of drug obtain to this population as well. Furthermore, the current study focused on individuals completing detoxification and produced results that reflected significantly less task persistence than found in previous studies. Therefore, future research should attempt to replicate these findings to determine if the physical and psychological correlates of detoxification serve to markedly reduce the predictive power of the MTPT due to lowering persistence in the sample as a whole. It may be that use of the MTPT is not appropriate until individuals have completely exited the withdrawal process and fully returned to homeostasis. Finally, task persistence
predicted entering treatment, but our limited sample size may not have provided adequate power to detect the ability of the MTPT to predict completing treatment; therefore, future studies assessing the functioning of the MTPT in a sample completing detoxification should be large enough to detect more distal outcomes such as completing treatment.
References


Substance Abuse and Mental Health Services Administration. (2010). *Results from the 2009 National Survey on Drug Use and Health: Mental Health Findings*, NSDUH


Footnotes

1 The Center decided that it would be better to approach everyone who felt well enough to be in the common areas during free time and not select participants based on CIWA/COWS score. CIWA/COWS scores were still extracted from Center records for potential analyses, but were not utilized in determining participation eligibility.
Table 1

*Substance Abuse History as a Percentage of the Sample*

<table>
<thead>
<tr>
<th>Substance</th>
<th>History of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heroin</td>
<td>73.3%</td>
</tr>
<tr>
<td>Marijuana</td>
<td>40.6%</td>
</tr>
<tr>
<td>Alcohol</td>
<td>24.8%</td>
</tr>
<tr>
<td>Cocaine</td>
<td>23.8%</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>13.9%</td>
</tr>
<tr>
<td>Other Opiates and Synthetics</td>
<td>12.9%</td>
</tr>
<tr>
<td>Methamphetamines</td>
<td>3.0%</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>1.0%</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>1.0%</td>
</tr>
<tr>
<td>Non-prescription Methadone</td>
<td>1.0%</td>
</tr>
</tbody>
</table>
Table 2

**Self-Report Measures**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CES-D</td>
<td>6</td>
<td>54</td>
<td>30.75</td>
<td>11.35</td>
</tr>
<tr>
<td>N-PANAS-1</td>
<td>11</td>
<td>50</td>
<td>30.11</td>
<td>9.25</td>
</tr>
<tr>
<td>N-PANAS-2</td>
<td>10</td>
<td>50</td>
<td>26.65</td>
<td>9.19</td>
</tr>
<tr>
<td>TA</td>
<td>50</td>
<td>109</td>
<td>85.60</td>
<td>13.21</td>
</tr>
</tbody>
</table>

*Note:* CES-D = Center for Epidemiological Studies Depression Scale; N-PANAS = Negative Affect subscale of The Positive and Negative Affect Schedule; TA = Task Approach
Table 3

*Correlations between Baseline Self-Report Measures*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CES-D</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2. N-PANAS-1</td>
<td>.599**</td>
<td>-</td>
</tr>
<tr>
<td>3. TA</td>
<td>-.248*</td>
<td>-.264**</td>
</tr>
</tbody>
</table>

*Note: *= p < .05; **= p < .01; CES-D = Center for Epidemiological Studies Depression Scale; N-PANAS = Negative Affect subscale of The Positive and Negative Affect Schedule; TA = Task Approach*
Table 4

*Background Variable Coding*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0 = male, 1 = female</td>
</tr>
<tr>
<td>Race</td>
<td>0 = non-white, 1 = white</td>
</tr>
<tr>
<td>Education</td>
<td>0 = did not graduate high school, 1 = did graduate high school</td>
</tr>
<tr>
<td>Employment</td>
<td>0 = unemployed, 1 = employed</td>
</tr>
<tr>
<td>Mental Health Treatment</td>
<td>0 = no previous treatment, 1 = previous treatment</td>
</tr>
<tr>
<td>Prior Treatment Completion</td>
<td>0 = did not complete, 1 = did complete</td>
</tr>
<tr>
<td>Problem Substance</td>
<td>dummy coded alcohol, cocaine, and other opiates (heroin as reference)</td>
</tr>
</tbody>
</table>
Table 5

*Univariate Tests of Demographic Variables Association with Entering Treatment*

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>$b$</th>
<th>Wald $\chi^2$</th>
<th>$p$</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.00</td>
<td>0.03</td>
<td>.87</td>
<td>1.00</td>
</tr>
<tr>
<td>Gender</td>
<td>0.40</td>
<td>0.96</td>
<td>.33</td>
<td>1.49</td>
</tr>
<tr>
<td>Race</td>
<td>-0.27</td>
<td>0.19</td>
<td>.67</td>
<td>0.76</td>
</tr>
<tr>
<td>Education</td>
<td>-0.60</td>
<td>1.04</td>
<td>.31</td>
<td>0.55</td>
</tr>
<tr>
<td>Employment</td>
<td>-0.38</td>
<td>0.75</td>
<td>.39</td>
<td>0.68</td>
</tr>
<tr>
<td>Mental Health Treatment</td>
<td>-0.33</td>
<td>0.59</td>
<td>.44</td>
<td>0.72</td>
</tr>
<tr>
<td>Prior Substance Treatment</td>
<td>-0.26</td>
<td>1.06</td>
<td>.30</td>
<td>0.77</td>
</tr>
<tr>
<td>Prior Treatment Completion</td>
<td>1.18</td>
<td>4.70</td>
<td>.03*</td>
<td>3.25</td>
</tr>
<tr>
<td>Substance Abstinence</td>
<td>0.00</td>
<td>0.06</td>
<td>.80</td>
<td>1.00</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.03</td>
<td>0.00</td>
<td>.95</td>
<td>1.03</td>
</tr>
<tr>
<td>Cocaine</td>
<td>0.32</td>
<td>0.12</td>
<td>.73</td>
<td>1.38</td>
</tr>
<tr>
<td>Other Opiates and Synthetics</td>
<td>-0.09</td>
<td>0.01</td>
<td>.91</td>
<td>0.92</td>
</tr>
</tbody>
</table>

*Note:* * = $p < .05$
Table 6

*Univariate Tests of Demographic Variables Association with Completing Treatment*

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>$b$</th>
<th>$Wald \chi^2$</th>
<th>$p$</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.03</td>
<td>0.70</td>
<td>.40</td>
<td>1.03</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.55</td>
<td>0.75</td>
<td>.39</td>
<td>0.58</td>
</tr>
<tr>
<td>Race</td>
<td>-0.86</td>
<td>0.58</td>
<td>.45</td>
<td>0.42</td>
</tr>
<tr>
<td>Education</td>
<td>1.42</td>
<td>4.11</td>
<td>.04*</td>
<td>4.13</td>
</tr>
<tr>
<td>Employment</td>
<td>0.53</td>
<td>0.51</td>
<td>.48</td>
<td>1.69</td>
</tr>
<tr>
<td>Mental Health Treatment</td>
<td>-1.36</td>
<td>4.14</td>
<td>.04*</td>
<td>0.26</td>
</tr>
<tr>
<td>Prior Substance Treatment</td>
<td>0.18</td>
<td>0.22</td>
<td>.64</td>
<td>1.20</td>
</tr>
<tr>
<td>Prior Treatment Completion</td>
<td>0.34</td>
<td>0.12</td>
<td>.73</td>
<td>1.40</td>
</tr>
<tr>
<td>Substance Abstinence</td>
<td>0.01</td>
<td>1.45</td>
<td>.23</td>
<td>1.01</td>
</tr>
<tr>
<td>Alcohol</td>
<td>1.22</td>
<td>1.19</td>
<td>.28</td>
<td>3.39</td>
</tr>
<tr>
<td>Cocaine</td>
<td>-0.17</td>
<td>0.02</td>
<td>.90</td>
<td>0.85</td>
</tr>
<tr>
<td>Other Opiates and Synthetics</td>
<td>0.24</td>
<td>0.04</td>
<td>.84</td>
<td>1.27</td>
</tr>
</tbody>
</table>

*Note:* * = $p < .05$
Table 7

*Univariate Tests of Demographic Variables Association with Days of Treatment Completed*

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>b</th>
<th>t</th>
<th>p</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.29</td>
<td>2.12</td>
<td>.04*</td>
<td>0.08</td>
</tr>
<tr>
<td>Gender</td>
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<td>-1.34</td>
<td>.19</td>
<td>0.03</td>
</tr>
<tr>
<td>Race</td>
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<td>-1.47</td>
<td>.15</td>
<td>0.04</td>
</tr>
<tr>
<td>Education</td>
<td>5.00</td>
<td>1.38</td>
<td>.17</td>
<td>0.04</td>
</tr>
<tr>
<td>Employment</td>
<td>4.84</td>
<td>1.43</td>
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<td>0.04</td>
</tr>
<tr>
<td>Mental Health Treatment</td>
<td>-4.19</td>
<td>-1.24</td>
<td>.22</td>
<td>0.03</td>
</tr>
<tr>
<td>Prior Substance Treatment</td>
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<td>.41</td>
<td>0.01</td>
</tr>
<tr>
<td>Prior Treatment Completion</td>
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<td>-1.07</td>
<td>.29</td>
<td>0.04</td>
</tr>
<tr>
<td>Substance Abstinence</td>
<td>0.02</td>
<td>0.91</td>
<td>.37</td>
<td>0.02</td>
</tr>
<tr>
<td>Alcohol</td>
<td>11.41</td>
<td>2.90</td>
<td>.01*</td>
<td>0.15</td>
</tr>
<tr>
<td>Cocaine</td>
<td>2.41</td>
<td>0.38</td>
<td>.71</td>
<td>0.15</td>
</tr>
<tr>
<td>Other Opiates and Synthetics</td>
<td>2.66</td>
<td>0.48</td>
<td>.64</td>
<td>0.15</td>
</tr>
</tbody>
</table>

*Note: * = p < .05; Alcohol, Cocaine, and Other Opiates and Synthetics were entered as a set in regression equation*
Table 8

*MTPT Predicting Entering Treatment after Controlling for Baseline Negative Affect*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>b</th>
<th>Wald $\chi^2$</th>
<th>p</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-PANAS-1</td>
<td>-0.01</td>
<td>0.10</td>
<td>.75</td>
<td>0.99</td>
</tr>
<tr>
<td>CES-D</td>
<td>0.00</td>
<td>0.00</td>
<td>.99</td>
<td>1.00</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTPT</td>
<td>0.01</td>
<td>3.71</td>
<td>.05</td>
<td>1.01</td>
</tr>
</tbody>
</table>

*Note:* N-PANAS = Negative Affect subscale of The Positive and Negative Affect Schedule; CES-D = Center for Epidemiological Studies Depression Scale; MTPT = Mirror-Tracing Persistence Task
Table 9

*MTPT Predicting Completing Treatment after Controlling for Baseline Negative Affect*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>b</th>
<th>Wald $\chi^2$</th>
<th>p</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-PANAS-1</td>
<td>0.01</td>
<td>0.05</td>
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<td>1.01</td>
</tr>
<tr>
<td>CES-D</td>
<td>-0.04</td>
<td>0.81</td>
<td>.39</td>
<td>0.96</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>MTPT</td>
<td>0.00</td>
<td>0.21</td>
<td>.65</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note:* N-PANAS = Negative Affect subscale of The Positive and Negative Affect Schedule; CES-D = Center for Epidemiological Studies Depression Scale; MTPT = Mirror-Tracing Persistence Task
Table 10

*MTPT Predicting Number of Days of Completed Treatment after Controlling for Baseline Negative Affect*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>b</th>
<th>t</th>
<th>p</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-PANAS-1</td>
<td>-0.11</td>
<td>-0.47</td>
<td>.64</td>
<td>0.04</td>
</tr>
<tr>
<td>CES-D</td>
<td>-0.13</td>
<td>-0.64</td>
<td>.53</td>
<td>0.04</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTPT</td>
<td>0.01</td>
<td>0.27</td>
<td>.79</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*Note:* N-PANAS = Negative Affect subscale of The Positive and Negative Affect Schedule; CES-D = Center for Epidemiological Studies Depression Scale; MTPT = Mirror-Tracing Persistence Task
Appendix A

IRB Approval

January 6, 2015

Brent W. Anderson
1839 Lincoln Ave. B
Cincinnati, OH 45212

Dear Mr. Anderson:

The IRB has completed the review of your protocol #14-047, Task Persistence as a Predictor of Substance Abuse Treatment Outcomes using expedited review procedures. We appreciate your thorough treatment of the issues raised and your timely response. Your study is approved in the Expedited category under Federal Regulation 45CFR46. Approval expires January 6, 2016. A progress report, available at http://www.xavier.edu/irb/forms.cfm, is due by that date.

If you wish to modify your study, including any changes to the approved Informed Consent form, it will be necessary to obtain IRB approval prior to implementing the modification. If any adverse events occur, please notify the IRB immediately.

We wish you success with your research!

Sincerely,

Morell E. Mullins, Jr., Ph.D.
Chair, Institutional Review Board
Xavier University

MEM/ob
Enclosure: stamped informed consent
Summary

Title: Task Persistence as a Predictor of Substance Abuse Treatment Outcomes

Problem: Substance abuse is a common problem in the United States, with an estimated 22.2 million people ages 12 years and older meet criteria for substance dependence or abuse (Substance Abuse and Mental Health Services Administration [SAMHSA], 2013). However, although approximately 2.3 million people age 12 years or older enter substance abuse treatment programs, only a fraction of those who enter complete treatment (SAMHSA, 2012); estimates show only 40-45% of individuals complete any given treatment program (Ravndal, Vaglum, & Lauritzen, 2005; SAMHSA, 2010). This low completion rate is particularly troubling as a primary predictor of treatment success is treatment duration, and patients who stay in treatment longer have better outcomes (Finney & Moos, 1998; Hubbard, Craddock, Flynn, Anderson, & Etheridge, 1997; Simpson, Joe, & Rowan-Szal, 1997). Therefore, a primary focus of substance abuse research should be identifying and understanding easily assessed person-factors related to retention. By identifying those individuals at most risk for premature treatment termination, programs can develop targeted preventative interventions. Previous research has found negative affect to predict treatment outcomes and revealed that negative emotional states are a marker of high-risk for substance abuse relapse and premature treatment termination (Flynn, Walton, Curran, Blow, & Knutzen, 2004; Hodgins, el-Guebaly, & Armstrong, 1995; Joe, Simpson, & Broome, 1999; Roffman, Klepsch, Wertz, Simpson, & Stephens, 1993). One pathway through which negative affect may affect treatment outcome is distress tolerance. Individual differences in tolerating distress have emerged as a promising predictor of treatment outcomes. In the context of substance
abuse treatment outcomes, individuals low in distress tolerance are more likely to leave substance abuse treatment prematurely (Daughters et al., 2005a) and to relapse following treatment discharge (Brandon et al., 2003; Daughters, Lejuez, Kahler, Strong, & Brown, 2005b; Quinn, Brandon, & Copeland, 1996). Previous research has utilized the Mirror-Tracing Persistence Task (MTPT), a behavioral measure of task persistence and analog of distress tolerance, to predict completing substance abuse treatment (Daughters et al., 2005a). However, to date, no studies have utilized the MTPT in a sample of individuals completing detoxification prior to entering formal substance abuse treatment. In addition to testing the utility of the MTPT as a predictor of substance abuse treatment entry and outcomes, one possible mechanism of distress tolerance was investigated. Specifically, how distress tolerance may be, at least in part, a learned behavior was investigated by applying the theory of *Learned Industriousness* (LI) (Eisenberger, 1992). This theory posits that persistence is related to individual reinforcement histories and those rewarded for effortful persistence in the past will likely demonstrate higher persistence in the present. The relation of LI and MTPT performance was explored.

**Method:** One hundred and one participants (57% men; 88.1% White; average age of 35.53 years) admitted for medically supervised detoxification at a substance abuse treatment center completed this study. Each participant completed the MTPT and three self-report measures – The Positive and Negative Affect Schedule (PANAS), Center for Epidemiological Studies Depression Scale (CES-D), and The Task Approach (TA), a measure of learned industriousness. In addition, demographic information and substance abuse history and the three outcome variables (entering treatment; completing treatment; total days in treatment) were obtained for each participant from treatment center files.
The majority of the sample was seeking treatment for heroin dependence (70.3%); this was followed by alcohol (16.8), other opioids/synthetics (7.9%), and cocaine/crack (5.0%).

**Findings:** Logistic regression was used to test whether the MTPT could predict entering treatment and completing treatment, whereas linear regression was used to test whether the MTPT could predict the number of days of completed treatment. Results indicated that the MTPT was a significant predictor of entering 28-day treatment, $b = .008$, $p < .05$. However, the MTPT was not a significant predictor of completing 28-day treatment, $b = .003$, $p = .596$ nor the number of days of treatment completed, $b = .010$, $p = .675$.

Follow-up analyses indicated that MTPT performance was not related to treatment outcomes when accounting for negative affect; however negative affect did not directly predict treatment outcomes. Counter to predictions, LI was not related to either MTPT performance or any of the treatment outcomes.

**Implications:** The modest results may be due to several factors. First, the sample included primarily opioid abusers (80.2%), and there was a negative correlation between heroin dependence and MTPT performance ($r = - .252$, $p = .011$), indicating that heroin addicts persisted less on the MTPT. Additionally, the sample showed significantly less persistence than seen in prior research. The lower overall persistence of the current sample may have made it difficult for the MTPT to distinguish between those with higher and lower distress tolerance. Finally, the sample was all volunteer and 40% of those approached declined; it is possible the individuals with the least ability to tolerate distress self-selected out of the study, thereby attenuating the findings.
The present study adds to the existing literature by exploring how persistence on the MTPT predicts treatment outcomes for a primarily opioid dependent sample. The MTPT in isolation predicted treatment entry; this finding supports further study of the measure in opioid dependent samples to replicate and possibly extend the current results. The current findings were more modest than expected and did not show the anticipated relations with affect. It is essential that continued research be done on opioid dependent samples to determine if reliable predictors of treatment outcome for other classes of drug obtain to this population and under what circumstances. Furthermore, the current study focused on individuals completing detoxification and produced results that reflected significantly less task persistence than found in previous studies. Additional research should focus on those completing detoxification to identify easy to assess factors related to entering and completing treatment so that appropriate supports can be provided to improve outcome.
Press Release

A recent study found that the ability to persist when facing difficult tasks leads a person to be more willing to attempt substance abuse treatment. Lead researcher, Brent Anderson, explained that substance abuse treatment is hard and people often feel frustrated when learning how to live life substance free. However, having high persistence may make the challenge of entering treatment seem less daunting. Identifying those with less persistence, particularly during pre-treatment detoxification, may allow for additional services to be provided and improve treatment outcomes.