FINAL REPORT TO THE NATIONAL INSTITUTE OF JUSTICE

"Neuropsychological and Emotional Deficits Predict Correctional Treatment Response"

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EXECUTIVE SUMMARY

This project represents a 3-year prospective research effort to assess (1) the role of neuropsychological and emotional deficits in behavioral problems and misconduct among inmates; (2) the usefulness of neuropsychological and emotional regulatory measures in characterizing recalcitrant and unresponsive inmates; and (3) the ability of these measures to predict treatment response in prison. A finding that difficult to control inmates have a higher incidence of such deficits and fail to respond to conventional intervention approaches has direct treatment implications. Understanding the mechanisms that underlie differential responses to treatment will maximize the return on investment that correctional administrators direct toward intervention strategies by making it possible to triage inmate subgroups based on programming needs.

Inmates (N=224) volunteering to participate in the cognitive-behavioral therapy (CBT) program (Thinking, Deciding, Changing; Communications; Relationships) offered by the Maryland correctional system were recruited from three facilities using a pseudo-random selection procedure during intake into the program. Several characteristics were exclusionary, including illiteracy, low IQ (<70), over age 49, and active mental illness. Consenting inmates received an extensive baseline testing battery of several complementary dimensions of higher order neuropsychological functions as well as conditions that influence them: (1) three executive cognitive (ECF) and one emotional perception tasks; (2) collection of salivary cortisol during an acute stress task (public speaking); (3) a short general neuropsychological test; (4) three psychological questionnaires; (5) an historical inventory to assess prior drug use and child and family background (e.g., family dysfunction, child abuse, family history of psychopathology); (6) and a treatment readiness scale. Salivary cortisol samples were collected before and after administration of a stress (public speaking) as a measure of stress reactivity. The test session took about 2 to 2.5 hours to complete. The Director of Health Services in the Department of Public Safety and Correctional Services provided approval to survey their Management Information System (OBSCIS) during this study to characterize inmates in terms of their history of crimes and institutional infractions and segregations. These instruments were assessed for their ability to characterize inmates into clinically relevant subtypes (e.g., history of violence, drug abuse, impulsive or nonimpulsive aggression, psychopathy, etc.).

Several additional tests were administered repeatedly throughout treatment. After each treatment group, inmates completed the Novaco Reaction to Provocation Questionnaire, which is sensitive to change in aggressive orientations in response to treatment, and social workers completed an evaluation of each inmate participating in the research. These evaluations produced a treatment responsivity score and a gain score. Two tests were also administered at baseline and after the 9 month period of treatment, whether or not inmates complied with treatment; noncompliance was considered a poor treatment response, thus, those who dropped out of treatment remained in the study. They included three vignettes using computerized virtual reality technology to measure pre- and post-intervention decision-making ability. These vignettes illustrate realistic scenarios involving risky behavioral choices directly related to CBT principles. They were presented during the initial testing session as well as after the last CBT session to measure changes in risky behaviors that may have been elicited by the intervention. Also, one neuropsychological test, the Cambridge Decision Making Task, was readministered to assess change in executive decision making. Following baseline assessments, inmates from the three prisons received similar CBT programming. A record review was conducted after program completion to ascertain incidents of institutional misconduct as well as treatment performance outcomes.

In summary, results strongly suggest that neuropsychological deficits, over and above any background measure, predicted treatment responsivity, gain, and completion, as well as institutional behavior. It is clear from this study that inmates who participate longer in treatment benefited in terms of behavioral change. However, neuropsychological deficits, particularly pertaining to disinhibition of behavioral responses and ability to recognize emotional cues, appears to prevent inmates from responding favorably to treatment and altering behavior. The only background measure that consistently predicted treatment outcomes was a history of childhood physical abuse. Surprisingly, psychopathy did not play the significant role that was hypothesized. A history of drug use also was not significantly related to treatment outcomes, however, there was very little variability in this sample given that most reported some drug use. Thus, relative deficits in ECF and emotional regulation is strongly implicated in treatment outcomes. Because such deficits are malleable, these inmates may respond favorably to *targeted* treatment approaches. Incorporation of this knowledge into criminal justice policies and practices could alter their course substantially to dramatically improve the ability to assess, detect, and treat offenders who are otherwise considered intractable.

Abstract

The three year study was designed to elucidate underlying neuropsychological and emotional regulatory mechanisms in variable responses to a standard correctional treatment approach among prison inmates. Cognitive-behaviorally based treatment (CBT) programs are generally considered effective in reducing behavioral problems in this population, but there is considerable variation in treatment response and outcome. A significant number of inmates do not respond favorably over time, exhibiting a lack of treatment engagement, a high level of attrition, poor behavioral and emotional self control, repeated institutional infractions, and eventual recidivism. Thus, it is critical to identify underlying bases for individual differences in treatment responsivity for purposes of developing a useful assessment battery that can be applied toward more effective tailoring of intervention approaches to specific needs of different inmate subgroups. While resources are too scarce to match treatments to individuals, at a minimum, research is needed to identify which inmates are likely not to respond to conventional treatments and which require that the approach take into account existing deficits that prevent a favorable response.

The present study examined the interrelationship between neuropsychological and emotional regulatory mechanisms and indicators of behavioral treatment response and outcome. Given evidence that integrity of executive cognitive function (ECF) and its modulation of emotional regulation may represent dimensions of neural processes related to risk for conduct problems, we hypothesized that particular dimensions of these functions may also play a key role in differential responses to treatment programming and subsequent posttreatment outcome. The premise of this study was that poor responsivity would be predicted by relative deficits in abilities to effectively process and apply curriculum materials from standard CBT correctional interventions, as reflected in aberrant processing of neurocognitive and affective stimuli and attenuated stress responses that exist at baseline and persist throughout the treatment period. In effect, deficits in these regulatory processes may compromise (i) cognitive processing of intervention curriculum materials; (ii) the ability to shift behavioral strategies based on new information; and/or (iii) inhibition of affective responses that promote maladaptive behaviors.

The specific aims of this study were:

(1) to determine the extent to which neuropsychological and emotional regulatory functions, including cortisol responses to a stress task, predict variability in (a) program responsivity (e.g., treatment engagement, motivation, attitude and retention) and (b) posttreatment outcomes (e.g., treatment completion, institutional infractions, decision making ability, risky behaviors, and self-reported anger) among inmates during and following participation in a widely used and well-established treatment intervention with a cognitive-behavioral base.

(2) to assess the extent to which these functions partially or fully explain the relationship between treatment exposure and posttreatment outcomes. Inmates were tested after the treatment program concluded whether they completed or not; those who dropped out for reasons other than transfer, work duties, and legitimate conflicts were considered poor responders. Treatment exposure was expected to alter neuropsychological and emotional performance, and psychophysiological responses to stress commensurate with any treatment-associated behavioral improvements that predict ultimate outcomes. Analyses included adjustments for age. Several relevant factors were also taken into consideration, including severity of drug use history, age, IQ, and length of incarceration. Theoretically, the extent to which behavioral change occurs may be accelerated by treatment in those who respond favorably.

(3) to examine a history of psychosocial stress and psychopathy, which have both been highly related to misconduct propensity and ECF and emotional regulation, as well as gender, will be examined as potential moderators of outcome. This information is considered critical for the design of appropriately targeted interventions that accelerate functional improvements and, in turn, reduce risk for institutional infractions and eventual recidivism at various stages of treatment.

Study Design and Methods:

This study tested the hypotheses that performance deficits in ECF tasks and emotional responses will characterize aggressive and disruptive inmates and predict treatment response. All subjects were examined using noninvasive behavioral, psychological, ECF, and hormone tests. Adjustments were made for age in all analyses. Specific hypotheses included the following:

H1. ECF performance (neuropsychological task performance), emotional perception (emotional task performance), and emotional regulation (cortisol response to a stimulating task) will be positively related.

H2. These independent variables will predict treatment response among inmates participating in a cognitive-behavioral therapy program. Outcome measures will include changes in decision-making abilities, rates of institutional misconduct, noncompletion, and other specific performance indicators of treatment response.

H3. These independent variables will be associated with psychopathy, a history of aggressive crimes against persons and an aggressive personality style.

H3a. ECF, emotional perception, and emotional regulation will discriminate between subtypes of aggressive inmates (drug abusers vs nonusers, psychopathic vs nonpsychopathic). Although a few instruments significantly predict violence (e.g., PCL-R), these measures do not provide clinically useful information about underlying mechanisms.

H4. The interaction between measures of psychopathy and substance abuse with ECF measures and rate of change in hormone levels will explain a significant amount of the variance in treatment responsiveness. Specifically, inmates with high scores on the LPS and ECF/emotional deficits and those with a history of substance abuse and ECF/emotional deficits will respond less favorably to treatment.

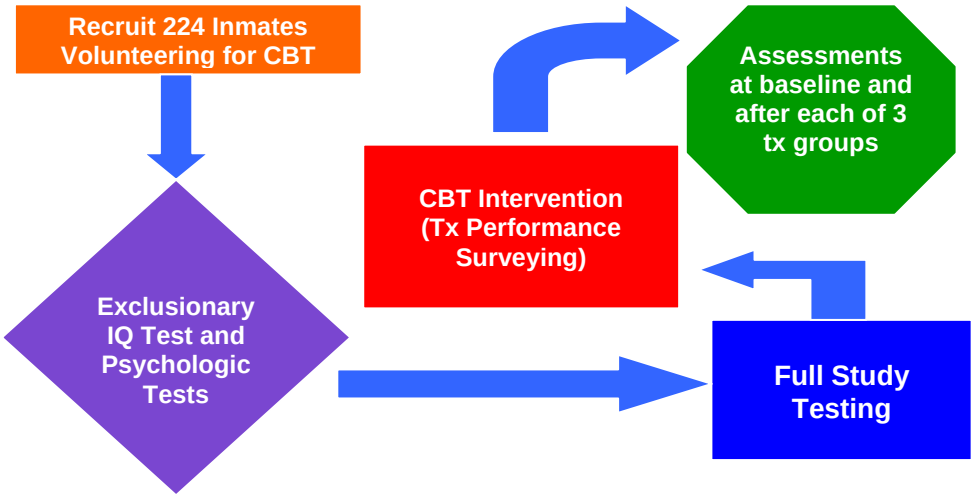
Subjects

Three medium/maximum facilities in the State of Maryland were selected by the Department of Corrections for participation in this study: Roxbury Correctional Institution, Western Correctional Institution, and the Maryland Correctional Training Center. Selection of these facilities was based on programmatic similarities to ensure continuity and uniformity of treatment, duration, type and modality of the program, treatment provider staff, and other environmental factors. A total of 224 male inmates were recruited using a pseudo-random procedure over a 2.5 year period. Inmates who volunteered for participation in the cognitive-behavioral therapy (CBT) program called “Thinking for a Change,” as part of the routine “treatment-as-usual” procedure in the prisons, constituted the subject pool. Those who met eligibility criteria for study participation were recruited from identification numbers provided by the facility to include only inmates who were between 21 and 49 years old with a minimum of 18 months left on their sentence to avoid the stress of pre-release preparations and potential for transfers, and reflected the ethnic

diversity of the offender population in the state study. Inmates who volunteered were first consented to complete an IQ test (Multidimensional Aptitude Battery); those with an IQ below 70 were excluded. Older subjects were excluded due to cognitive decline that occurs naturally over time and the effects of chronic drug abuse on ECF. Those with mental retardation, dementia, amnesia, or delirium and those who are illiterate were excluded because these conditions interfere with performance and because of inability to understand the implications of consent. The sample was ethnically diverse and representative of the offender population in the state; however, race was not expected to affect results of this study. Those eligible were scheduled for testing, signed the full consent form and took a consent test to ensure comprehension.

Design

Consenting inmates received baseline testing of several complementary dimensions of ECF and conditions that influence its development: (a) 3 ECF and 1 emotional perception tasks; (b) saliva cortisol responses to a stressful task; (c) a general neuropsychological test; (d) several psychological and behavioral surveys; and (e) an historical inventory to assess prior drug use and child and family background. In addition, interactive virtual reality vignettes were used to assess actual pre- and post-treatment change in decision making. Official state institutional records were also perused to determine inmates' history of violent crimes and institutional infractions (e.g., dates of prior arrests and convictions, offense types, conviction status, sentence, and present incarceration length). Cutoff scores were derived from each instrument to categorize inmates into clinically relevant subtypes (e.g., drug abuse, impulsivity, psychopathy) for assessment of both group differences (using mean cut-offs) and correlations. The variable set that best discriminated between inmates who performed well and poorly in treatment were then assembled into an assessment battery with high predictive value. It is important to note that inmates who dropped out of treatment were retained in the study; those who dropped for "negative reasons" were considered poor treatment responders and in all possible cases were tested according to the same schedule as those who remained in treatment. Also, only those who remained in treatment for at least half of the first treatment group were included in analyses



Behavioral, Neuropsychological, and Psychological Test Battery

Questionnaires were administered after the ECF and emotional tasks to avoid the effects of

fatigue on cognitive functioning. These tests characterized subjects to (a) adjust for their independent and interactive effects on aggression and other forms of misconduct, (b) correlate them with performance on cognitive tasks to determine whether they are related to misconduct, and (c) relate them to treatment performance. Given evidence that these characteristics can complicate treatment efforts (e.g., psychopathy and substance abuse), interactive effects were analyzed.

General Neuropsychological Function.

The **Multidimensional Aptitude Battery** (MAB; Sigma Assessment Systems, 1999) was administered to identify general intellectual deficits that may have resulted from head injury or other causes and to isolate the contribution of ECF to aggression, given that higher cognitive abilities rely on the integrity of general intelligence. When these more basic functions are impaired, ECF can be expected to suffer as well.

Questionnaires

A revised version of the **Addiction Severity Index** (ASI) (McLellan et al., 1992) was used to assess nature and extent of prior drug use, background factors such as socioeconomic status (Hollingshead rating), religious preference, race/ethnicity, family history of drug use, alcoholism, and mental illness, head injuries, child abuse, medical and psychological status, and other demographic factors.

The **Psychopathy Checklist-Screening Version** (LPS) (Hare, 1991; Hart et al., 1995; Levenson et al., 1995) is a self-report version of the PCL-R showing high correlation with the original test (Hart et al., 1995). This test was used to characterize inmates on the basis of psychopathic personality traits so that those with high scores could be separated from the rest of the population to determine whether their treatment outcomes were related to personality traits rather than solely neuropsychological factors.

The **Reactive-Proactive Questionnaire** (RPQ) (Raine et al., in press) provided an assessment of predatory (proactive) and impulsive (reactive) aggressive inmates and determine the extent to which these distinctions interact with ECF to contribute to treatment outcomes.

A **Success Inventory** was developed for two purposes. First, this instrument allows us to determine whether their treatment progress is related to the inmates' feelings of failure due to parental admonishments or insults, or earlier experiences in school that may contribute to frustration with classroom-like settings. Second, this instrument asks inmates about their reasons for volunteering for treatment, how they feel about being in treatment, and whether or not they have tried treatment in the past. In some cases, inmates have reasons other than seeking treatment for volunteering or they have had negative experiences in the past. Thus, a full evaluation of factors that underlie treatment response includes this type of assessment. References to this inventory distinguish between expectations of failure and attitudes toward treatment.

The **Early Trauma Questionnaire** (Bremner et al., 2000) assesses traumatic events, including accidents and serious family illnesses, parental loss, murder of family member or friend, and violent crime victimization. Inmates rated the frequency with which events occurred to them before the age of 18 on a scale from 0 (never happened) to 2 (happened 2 to 10 times). This instrument was included to assess lifetime adversity which is known to impair development of the prefrontal cortex and, in turn, neuropsychological function.

ECF Tasks

Cognitive tasks are computerized and non-intrusive – they do not produce physical or emotional discomfort and most participants enjoy completing them. Inmates were tested at a time that did not interfere with meals, lock-downs, or counts. Each task takes 10-20 minutes.

The **Cambridge Decision Making Task** (CDMT: Rogers et al., 1999a, 1999b) was developed to dissect the cognitive components involved in decision making and measures willingness to take risks and relative sensitivity to rewards versus penalties. It has been found to have sensitivity and specificity in high-risk populations (Fishbein et al., 2005) and reliably activates a portion of the PFC involved in social skills, impulse control, and sensitivity to rewards. Inmates with ECF impairment take more risks in pursuit of a large reward and tolerate a higher probability of a large loss; this tendency often describes inmates who engage in impulsive offenses. Performance scores generated by this task include percentage of choice of the most likely outcome and mean deliberation times as a function of the balance of rewards.

The **Logan Stop-Change Task** measures impulsivity and response shifting (Logan & Burkell, 1986) and has been shown to activate the right hemispheric anterior cingulate cortex, supplementary motor area, and inferior prefrontal and parietal cortices, which modulate error monitoring, interference control, and task management (Rubia et al., 2001). This task requires deep concentration, impulse control, timing, and the ability to shift responses in light of newly presented information.

The **Stroop Interference Task** uses previously learned information to assess the 3 attributes of executive frontal lobe function: complexity, a “nonroutine” nature, and the novel use of old information. Patients with frontal lobe damage are typically influenced by stereotypical thinking, which would interfere with the ability to produce the atypical responses required on the Stroop (Luria, 1980; Mesulam, 1986), and often experience difficulty with mental flexibility (Stuss & Benson, 1986). Studies suggest that the anterior cingulate (believed to be involved in aggression) is involved in performance on the Stroop (Pardo et al., 1990; Bench et al., 1993).

Emotional Perception Task

Research suggests that emotion-processing deficits lead to a distorted perception of social cues that has been associated with aggressive behavior (Crick & Dodge, 1996; Dodge, 1980). PFC impairment reduces inhibition of emotional behaviors that may be generated from these distorted perceptions. Thus, measurement of emotion perception is critical. An **Emotional Expression Task** using a facial recognition technique was used due to its high level of validity and reliability and its consistent activation of the amygdala, a limbic structure involved in emotion and aggression (Gorno-Tempini et al., 2001; Stevens et al., 2001).

Emotional Regulation Task

The significant effect of public speaking on emotional and physiological stress responses has been well demonstrated (see Rohrmann et al., 1999). Inmates were instructed to make a 10-minute persuasive speech providing justification to a parole board for an early release. They were told that the research assistant would judge the speech according to how compelling and effective it was, and in terms of its formal aspects and content. Cortisol levels were measured noninvasively in saliva–the most valid assessment of cortisol responsivity (Yao et al., 1998). Saliva (2ml) was collected before, during, and after the speech. Cortisol tends to rise about 20

minutes after a stressor and then falls precipitously, thus we were able to evaluate the curve to determine whether inmates who performed better in treatment showed a more effective rise and fall in cortisol than inmates who did poorly. This test assessed the inmate's stress response to emotional stimuli, which is essential when measuring ability to process and regulate emotions.

In order to evaluate the inmates' present emotional state, which may have an effect on their stress response, the Symptom Checklist 90 (SCL-90) was administered immediately before this task (Derogatis et al., 1973). This instrument evaluates a broad range of psychological problems and current symptoms of psychopathology using 6 symptom scales plus a global index of severity. The instrument is useful in measuring patient progress or treatment outcomes, including evaluation of patients at intake as a method for symptom screening; measuring patient progress during and after treatment to monitor change; outcome measurement for treatment programs through aggregated patient information; and clinical trials to help measure the changes in symptoms such as depression and anxiety.

Table 1. Baseline Test Battery and Measures

Variables (Predictors & Mediators)	**Measurement Instruments**
General neuropsychological function	Multidimensional Aptitude Battery
Demographics, prior drug use, etc.	Background Inventory (adopted from the ASI)
Psychopathy	Psychopathy Checklist – Screening Version
Aggression Type	The Reactive-Proactive Questionnaire
Past Failures/Successes	Success Inventory
Lifetime stress	Early Trauma Inventory
Executive cognitive performance	Cambridge Decision Making Task Logan Stop-Signal Task Stroop Color-Word Interference Task
Emotional perception	Facial Recognition Task
Emotional regulation	Speech Task with Cortisol Sampling SCL-90

Treatment Program Participation

After baseline assessments, inmates began their participation in the facilities' CBT-type program. CBT is the most widespread and rapidly growing treatment program in U.S. correctional institutions to reduce violence, drug abuse, sexual offending, and other behavioral disorders common in inmates (Holbrook, 1997; Nicholaichuk et al., 2000). CBT is designed to help inmates develop impulse control, manage anger, and learn new behavioral responses to real-life situations. The underlying assumption is that learning processes play an important role in the development and continuation of antisocial behavior and can be used to help individuals enhance their ability to exert self-control. CBT is designed to help patients *recognize* situations in which they are likely to become agitated or aggressive, *avoid* these situations when appropriate, and *cope* more effectively with a range of problems and behaviors associated with aggression.

In the three facilities where this study was conducted, the Maryland correctional system offers a series of 3 groups that meet for 90 minutes twice a week, totaling 50 sessions. The first group is called "entry point" and involves curricula on "Thinking, Deciding, Changing." Entry point blends a decision making and cognitive restructuring modality (a self-reflective process to

search for triggers of misconduct) into a cognitive-behavioral modality (an external, skill-building process) for self change. The second group is called "Communication" and is designed to orient members to the importance of effective communication in one's everyday life and encourage the experience of group cohesion and ownership by enabling members to create their own goals and rules through the use of dyad interviews. The third group is called "Relationships" and is designed for clients who have successfully completed the first two groups. The focus is on the examination of the way elements in the environment are dealt with or related to, including persons, places and things. These latter two groups are based on cognitive-behavioral principles. The sole requirements for retention in the programs are that inmates do nothing to undermine the group process and remain infraction free. Those who commit infractions while in the program are considered unfavorable responders.

Processing of curriculum materials from CBT relies on the ability of participants to (a) be cognizant of and responsive to potential negative consequences of their behavior, (b) inhibit inappropriate behavioral responses, and (c) understand and act on the benefits of deliberate and cautious decision making. Hypothetically, participants with deficiencies in neuropsychological and emotional regulatory skills are not as likely to benefit from programs that do not first target these deficits. Although correctional treatment programs are considered effective for particular inmates, we expected that the subgroup that does not respond favorably to treatment is unable to process the materials due to skill deficiencies. It was further expected that "nonresponders" would constitute that subgroup of inmates who repeatedly engaged in misconduct (as measured in institutional infractions), posing the greatest danger within and outside the prison environment.

Follow Up Testing to Evaluate Treatment Outcomes

Immediately after inmates completed the CBT program, treatment performance was evaluated by staff and the inmate. Institutional records were reviewed to assess level of responsiveness to the program, as measured by performance indicators (gain and responsivity scales), program completion, and the commission of institutional infractions. Change in risky behaviors was assessed by administering interactive virtual reality vignettes (see below) during baseline and following treatment.

Treatment Performance Indicators

There is much concern regarding the use of self-report to assess correctional treatment efficacy, particularly among violent offenders (Novaco, 1994; Bellemare & McKay, 1992; Hughes, 1993). Thus, this study used primarily behavioral performance measures, taken at baseline and post-intervention, which do not rely solely on self-reports. Evaluations from Social Workers were also collected. Thus, measures of differential treatment efficacy used in this study demonstrate the extent to which participants were able to transfer knowledge gained in the program to change in behavior.

Treatment readiness was evaluated using a self report measure, the Treatment Readiness Scale developed by Ralph Serin (Director of Programs Research, Correctional Service of Canada). Subscales include: problem identification, macro treatment benefits, micro treatment benefits, treatment distress, treatment goals, treatment behaviors, behavioral congruency, and treatment support. This instrument was administered at baseline, prior to treatment participation.

Treatment performance was evaluated by the Social Workers using the Treatment

Responsivity and Treatment Gain scales developed by Ralph Serin. These scales were designed to assess CBT performance (Kennedy & Serin, 1997, 1999; Serin, 1998; Serin, in press) by a variety of staff and across a range of programs. Each domain is represented by a description, questions to be incorporated into therapists' semistructured interview formats, and a 4-point rating scale with behavioral examples for each level. This evaluation was conducted after each of the 3 CBT groups.

The Novaco **Reaction to Provocation** (RP)inventory was given at baseline and again after treatment completion. There are two parts, the first assessing cognitive, arousal and behavioral domains and the second assessing impulsive reaction, verbal aggression, physical confrontation and indirect expression. This instrument is sensitive to behavioral change particularly in response to an intervention.

The **CDMT** was readministered after completion of the treatment program to determine whether executive cognitive decision making behaviors changed and in which subgroups.

Decision-making vignettes, using RTI-developed virtual reality assessment architecture, was employed to measure pre- and post-intervention decision-making and problem-solving ability. Vignettes consist of short, focused interactions to examine dialog, behaviors, and decisions made in a real-world context. Each vignette invokes a specific cognitive function consistent with relevant ECF dimensions measured in the task battery: risky decision making, impulsivity, and sensitivity to penalties. They require processing of information, judgment, and selection of appropriate and effective decisions. One vignette allows for choices that involve risks where a harmful consequence is possible and includes 2 virtual characters: a correctional officer and a peer simulate the common situation whereby peers are influential in reactions to officers. A second vignette allows for choices *after* a penalty has been dispensed to determine whether inmates learned to shift strategies. A third vignette measures whether inmates choose a decision *before* adequate information has been provided, to reflect impulsive decision making. Such instructional designs differentiate between “knowledge” and “skills” that may be acquired during exposure to the experimental stimulus (Hubal & Helms, 1998); that is, the vignettes will assess inmates’ situation-specific behavior rather than merely test their understanding of risk, impulsiveness, or sensitivity to penalties. Decision-making responses in these scenarios were related to baseline ECF and emotional measures and used to gauge changes in risky and impulsive decision making induced by the CBT program.

Measures of **institutional misconduct** were gleaned from inmate files. Although many types of misconduct were considered (e.g., infractions repeatedly committed, noncompliance, defiance of authority), the following offenses will be classified as “serious” to assess degree of aggressive and antisocial behavior: homicide, attempted homicide, aggravated assault, possession of a dangerous weapon, fighting, threatening bodily harm, simple assault, setting a fire, taking hostages, drug use or possession, or 3 or more segregation episodes due to aggressive behavior. Inmates generally receive segregation time for these offenses and thus were placed in the “noncompletion” category. Also, change in infraction and segregation rate from prior to onset of treatment and during treatment were measured as continuous outcomes.

Noncompletion of the program due to disinterest, commission of an infraction, disruption to the group, or a related reason was considered a treatment failure. Noncompletion due to obtaining a job, mandatory transfer, or other reason unrelated to noncompliance was excluded in analyses.

Table 2. Post-Test Battery and Measures

Outcome Variables (pre and post)	Measurement Instruments
Change in behavioral control	Novaco: Reactions to Provocation
Events that could alter tx response	Events Checklist
Risky Decision Making	Virtual Reality Vignettes
Executive cognitive performance	Cambridge Decision Making Task
Institutional Behaviors	OBSCIS Data on infractions
Treatment Response/Progress	Responsivity and Gain Scales from Social Workers

Statistical Techniques

Group differences were assessed using ANCOVAs whereby treatment readiness, gain, and responsivity were split by their means. Treatment completion was coded as 0 or 1, indicating that the inmate completed at least the first group or discontinued due to noncompliance, lack of engagement, disruption to group, segregation or other negative reason. Those who dropped out due to neutral reasons (e.g., work assignment, transfer, etc.) were excluded from analyses. Psychopathy groups were created by splitting inmates into high (>29) and low (<30) scorers on the LPS. A linear regression analysis was used to develop a best prediction model with the treatment responsivity scale used as a continuous dependent variable and primary neuropsychological constructs as predictors. For the determination of whether inmates who remained in treatment longer incurred change over time in the CDMT and RP measures, repeated measures ANCOVAs were used. Multivariate GLMs were used to assess interaction effects between ECF measures and psychopathy and prior drug use separately. In all cases, age was included as a covariate. Importantly, there were no IQ differences (verbal, spatial or full) for any of the treatment variables; thus, adjustments were not made for IQ in the analyses. Also, the correlation between SCL-90 scores and cortisol levels were assessed and none were found to be significant.

Results

In table 3, a description of the population including inmates from all three prison facilities is provided. In addition, 16.3% (n=41) were Caucasian, 68.1% (n=171) were African American, and 5.2% (n=13) fell into other ethnic/racial categories. The following percentages reflect a history of psychopathology among immediate family members: alcoholism: 46.4%; drug abuse: 52.2%; and mental illness: 22.8%. And a total of 28.3% (71) reported severe head injury. A quick analysis was conducted to determine whether history of head injury discriminated between good and poor treatment responders; those with head injury had less treatment gain ($p<0.05$) than those without head injury. The only ECF dimension related to head injury was inhibition/response shifting and their contributions to treatment gain appeared to be independent; interaction effects between head injury and each ECF domain on treatment outcomes (ANCOVAs) were insignificant. On the other hand, those with head injuries had more psychological problems in the last 30 days, a greater history of physical, emotional, and sexual abuse, and higher levels of proactive and reaction aggression.

Table 3. Population Descriptives

	N	Minimum	Maximum	Mean	Std. Deviation
age of inmate	224	21	49	31.08	5.760
verbal iq	224	70	117	88.04	11.489
performance iq	224	70	136	90.46	15.111
full scale iq	224	70	122	88.50	12.365

months in prison	221	1	251	38.67	40.525
years of education	224	4	21	11.39	1.690
weight	220	135	360	202.37	36.936
height	220	60	83	67.26	3.080

Prior to examination of primary hypotheses, relationships among background and treatment outcome variables were assessed. Background variables included IQ, age, years of education, total months of imprisonment, last voluntary abstinence from illicit drugs and alcohol, family history of alcoholism, drug abuse or mental illness, psychological problems in past 30 days, psychopathy (primary and secondary), aggression (reactive and proactive), stressful events that occurred during treatment, perception of treatment failure, and attitudes about treatment. Importantly, very few significant relationships emerged. Inmates reporting greater treatment readiness had fewer total months in prison. Those with greater treatment gain were not distinguishable in terms of background characteristics. Those with greater treatment responsivity and who completed at least the first group of the treatment program reported fewer psychological problems in the last 30 days. And the only discriminant for those who committed any infraction or received segregation time had higher primary psychopathy scores. Overall, most background characteristics were not significantly different between high and low performers.

Hypothesis 1: Predictor variables will be significantly related.

Only central variables for each neuropsychological task were used in order to reduce the number of correlations. All of the predictor variables were not significantly related to one another, suggesting a smaller level of co-occurrence among relative deficits than expected. On the Stop-Change Task, the number correct responses on the distractor portion of the task were significantly and positively related to the Stroop Interference score (higher scores indicate lower interference; p=.01), negatively related to the median reaction time for number correct on the color-word portion of the Stroop (p=.06), and positively related to the percent correct for the all facial expressions on the FEEST (p=.05). For the CDMT, the percentage of safe choices on the entire task was positively related to the percent correct for all facial expressions on the FEEST (p=.03) and for reaction time on this task there was a positive relationship with the average baseline cortisol level (.03) and a negative relationship with the Stroop Interference score (p.01). Interestingly, variables generated by the CDMT and the SCT tasks were not significantly related, suggesting that, in this population, impulsivity and risky decision making are separable constructs. Also noteworthy, cortisol levels were not related to most tasks with the exception of RT on the CDMT and baseline cortisol, suggesting that higher baseline cortisol is related to lengthier reaction times during decision making.

Table 3. Correlations Between Central Task Measures (significance with DFs between 88-184)

Central Task Measure	SCT: % corr all trials: Both Tone Blocks	SCT: RT for Both Tone Blocks	Dice % safe choices for entire task	Dice RT all trials	percent correct for all faces	stroop interfere-ence	median RT for # correct on color-word	average baseline cortisol	average active cortisol	cortisol change score: cort2-cort1
SCT: RT for Both Tone Blocks	1.00	-.63 (.000)	.02 (.81)	-.01 (.85)	-.06 (.47)	.08 (.375)	-.14 (.10)	.10 (.34)	.08 (.42)	.01 (.89)
SCT: % corr all trials: Both Tone Blocks	-.63 (.000)	1.00	.06 (.47)	.03 (.63)	.15 (.05)	.22 (.01)	-.16 (.06)	.01 (.88)	.11 (.24)	.09 (.34)
Dice % safe choices for entire task	.02 (.81)	.06 (.47)	1.00	-.04 (.63)	.16 (.026)	.10 (.24)	.10 (.22)	.10 (.29)	.07 (.45)	-.08 (.38)
Dice RT all trials	-.01 (.85)	.03 (.65)	-.04 (.63)	1.00	-.01 (.92)	-.20 (.01)	.02 (.78)	.20 (.03)	.11 (.25)	-.11 (.24)
percent correct for all faces	-.06 (.47)	.15 (.05)	.16 (.03)	-.01 (.92)	1.00	.09 (.29)	-.12 (.16)	-.11 (.24)	-.06 (.55)	.05 (.63)
stroop interference	.08 (.38)	.22 (.01)	.10 (.24)	-.20 (.01)	.09 (.29)	1.00	-.54 (.000)	-.07 (.46)	.07 (.47)	.16 (.13)
median RT for # correct on color-word	-.14 (.10)	-.16 (.06)	.10 (.22)	.02 (.78)	-.12 (.16)	-.54 (.000)	1.00	-.02 (.81)	-.01 (.91)	.03 (.77)
average baseline cortisol	.09 (.34)	.01 (.88)	.10 (.29)	.20 (.03)	-.11 (.24)	-.07 (.46)	-.02 (.81)	1.00	.82 (.000)	-.08 (.41)
average active cortisol	.08 (.42)	.11 (.24)	.07 (.45)	.11 (.25)	-.06 (.55)	.07 (.47)	-.01 (.91)	.82 (.000)	1.00	.51 (.000)
cortisol change score: cort2-cort1	.01 (.88)	.09 (.34)	-.08 (.38)	-.11 (.24)	.05 (.63)	.16 (.13)	.03 (.77)	-.08 (.41)	.51 (.000)	1.00

Hypothesis 2a: Neuropsychological function will be predictive of treatment outcomes.

ANCOVAs were conducted to determine whether neuropsychological functions discriminated between high and low scorers on treatment readiness, gain, and responsivity scales, as well as retention in the first group of treatment, and change in infractions and segregations before and during treatment.

Treatment Readiness

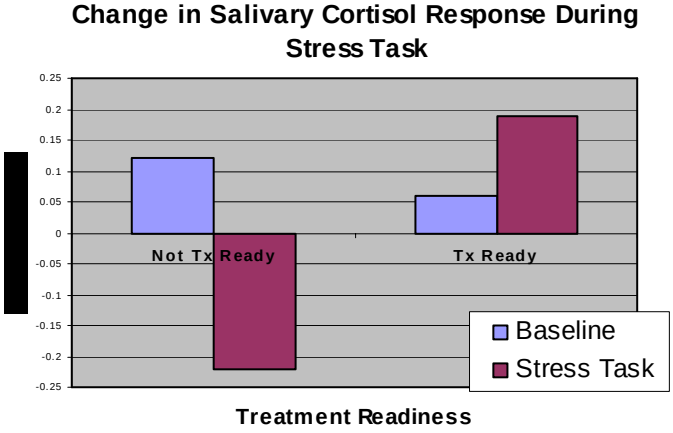
As seen in table 4, misattributions of anger, all facial expressions combined, and marginally of disgust, distinguished between high and low treatment readiness scores. Two indices of risky decision making on the CDMT were related to treatment readiness; i.e., choosing the largest bet [90] when the odds are 33% against winning [i.e., Y2], and choosing those options with the smaller likelihood of winning overall with a large bet, which holds the greater chances of losing a larger amount of points. It is noteworthy that no background measures (e.g., months in prison, education, drug use history, IQ, etc.) significantly discriminated between groups.

Table 4. Differences between Low and High Treatment Readiness (age adjusted)

Neuropsychological Measure	Low readiness mean (sd)	High readiness mean (sd)	F Level	Sig
FEEST: Disgust (correct)	5.083(.311)	5.97 (.24)	5.11	<.03
FEEST: Anger (correct)	6.439(.25)	6.981(.19)	3.0	<.10
FEEST: % correct	68% (9)	72% (12)	5.69	<.02
CDMT: Bet 90, 1/3 odds	1.67 (1.5)	1.2 (1.2)	3.95	<.05
CDMT: Bet 90, all low odds	6.21 (2.57)	5.5 (2.3)	3.3	=.07
SCT: % correct Delay 2	.31 (.04)	.21 (.03)	3.7	<.06
SCT: % correct Delay 3	.43 (.05)	.30 (.04)	3.58	=.06
SCT: % correct Delay 4	.53 (.05)	.36 (.04)	6.23	=.01

Also, change in cortisol response from baseline to the stress task was significantly different between high and low treatment readiness scores, controlling for both age and body mass index (BMI; important to analyses of cortisol data). Figure 2 below shows that those with higher self-reported levels of treatment readiness had a greater cortisol response to an acute stressor than those with low treatment readiness, who showed a relative decrease in cortisol from baseline ($F = 7.06$, $p = .009$)

Figure 2



Treatment Gain

For the treatment gain scale, which reflects evaluations by social workers, the results indicate that several neuropsychological constructs predict outcome. Table 5 shows that central measures from the Stop-Change Task and CDMT significantly discriminate between those evaluated as achieving high versus low treatment gain. In all cases, the high group performed better and with longer reaction times. For the FEEST, however, the high group misattributed the emotional expression of surprise more often than the low group. On the Stroop, the measure of error monitoring and cognitive flexibility – the interference score – did not discriminate between groups but reaction times were significantly longer for the low gain group suggesting greater cognitive inefficiency.

Table 5: Differences between Low and High Treatment Gain (age adjusted)

Predictors	Low Gain mean (sd)	High Gain mean (sd)	F Level	Sig
# days in last 30 psyc prob's	4.27 (.78)	2.26 (.69)	3.66	< .06
History of physical abuse	14.0(.65)	12.3 (.57)	3.83	=.05
SCT: % correct Delay 1	.05 (.02)	.13 (.02)	6.72	=.01
SCT: % correct Delay 2	.17 (.04)	.32 (.03)	7.95	=.005
SCT: % correct Delay 3	.22 (.05)	.45 (.04)	12.88	<.0001
SCT: % correct Delay 4	.30 (.06)	.52 (.04)	10.45	=.001
SCT: Reaction Time	794 (8.1)	823 (5.5)	8.92	=.003
CDMT: Risky choices – Highest bet, 1/6 oddds	1.80 (.23)	1.23 (.16)	4.27	< .05
CDMT: Risky choices – Highest bet, 1/3 odds	2.50 (.22)	2.00 (.15)	3.82	= .05
FEEST: Surprise (correct)	8.7 (1.9)	8.3 (1.4)	3.64	< .06
Stroop: RT for word trials	884 (41)	785 (27)	4.08	<.05
Stroop: RT for incongruent trials	1267 (94)	990 (61)	6.11	=.015

Treatment Responsivity

Treatment responsivity is also evaluated by social workers for each inmate who completed the groups. As seen in Table 6, those with lower scores on the treatment responsivity scale differed significantly from the high group, having a greater history of physical abuse and number of days in the last 30 that they experienced psychological problems. No other group differences were found in background measures or cortisol responses. With respect to neuropsychological function, the poor treatment responsivity group performed significantly worse on the impulsivity and risky decision making tasks and had longer reaction times during two sets of the Stroop task.

Table 6. Differences between High and Low Treatment Responsivity (age adjusted)

Predictors	Low Response mean (sd)	High Response mean (sd)	F Level	Sig
History of physical abuse	14.24(.66)	12.17 (.57)	5.71	<.02
# days in last 30 psyc prob's	4.72 (.79)	1.98 (.68)	6.88	=.009
SCT: % correct Delay 1	.05 (.03)	.12 (.02)	6.96	=.01
SCT: % correct Delay 2	.17 (.04)	.31 (.03)	7.63	=.006
SCT: % correct Delay 3	.22 (.05)	.45 (.04)	13.24	<.0001
SCT: % correct Delay 4	.29 (.06)	.52 (.04)	10.99	=.001
SCT: Reaction Time	791 (8.3)	824 (5.4)	10.96	=.001

CDMT: RT all trials	2355 (261)	2895 (174)	2.97	<.10
CDMT: highest risk (Y1b90)	1.74 (.24)	1.26 (.16)	2.87	<.10
CDMT: next highest risk (Y2b90)	2.50 (.23)	2.02 (.15)	3.19	<.10
Stroop: RT - neutral	891 (42)	785 (26)	4.59	<.05
Stroop: RT - incongruent	1284 (96)	988 (60)	6.77	=.01

Treatment Completion

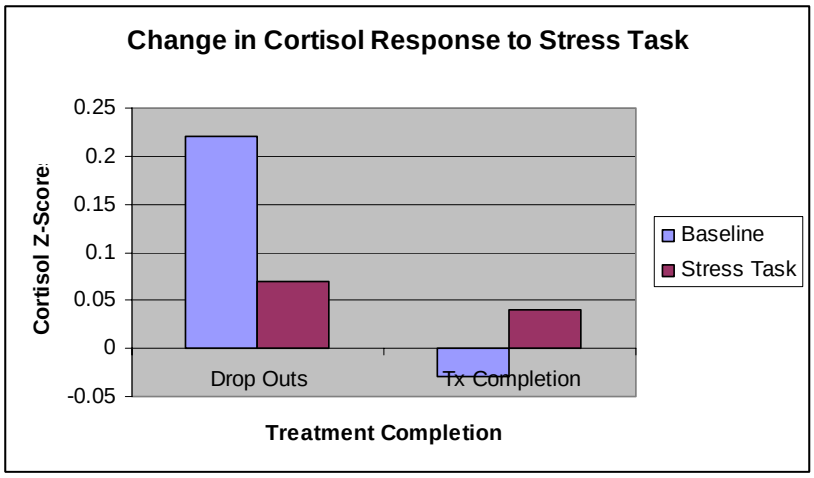
For inmates who completed at least one treatment group, and excluding those who began treatment but dropped out for legitimate reasons (e.g., transfer, work, etc.), a lesser history of physical abuse and psychological problems was found. No other background measures significantly discriminated between groups. Also, completers showed significantly less impulsivity on the SCT and longer reaction times in response to risky trials on the CDMT. On the other hand, in response to all three trials on the Stroop, noncompleters had significantly longer reaction times, again indicating cognitive inefficiency.

Table 7. Differences between Treatment Completion Groups (age adjusted)

Predictors	Drop Outs mean (sd)	Completers mean (sd)	F Level	Sig
History of physical abuse	14.98 (.77)	11.87(.7)	8.89	=.003
# days in last 30 psyc prob's	4.31 (.82)	1.54 (.75)	6.18	= .01
SCT: % correct Delay 2	.21 (.04)	.31 (.04)	3.33	=.07
SCT: % correct Delay 3	.27 (.05)	.46 (.04)	7.90	=.006
SCT: % correct Delay 4	.35 (.06)	.54 (.05)	6.97	=.009
SCT: Reaction Time	802 (8.0)	822 (6.67)	3.74	=.055
CDMT: RT to All Risky Trials	2357 (140)	2757 (123)	4.63	=.03
Stroop: RT – neutral	852 (36)	756 (28)	4.42	< .05
Stroop: RT - congruent	743 (27)	675 (20)	4.19	<.05
Stroop: RT - incongruent	1280 (98)	943 (75)	7.52	=.007

Treatment completers also showed a different pattern of cortisol responses to the stress task. Controlling for both age and body mass index, z-scores of cortisol levels were subjected to an ANCOVA repeated measures analysis. Inmates who did not drop out of treatment showed a moderate relative increase in cortisol levels from baseline to the acutely stressful situation. Inmates who dropped treatment for "negative" reasons showed the opposite pattern, with cortisol dropping precipitously from baseline ($F = 3.37$; $p = .07$).

Figure 3



Institutional Infractions

Institutional infractions constituted another type of outcome measure, reflective of institutional behavior. The number of infractions prior to treatment was subtracted from the number of infractions committed during treatment to produce a score indicating the extent to which behavior changed in response to treatment. Table 8 below indicates that the greater the change (i.e., reduction) in infractions during the course of treatment, the predictor variable is either positively (+) or negatively (-) associated. For example, inmates showing a reduction in infractions are less likely to have a history of emotional or sexual abuse. They also have spent fewer months in prison throughout their lives and report fewer psychological problems in the last 30 days. There is a tendency for a greater reduction in infractions to be related to fewer high risk choices on the CDMT and a greater number of correct responses on the FEEST. And finally, change in infraction numbers was related to greater change in cortisol response to an acute stressor.

Table 8: Correlations Between Predictor Variables and Change in Institutional Infractions

Predictor	Correlation	Sig
Emotional abuse	-.13	<.07
Sexual abuse	-.15	<.05
Months in Prison	-.24	=.001
Psychological Problems in the last 30 days	-.12	=.085
CDMT: Highest Risk (Y1b90)	-.20	=.007
CDMT: Next highest risk (Y2b90)	-.17	=.02
CDMT: High risk choices with no neutral bets	-.15	<.05
FEEST: Percent correct for all facial expressions	.13	=.07
FEEST: Percent correct for happiness expression	.20	=.006
Cortisol Change score	.21	<.03

Segregations

Segregations resulting from Institutional infractions constituted another type of outcome measure, reflective of institutional behavior. The number of segregations prior to treatment was subtracted from the number of segregations committed during treatment to produce a score indicating the extent to which behavior changed in response to treatment. Table 9 below indicates that the greater the change (i.e., reduction) in segregations during the course of treatment, the predictor variable is either positively (+) or negatively (-) associated. For example, inmates showing a reduction in segregations are less likely to have a history of emotional or

sexual abuse. They also have spent fewer months in prison throughout their lives and report fewer psychological problems in the last 30 days. There is a tendency for a greater reduction in segregations to be related fewer high risk choices on the CDMT and a greater number of correct responses on the happiness expression on the FEEST. And finally, change in segregation numbers was related to greater change in cortisol response to an acute stressor.

Table 9: Correlations Between Predictor Variables and Change in Segregations

Predictor	Correlation	Sig
Emotional abuse	-.12	<.10
Sexual abuse	-.13	<.04
Months in Prison	-.16	<.03
Psychological Problems in the last 30 days	-.15	<.04
CDMT: Highest Risk (Y1b90)	-.21	=.005
CDMT: Next highest risk (Y2b90)	-.18	=.015
CDMT: High risk choices with no neutral bets	-.17	<.025
FEEST: Percent correct for happiness expression	.19	=.01
Cortisol Change score	.18	=.06

Virtual Reality: Risk Taking Behavior

The virtual reality data did not show adequate variation for analyses as an outcome measure. This appeared to be due to the lack of familiarity and comfort of inmates in using interactive computer techniques, as well as the possibility that there may have been fear that their recorded responses to risk taking scenarios may become accessible to prison staff.

Hypothesis 2b: Change in neuropsychological function will predict response to treatment.

In order to test this hypothesis, the CDMT was administered twice; once at baseline and once again following treatment. Inmates who dropped out of treatment early received the CDMT on the same timeline as those who completed. Thus, inmates were asked to complete the CDMT after the treatment period, despite variable participation times to determine whether change in executive decision making was incurred in response to treatment. Differences in the magnitude of change were expected between those who responded well to treatment versus those who did poorly or dropped out. Outcome measures for these analyses included treatment responsivity, gain, completion, infractions and segregations.

It is noteworthy that many inmates who did not complete treatment for negative reasons did not complete the second CDMT; thus, those with low treatment responsivity scores were so much less likely to have received the post-CDMT that several of the analyses could not be conducted. This both validates our measure of treatment responsivity and complicates our test of this hypothesis. Using a mean split was not possible, so instead correlational analyses were conducted. Results are reported below for those analyses with smaller sample sizes than the analyses reported above and includes those who completed at least the first treatment group (df=72).

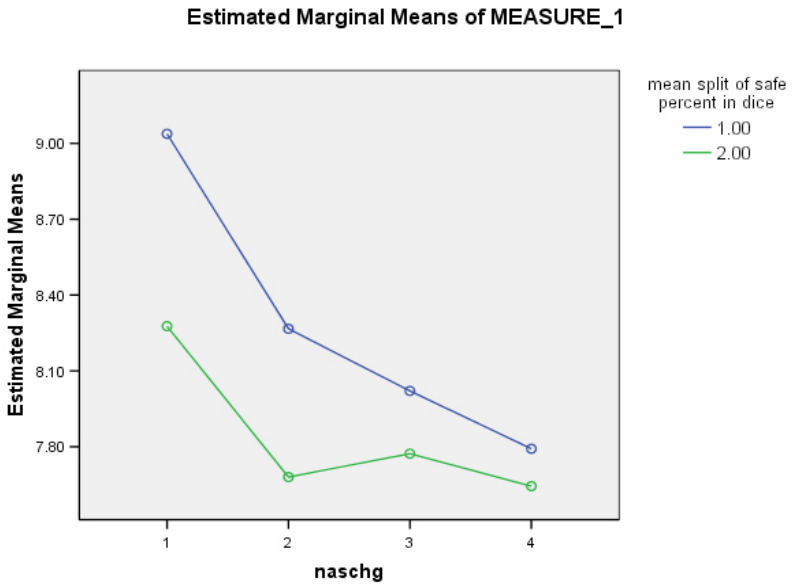
Change in the extent to which inmates selected the riskiest choice (y1b90) was significantly correlated with treatment readiness ($R = .25$, $p = .03$) and change in risky choices overall was marginally related to readiness ($R = .21$, $p < .08$). In both cases, treatment readiness was related to the selection of a greater percentage of risky choices from before to after treatment. Treatment gain was significantly related to change in reaction time when selecting risky choices ($R = -.23$; $p < .05$) with shorter RTs in the second administration than the first. Gain was also

marginally related to change in risky choices overall (R = -.21, p < .07), suggesting that fewer risky choices were related to greater gain. Treatment responsivity was significantly related to change in reaction time (R = -.30, p = .01) and marginally to change in risky choices overall (R = -.19, p = .10), showing the same directionality as with the Gain scale. These results are interesting in the context of the outcome measures: treatment readiness is self evaluated prior to treatment while responsivity and gain are evaluated by social workers during and after treatment. Thus, those with perceptions of high readiness actually performed worse on the CDMT in response to treatment while those who responded more favorably to treatment according to social workers showed significantly greater improvement on the CDMT.

Change in neither institutional infractions nor segregations were related to change in the CDMT measures. Also, the virtual reality scenarios were also presented at baseline and post-treatment, however there was not sufficient variability to determine whether change in this measure occurred.

The Novaco Reaction to Provocation (RP) was also administered at baseline and after each treatment group to assess change in aggressive behaviors and attitudes. Treatment responsivity scores were not related to RP scores at baseline (df=191) or after the first treatment group (df=131). RP scores became significantly and negatively related to treatment responsivity, however, after the second (R=-22, df=92, p<.05) and third groups (R=-.21, df=85, p=.05), suggesting that those who responded well to treatment showed a significant trend toward less aggressive behavior over time. Again, it is important to note that as treatment progressed, fewer inmates were retained and a greater number dropped out of the study; thus, the latter correlations include fewer numbers and specifically those who performed better in treatment. There were no significant relations between change in RP and treatment readiness or gain scales.

More relevant to the present study, RP scores were contrasted between high and low cognitive functions (mean split) including only one central measure from each task. A significant difference was found between high and low scorers on the CDMT measure of safe choices; those who selected a lesser number of safe choices showed a steeper decline in aggressive behaviors than those who selected greater safe choices (F=4.06, df=3,79, p,.05).



RP scores were then broken into subscales, including the following "provocation" domains: cognitive, arousal, behavioral, and anger relating to specific types of provocations. Two administrations after the first and second groups were included in a repeated measures ANCOVA using a mean split for each primary measure on the neuropsychological tasks as well as a mean split for the measure of stressful experiences during treatment. Those with higher levels of self reported stressful experiences had higher baseline levels of arousal and then a larger decline in arousal after the second treatment group ($F=5.49$, $p=.02$) and a greater reduction in angry reactions to specific provocations ($F=3.53$, $p=.06$). Similarly, inmates who selected fewer "safe" choices on the risky decision making task showed a higher baseline and greater decline in arousal after the first treatment group than those selecting fewer safe choices ($F=4.22$, $p<.05$).

H3. Independent variables will be associated with psychopathy, a history of aggressive crimes against persons and an aggressive personality style.

Inmates scoring high on the psychopathy measure performed significantly worse on several background and neuropsychological measures than inmates with lower scores. High scorers showed a lower percentage of correct responses on 3 out of 4 tone distracters on the SCT and had greater omission errors throughout the task. They also had a greater number of extra presses on the CDMT and a shorter reaction time; these particular scores are not direct measures of executive decision making but may more appropriately reflect impulsivity. High scorers also were less accurate in their appraisals of the expression disgust and overall in the FEEST responded with significantly fewer correct attributions. And finally, there was a marginal finding for a longer RT on the Stroop during the incongruent trial; given that groups did not differ in terms of number correct, this slowness may suggest greater cognitive inefficiency. No background measures distinguished between high and low scorers, however, high scorers had significantly greater scores on both proactive and reactive aggression, as well as number of segregations and infractions within the institution, as expected.

Predictors	Low Psychopathy mean (sd)	High Psychopathy mean (sd)	F Level	Sig
SCT: % correct Delay 1	.14 (.02)	.07 (.02)	6.87	=.01
SCT: % correct Delay 3	.46 (.04)	.32 (.04)	5.43	=.02
SCT: % correct Delay 4	.54 (.05)	.39 (.04)	5.51	=.02
SCT: Omission Errors	3.41 (.39)	4.57 (.34)	4.90	<.03
CDMT: Extra Presses	.50 (.35)	1.40 (.31)	3.72	<.06
CDMT: RT risky trials	2492 (128)	2182 (114)	3.26	=.07
FEEST: Disgust	6.05 (.27)	5.3 (.24)	4.27	<.05
FEEST: % Total Expressions	.72 (.01)	.69 (.01)	4.28	<.05
Stroop: RT on incongruent trials	968 (79)	1143 (67)	2.83	<.10

Also, although not quite significant (F=2.52, p = .11), there was a tendency for inmates with psychopathic traits to show a decrease in cortisol response (from z-score of .06 to -.01) to a stressor while the nonpsychopaths show an increase (from z-score of -.01 to .10), controlling for age and BMI, which was expected.

A few of the neuropsychological measures were significantly related to self-reported history of either proactive or reactive aggression. Reactive aggression was negatively related to the CDMT measure of the percentage of safe choices during the entire task (R = -.17, p< .02) and to the ability to discern the facial expression of disgust (R = -.16, p < .04). The proactive aggression measure was also related to misattributions of disgust (R = -.14, p < .06). Unexpectedly, proactive aggression was also positively related to percentage correct on the third delay (next to easiest) in the SCT (R = .15, p = .05) and marginally to the fourth delay (easiest) (R = .14, p = .07). There were no significant relationships with the Stroop.

With respect to a history of aggressive crimes, there was not a sufficient number of inmates who committed only property crimes in these three prisons to permit an analysis of ways in which crime types may be related to neuropsychological function. The overwhelming majority of those who did not commit a crime against persons were charged/convicted of drug crimes, which is not an adequate comparison group. Thus, an analysis was undertaken to determine whether self reported history of “violent behavior” (none vs any) was related to neuropsychological function. Those with such a history performed somewhat worse on the Stroop, showing greater cognitive interference (F = 2.39, p < .10), fewer safe choices on the CDMT (F = 3.93, P = .03), and a lower percentage of correct responses during the first tone delay (F = 6.36, p < .01) and on the third tone delay on the SCT (F = 3.0, p < .01). The implications of these findings are that inmates with a history of violent behavior may present with deficits that need to be addressed in order for treatment to be effective. And, in fact, those who reported violent behavior tended to score lower on treatment gain and responsivity.

H4. Inmates with ECF/emotional deficits who have either high psychopathy scores or a history of substance abuse will respond less favorably to treatment.

Those with high scores on the LPS showed poorer responsivity to treatment (high responsivity mean = 13.42, sd=.96; low responsivity mean = 10.76, sd = .82; F=4.42, p<.04). This relationship remained significant after controlling for central ECF measures from each task. High scorers on this psychopathy index also showed a trend toward having less treatment gain (F=2.91, p<.10), and significantly more infractions committed during treatment (F=5.67, p<.02).

Unexpectedly, high scorers on psychopathy showed a tendency toward greater improvement in performance on the CDMT, irrespective of treatment response, selecting more safe choices in administration 2 than during baseline (baseline mean = .65, sd = .02; post-treatment mean = .71, sd = .02). Low psychopathy scorers did not significantly change in their CDMT response from baseline (baseline mean = .66, sd = .02) to post-treatment (.65, sd = .02; $F = 6.63$, $p = .06$). Similar, although even more pronounced, results were found for another CDMT measure – percentage of selections of the highest risk choice. Consistent with these findings, the repeated RP measure from the Novaco inventory also showed change contingent upon psychopathy scores. Specifically, although high psychopathy scorers had a greater tendency toward aggressive reactions to provocation at baseline, both high and low scorers reported less reaction to provocation as treatment progressed. Importantly, however, higher psychopathy scorers showed greater improvement than lower scorers ($F = 5.15$, $p < .05$). Also, although psychopathy and baseline RP scores are strongly related ($R=.27$, $p < .0001$), the degree of correlation suggests that these concepts are separable. These results only apply to those inmates who remain in treatment and the study long enough to provide data.

In order to further dissect these unexpected findings, the effects of the interaction between ECF measures (using the mean split) and psychopathy on treatment outcomes were examined. The only significant finding was the interaction between attributions of emotional expressions (FEEST) on number of infractions ($F=4.39$, $p<.05$). Inmates with high psychopathy scores and lower accuracy in attributing emotions to facial expressions had a greater number of infractions than the other three groups (i.e., low psychopathy – low accuracy; low psychopathy – high accuracy; high psychopathy – high accuracy).

Similar analyses were conducted for the effects of prior drug use on various measures of treatment outcome and to determine whether there was an interactive effect of drug use and ECF on treatment outcome. No significant relationships were revealed, suggesting that neurocognitive function plays significant role in treatment outcomes irrespective of prior drug use.

Summary Model

In order to identify those background and neuropsychological factors that best predict treatment responsivity, a linear regression analysis was conducted including primary ECF measures to assess their relative predictive ability. First, those few background measures that were related to treatment responsivity (age, months in prison, past 30 days with psychological problems, and histories of physical abuse and sexual abuse) were included in a stepwise regression model without ECF measures to identify which had the most predictive utility. Only a history of physical abuse survived in this model. Its predictive ability, however, appears to occur independently of ECF in that they are not directly correlated with physical abuse and when ECF variables are entered, the relationship between physical abuse and treatment responsivity declines, suggesting that dimensions of ECF have more predictive value. Table 10 shows that, relative to age, the SCT measure of impulsivity and response shifting (the easy delay trial) most highly predicted outcome, followed by reaction time on the riskiest choices in the CDMT (actual risky decisions did not enter the equation), and then by the number correct on the word-color segment of the Stroop (but not the interference score). Measures from the FEEST did not enter the equation when the other variables were present.

Table 10. Best Model Prediction of Treatment Responsivity

	R	R Square	Adjusted R Square	F Change (df)	Sig
MODEL	.426	.181	.156	7.20	.0001

Predictors	Unstandard. Coef's		t	Sig.
	B	Std. Error		
age of inmate	.15	.13	1.15	.25
Stroop: word-color correct	.198	.087	2.27	.02
CDMT: RT highest risk choices	.002	.001	2.90	.005
SCT: % corr tone delay4	5.13	1.64	3.13	.002

Conclusions

Findings from this research suggest that inmates with deficits in cognitive functions under study, in particular lack of behavioral inhibition and inability to shift responses, impulsivity when selecting high risk choices, and cognitive inflexibility, were less likely to progress in this type of CBT treatment program and more likely to drop out early and commit infractions during treatment. It is possible that these inmates will be more effectively impacted by targeted, neurocognitive-based treatment regimens suitable for administration within an institution to reduce violence among prison inmates. Of great clinical significance, it should also be noted that a history of physical abuse appears to contribute independently to poor treatment responses and outcomes.

The following items summarize the results of this study:

- Neuropsychological deficits, especially behavioral disinhibition, inability to shift responses based on new information, impulsivity during risk taking, and cognitive inflexibility, significantly predicted treatment response, gain and retention;
- History of physical abuse significantly predicted treatment outcomes;
- Younger inmates fared better in treatment, but total months in prison was not predictive;
- Self evaluations of treatment readiness differed from social worker evaluations and were not predictive of actual treatment performance;
- IQ was not different between treatment readiness, gain, responsivity or completion groups, suggesting that higher order cognitive functions played a direct role in treatment outcomes;
- There were no differences between treatment groups on measures of prior drug use;
- None of the background variables discriminated between treatment groups, including education, duration of total prison time, family history of criminality, mental illness, and drug abuse, aggressive behavior, stressful events that occurred during first treatment group, and attitudes about treatment. Thus, none were included as covariates.
- There was one exception: extent to which psychological problems were experienced in the past 30 days distinguished between low and high treatment responsivity groups.

These findings suggest that certain individual characteristics distinguish between offenders positively affected by correctional CBT-based interventions relative to those least affected and may be informative with respect to what treatment components are needed to design an effective intervention strategy. A targeted cognitive neurorehabilitation approach or one that focuses on emotional regulation, impulse control and language development (the underpinnings for executive functions) may potentially remediate these malleable functions, thereby improving overall treatment outcomes and potentially reducing institutional misconduct. In a variety of settings, evidence is mounting to implicate dysfunction of the thinking process, emotional perceptions, and regulation of emotions in offenders who do not respond to conventional treatments. The present study is consistent with these findings, suggesting that relative deficits in ECF and emotional regulation may play a significant role in treatment outcomes. Because such deficits are malleable, these inmates may respond favorably to perhaps pre-treatment or treatment readiness approaches that support higher order cognitive abilities. Incorporation of this knowledge into criminal justice policies and practices could alter their course substantially to dramatically improve the ability to assess, detect, and treat offenders who are otherwise considered intractable.

This study also has potential to inform the development of assessment tools that can be readily used within both correctional and clinical settings to identify offenders who are unlikely to respond to present treatment approaches and to isolate deficits that are in need of remediation. The overriding goal is to provide either treatment readiness programs for these inmates that target underlying deficits or to design or adapt new treatments for this more challenging population of offenders. Because the subgroup of offenders that does not respond to conventional treatments often possess underlying individual vulnerabilities and adverse social conditions that compound their problems and are particularly at risk for persistent serious criminality and substance abuse, this subgroup requires more intensive and customized approaches. Accordingly, offenders will be better equipped to maintain control over their own behavior rather than requiring severe methods of external restraint that are terminated upon release. Consistent findings indicate that far fewer crimes are committed when individuals are actively in treatment (see Fishbein, 1991; Fishbein and Pease, 1996). Similarly, in the present study, those inmates who remained in treatment longer showed fewer behavioral maladjustments. Accordingly, development of a sensitive and specific screening test to predict recidivism, institutional misconduct, and/or treatment outcomes would constitute an important advance for treatment planning.

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