Section 1: Statement of the Problem

Introduction

Research suggests that a number of persons who utilize community mental health services experience cognitive limitations that adversely impact their ability to benefit from those services. This may be particularly true for individuals who experience the dual conditions of mental illness and substance dependence; however, many other persons in chemical dependency treatment also appear to experience cognitive limitations, as well. The provision of traditional "cognitive rehabilitation" may not be feasible either because most community rehabilitation is not sufficiently intensive or because the cognitive impairments may not be amenable to change. In these cases, an alternative approach is to provide individuals with strategies for understanding the extent and contexts of their cognitive limitations, and then assisting them in developing compensation strategies for accommodating to their cognitive limitations.

Because there has been limited research about addressing cognitive limitations among persons with mental illness in community settings, several researchers at Wright State University conceptualized a pilot study to investigate the potential efficacy for improving cognitive compensation skills in a population with clinically proven cognitive deficits. The Consumer Advocacy Model (CAM) program is an outpatient alcohol and drug treatment program in Dayton that is operated by SARDI within the School of Medicine. This program was especially established to serve persons with substance dependence and co-existing, severe disabilities. CAM's clientele includes a high percentage of persons who have accompanying mental illness diagnoses (CAM also has ODMH mental health certification). Using this program for the original subject pool, an investigation of cognitive compensation skills training was undertaken from 1999 – 2002. The experimental results are presented herein. The project, supported largely through Ohio Department of Mental Health (ODMH) funding, required that a number of related areas and concepts be investigated, and as such this report is considered to be a pilot study for subsequent, more highly focused research.

Literature Review

Mental Health Issues

Over the past two decades, the field of mental health has moved away from the institutionalization of individuals with severe and/or chronic mental illness, and toward a model of community integration (Roth, Lauber, Crane-Ross, & Clark, 1997). Accompanying these

changes has been the need for a range of additional services in the community to replace and supplement the functions of long-term institutional care (Felce & Perry, 1995). Related changes in policy changes have led to an increase in the number of services received by individuals meeting the criteria for a severe mental disability in the state of Ohio over the past 10 years, partly because increasing emphasis on case management has resulted in better consumer access to additional services (Roth et al., 1997). Nevertheless, persons with mental illness continue to experience high rates of relapse with inpatient admissions, homelessness, and unemployment (Kessler, Foster, Saunders, & Stang, 1995). Therefore, a great need still exists for more effective community-based treatment strategies allowing mentally ill consumers to live more independent and productive lives.

Dual Diagnosis

It is estimated that as many as half of all individuals with a serious mental illness are also dependent on alcohol and/or illicit drugs (Bellack & DiClemente, 1999; Kessler et al., 1996). National epidemiological studies over the past ten years have found that individuals with alcohol abuse problems are at least 2.3 times more likely to have a co-occurring mental disorder than individuals in the general population (O'Hare et al., 2001; Pickens et al., 1999; Primm et al., 2000; Regier, Burke, & Burke, 1990). Substance-related comorbidity is especially high in clinical patient populations, with estimates ranging from 25% to as high as 68% in persons receiving mental health treatment (Carey, 1989; Conner et al., 1995; Mowbray et al., 1995; Ries, Mullen, & Cox, 1994; Sciacca, 1991). Estimates of co-occurring psychiatric disorders in persons with substance use disorders are also consistently high (Helzer & Przybeck, 1988; Mirin, Weiss, & Michael, 1988; Penick, Nickel, Cantrell, & Powell, 1990; Hesselbrock, Meyer, & Keener, 1985). Bates et al. (2002) note that 30-80% of substance use treatment clients have mild to severe neuropsychological deficits. Furthermore, these deficits may explain lack of client motivation and poor treatment outcomes.

A history of deep divisions between mental health and substance abuse treatment services often results in failure to provide coordinated services for these dually diagnosed consumers (Burnam et al., 1995). Moreover, they appear to have an especially difficult time receiving and maintaining treatment, and achieving successful treatment outcomes (Bartels, Drake, & Wallach, 1995). For example, a study of dually diagnosed homeless individuals in New York City found that of 694 candidates for treatment, 89% were either rejected for admission at their assigned

facility, failed to show up for treatment, or dropped out of treatment during the first year (Nuttbrock, et al., 1997). Dually diagnosed consumers who do enter treatment appear to require longer and more intensive treatment (Moos, King, & Patterson, 1996). Furthermore, inpatient readmission rates are much higher for dually diagnosed consumers than for those with only severe mental illness (Gupta et al., 1996) or with only substance abuse diagnoses (Moos & Moos, 1995). In the rehabilitation field, substance abuse among persons with mental illness has been found to impact negatively on work performance and rehabilitation outcomes (Brown & Saura, 1996). Finally, substance abuse diagnoses often cost more to treat than other chronic conditions (e.g., arthritis, asthma, and diabetes), especially for individuals with mental health claims (Garnick, Hendricks, Comstock, & Horgan, 1997).

Impact on Cognitive Functioning

Mental illness and substance abuse conditions alone frequently lead to cognitive impairments. When these conditions co-occur, cognitive impairments are especially likely to impact treatment outcome (Bates & Convit, 1999; Burns & Teesson, 2002; Ross, 1995). Many additional disability conditions that may co-occur with mental illness also lead to or intensify cognitive difficulties. Most notably, substance abuse may cause brain dysfunction, due to toxicity, that does not necessarily disappear with recovery from active use (Cleaveland & Denier, 1998). Moreover, persons who abuse substances appear to have a higher risk of traumatic brain injury (TBI) (Corrigan, 1995; Sparadeo & Gill, 1989).

Thus, effective treatment of mental illness must take into account differences among consumers in their levels of cognitive functioning (Silverstein, Hitzel, & Schenkel, 1998). This is of particular importance when additional disabilities such as substance use disorder or TBI are present. However, the vast majority of chemical dependency treatment programs do not address the potential cognitive limitations of their clients (Drake et al., 1993; Kaufman & Charney, 2000). For example, many treatment models utilize psychoeducational components, which typically involve didactic instruction in a group setting (e.g., teaching the clients about their illnesses and explaining risk factors). The extent of memory, attention/concentration, and analytical thinking deficits frequently present in persons with mental illness (particularly in combination with prolonged substance use and/or TBI) may render instructional components delivered at a “standard level” less effective. Consequently, it has been suggested that cognitive

limitations that go unaddressed are one important cause of treatment failures in programs serving dually diagnosed mental health consumers (Bellack & DiClemente, 1999; Wilson, 2000).

Cognitive Impairments Associated with Mental Illness

Questions concerning the cognitive capacity of individuals diagnosed with mental illness constitute one of the most frequent referrals to neuropsychologists (Bates, Bowden, & Barry, 2002; Bates, Labouvie, & Voelbel, 2002; Grant & Adams, 1996). Cognitive screening measures or basic mental status examinations may fail to uncover deficits, but more detailed evaluation may reveal significant cognitive impairment that can impact future treatment or management of the patient (Johnson-Greene & Adams, 1998). Quantifying an individual's neuropsychological strengths and weaknesses may clarify the nature and intensity of needed clinical interventions such as psychotherapy or substance abuse treatment (Bates, Labouvie, & Voelbel, 2002). Additionally, a clear understanding of the person's cognitive capacity can serve as a guide for modifying treatment, thereby making it more accessible to the neuropsychologically impaired consumer.

While a variety of psychiatric conditions are frequently present among individuals diagnosed as mentally ill with accompanying cognitive sequelae, the current review is focused on affective disorders, anxiety, and schizophrenia. These three psychiatric conditions most often tend to be associated with neurological deficits, structural changes in the brain, and accompanying alterations in cognition (Rahman et al., 2001). Moreover, perhaps because these types of disorders are the most common, there is a relative paucity of neuropsychological investigations concerning other conditions.

Affective Disturbance

Affective disorders comprise one of the most common types of psychiatric disturbance for which mental health treatment is sought. Comorbidity of alcohol use disorders and major depression appears to be pervasive in the general population of individuals with such disorders (Grant & Harford, 1995). Moreover, depression is frequently one of the first reported symptoms preceding a variety of general medical conditions (Hall, 1980). Clearly, in such cases it is critical to discern what degree of cognitive deficit is related to affective disturbance rather than to a neurological condition alone. Historically, it was believed that unipolar depression tended to produce specific deficits largely in the domains of learning/memory (King, Caine, & Cox, 1993; Speedie, Rabins, & Pearlson, 1990; van Gorp et al., 1998) and psychomotor speed (Cassens,

Wolfe, & Zola, 1990). Both of these domains require effortful processing to some degree, suggesting that at least some of the performance impairment noted in depression may be due to difficulty activating effortful processing. This possibility is supported by the finding of better memory performance on recognition trials, which eliminate the need for more effortful recall strategies. Typically, learning/memory and psychomotor speed deficits are associated with more severe levels of depression, which are accompanied by inpatient treatment for the disorder. In contrast, Fischer and colleagues found that depressed patients were impaired on 10 of 14 formal cognitive measures, suggesting global rather than focal deficits (Fischer, Sweet, & Pfaelzer-Smith, 1986). These authors go on to suggest that clinicians may need to adjust their impairment criteria when working with depressed patients to prevent diagnostic misclassification.

Even less research evidence is available concerning the cognitive impact of bipolar disturbance. A study by Jones and colleagues (Jones, Duncan, Mirsky, Post, & Theodore, 1994) found that neurologically intact patients with bipolar disorder showed relatively specific impairment in the "focusing-executing domain" when assessed by tasks such as the Trail-Making Test, Stroop Color-Word Interference Test, or the Purdue Pegboard Test. They did not, however, differ from the healthy control sample on tasks of learning or memory.

Anxiety

Along with affective disorders, anxiety is perhaps one of the most common psychological conditions accompanying neurological disturbance. The majority of studies reviewing the impact of anxiety on cognitive test performance have found mild declines on tests of psychomotor speed, focused attention, and concentration or vigilance (Dibartolo, Brown, & Barlow, 1997; Hodges & Spielberger, 1969; Rankin, Gilner, Gfeller, & Katz, 1994; Reitan & Wolfson, 1997). An investigation by Dodrill (1979) found significant anxiety effects related to gender for normal control subjects but not for neurological patients. Patients undergoing neuropsychological evaluation also may have an increased likelihood of manifesting symptoms of post-traumatic stress disorder (PTSD). Patients with PTSD may have particular difficulty on tasks that place a greater demand on attentional processes or psychomotor speed. In general, it appears that individuals with PTSD display cognitive difficulties similar to those of patients with other anxiety disorders. Specifically, they demonstrate greater deficits on tasks with a large attentional or psychomotor speed component (Dalton, Pederson, & Ryan, 1989).

Schizophrenia

Perhaps the most chronic and fiscally costly psychiatric condition is schizophrenia. While a number of etiologic factors have been put forth, the neurodevelopmental genetic risk model of Goldstein (1994) appears to best integrate the role of genetic and nongenetic factors in the development of this disorder. In general, schizophrenia appears to lead to the greatest cognitive impairment in the most neuropsychological domains. A well-controlled study by Goldberg and colleagues (1990) found greater overall cognitive impairment in the affected twin of monozygotic twin pairs discordant for schizophrenia. While a number of early investigations suggested diffuse cognitive impairment (Chelune, Heaton, Lehman, & Robinson, 1979; Seidman, 1984), these conclusions may have been overstated, due to failures to control for multiple confounding variables (Blanchard & Neale, 1994).

More recent investigations have indicated more focal impairment in finite cognitive domains. In fact, Goldstein (1994) has suggested that the specific constellation of cognitive deficits displayed by schizophrenic patients can be used to meaningfully differentiate subtypes of the disorder. The first and broadest cognitive domain that appears frequently to be affected by schizophrenia is that of executive functions, deficits which are believed to reflect frontal lobe neuropathology (Bechara & Damasio, 2002; Bechara, Dolan, & Hindes, 2002; Milner, 1963) and are frequently manifested in schizophrenic patients (Bornstein, Nasrallah, Olson, Coffman, Torello, & Schwartzkopf, 1990). These deficits typically lead to decreased function in the areas of foresight and planning, abstract reasoning, concept formation, the ability to solve problems, and the capacity to utilize feedback. Bellack and DiClemente (1999) and Hellerstein, Rosenthal, and Miner (2001) both suggest that an integrated substance abuse treatment approach for clients with schizophrenia, an approach that incorporates development of social and cognitive skills.

A second cognitive domain that seems to be impacted by schizophrenia is that of attention (Nuechterlein & Dawson, 1984). Vigilance and visual detection appear to represent aspects of attention that are particularly vulnerable (Asarnow & MacCrimmon, 1978; Granholm, Asarnow, & Marder, 1996). Finally, a third major cognitive domain that appears to show decline in individuals with schizophrenia is memory (Landro, 1994; Tamlyn, McKenna, Mortimer, Lund, & et, 1992). These deficits have been found with both verbal and nonverbal material as well as explicit and implicit memory tasks. Additionally, there is no strong evidence that the impairment is isolated to any single stage of the classic memory process (e.g. encoding).

Impact on Treatment

Whereas the literature base concerning the cognitive deficits seen in psychiatric illness is relatively sparse, studies evaluating the impact of cognitive deficits on treatment of those conditions are nearly nonexistent. There appears to be a growing awareness by some that the cognitive deficits seen in various psychiatric conditions substantially limit the effectiveness of various therapeutic approaches and patient social and functional outcomes (Corrigan & Yudofsky, 1996). Some authors further believe that remediating abnormal cognitive functions will increase treatment efficacy and improve functioning in general (Silverstein et al., 1998).

One focus of this perspective has been the psychiatric rehabilitation of individuals with schizophrenia (Starkey et al., 1997). In general, it is maintained that the cognitive deficits that accompany schizophrenia limit the affected individual's ability to learn and acquire new skills in psychiatric rehabilitation settings (Green, 1996). For example, an investigation of skill acquisition in schizophrenia suggested that sustained attention or vigilance was a significant predictor of skill acquisition (Silverstein, Schenkel, Valone, & Nuernberger, 1998). An additional study described by Silverstein and colleagues (1998) found that schizophrenic patients with the most severe deficits in attention and memory were the least successful in learning basic conversation skills. Collectively, these studies suggest that attention and verbal memory may be particularly critical abilities underlying skills training in schizophrenia. Whereas attention and memory may be most crucial in the acquisition of new skills, executive functioning may be most vital to the patient's ability to implement and modify such skills in the real world. While executive skills are certainly impaired in a variety of psychiatric conditions, the impact of this impairment on acquisition and utilization of skills acquired in treatment is largely unknown.

In summary, the domains of attention, memory, and executive functioning appear to have critical implications for the delivery of treatment and skills training to psychiatric populations. Whereas memory deficits have most commonly been implicated in depression, some evidence suggests more global cognitive impairment. Attention deficits are most commonly associated with anxiety disorders, and all three domains are frequently impaired in schizophrenia.

Cognitive Impairments Associated with Substance Abuse

In a recent study, Cleaveland and Denier (1998) stated that "a significant body of research demonstrates that alcoholics and drug addicts who participate in substance abuse treatment have poor attention and concentration, memory, abstraction, and problem-solving

skills even after a significant detoxification period" (p. 113). The following sections briefly discuss this body of research, beginning with studies on the cognitive impact of alcohol abuse or dependence, and then addressing investigations relating to other drug use.

Alcohol

The neuropathological effects of alcohol are widespread and include cell necrosis, loss of dendritic branching, decreased synaptic efficiency of existing neurons, ventricular enlargement, meningeal thickening, and increased embolization (Altura & Altura, 1984). These neuropathological findings appear to be brought on by (a) the direct toxic effects of alcohol on the nervous system, (b) indirect effects (e.g., malnutrition in chronic alcoholism), and (c) effects related to withdrawal from alcohol (Schaumberg & Sterman, 1980). Substance abuse and many neuropsychiatric disorders affect common neural pathways, including the orbitofrontal cortex, ventral striatum, and modulatory ascending neurotransmitter systems, that substantially control memory, attention, and aspects of executive functioning such as decision-making (Rahman et al. 2001; Rogers et al., 1999). Importantly, cognitive deficits associated with long term alcohol abuse appear to persist even after a period of abstinence (Bates, Bowden, & Barry, 2002; Di Sclafani et al., 1995).

Tracy and Bates (1999) demonstrated with healthy volunteers that alcohol intake tends to dissociate automatic and effortful memory processes. Furthermore, Morgenstern and Bates (1998) found that individuals with cognitive impairments undergoing 12-step substance abuse treatment were less successful in outcomes compared to individuals without such impairments; cognitive impairments appear to moderate the interaction of change processes and treatment outcome. Bates, Bowden, and Barry (2002) stressed the importance of training for the improvement of cognitive functioning to improve clients' chances of long-term abstinence and related successful outcomes.

Several studies illustrate the negative impact of substance use on cognitive and executive functioning (Bechara & Damasio, 2002; Bechara, Dolan, & Hindes, 2002; Ernst et al., 2003; Grant, Contoreggi, & London, 2000). Bechara et al. (2001) noted that deficits in executive functioning among alcohol and drug abusers mirror similar impairments in individuals having damage to the ventromedial cortex. Therefore, these results, combined with those of Bates, Bowden, and Barry (2002), implicate a strong relationship between chronic substance use,

neurological dysfunction, and behavioral disruption preventing the success of substance abuse treatment programming.

The nature and magnitude of different individuals' cognitive impairments associated with alcohol abuse appear to fall into one of three relatively discrete diagnostic categories: Korsakoff's syndrome, alcohol dementia, or subclinical impairment. While Korsakoff's syndrome represents the most severe form of alcohol-related cognitive decline, it is also less common than the other two categories. This disorder denotes the chronic residual symptoms of Wernicke's encephalopathy, most typically confabulation, and a severe anterograde amnesia dating from near the time of illness onset (Butters, 1985). While visuospatial measures and tasks of executive control functioning may also show some deficiencies, it is the dense amnestic facet that characterizes this disease. Historically, one of the hallmarks of Korsakoff's was the presence of confabulation. It now appears that this feature of the disorder may not be invariant and, if present, may occur early in the course of the disease. Indeed, it is rare to find this symptom in patients who have Korsakoff's for a period of five years or longer (Butters & Cermack, 1980). Flores (1988) identifies some of the specific impairments that make this population difficult to treat, including poor motivation, deficits in new learning, memory impairment, and affective changes and difficulties with insight and planning.

A second group of substance abusing individuals may not manifest the dense amnestic problems seen in Korsakoff's but do display significant memory impairment. When such amnestic disturbance is coupled with impairment in a second domain (e.g., visual perception, abstraction), the individual may meet criteria for alcoholic dementia. In general, neuropsychological test batteries that load heavily on visuospatial abilities, memory, abstract reasoning, and cognitive flexibility appear most sensitive to this condition (Hartman, 1995). There has been some speculation that this constellation of deficits is specifically related to changes in physiologic function of the frontal lobes (Bechara & Damasio, 2002; Bechara, Dolan, & Hindes, 2002; Kessler et al., 1984).

A third group of substance-abusing individuals may display an even more diverse array of cognitive symptoms which are not of the magnitude seen in Korsakoff's or alcoholic dementia. For individuals who exhibit this subtle symptom pattern, there is frequently an average intellectual level and uncompromised verbal skills (Hesselbrock, Weidenman, & Reed, 1985). Collectively, these issues serve to cloud the diagnostic picture, often allowing individuals who

"talk a good game" to avoid formal assessment, diagnosis, and treatment of their cognitive deficits (Flores, 1988).

Comorbid Conditions with Alcohol Abuse

Along with the direct toxic and nutritional neuropathological consequences of alcohol abuse, there are a number of concomitant disorders that can also lead to cognitive impairment. Perhaps two of the most critical are other drug use and traumatic brain injury.

Other drug use. One of the most common drugs to be taken with alcohol is cannabis. It has been suggested that attention, psychomotor speed, and short-term memory are the domains most vulnerable to the effects of cannabis, but these disruptions have only been demonstrated in the short term (Pope, Gruber, & Yurgelun-Todd, 1995). For reasons that are currently unclear, the combination of alcohol and cocaine as drugs of choice may represent a particularly volatile pairing in terms of the neurocognitive sequelae.

A study by Cleaveland and Denier (1998) investigated the cognitive functioning of a group of alcohol and other drug abusers presenting for treatment. This group displayed attention/concentration capacities that were better than only 38% of the general population. As an average, they recalled only 5 digits as opposed to the typical 7 for digit span. Verbal comprehension, which was assessed using only a vocabulary measure, suggested that the group was performing near the 31st percentile of the normative sample. Verbal memory reflected considerable loss of material even during a brief five-minute delay, as patients retained only 57% of the information that they had originally been presented. Interestingly, abstraction scores for this patient group were within normal limits (46th percentile) as measured by the Shipley Abstraction Scale.

Traumatic brain injury. Traumatic brain injury and alcohol use are intricately related (Alterman & Tarter, 1985). Alcohol use prior to injury is the most frequently cited and best established predisposing factor in head trauma (Sparadeo & Gill, 1989). While the acute use of alcohol and drugs prior to head trauma is well established, more chronic substance abuse histories also appear more prevalent among individuals sustaining head injuries. Indeed, it has been argued that more than a third of head trauma victims are diagnosed as alcohol dependent (O'Shanick, Scott & Peterson, 1984). Moreover, alcohol abuse among individuals having a pre-injury pattern of abuse often continues following their trauma. The National Head Injury

Foundation (NHIF, 1988) found that approximately 40% of patients in post-acute rehabilitation facilities had moderate to severe problems with alcohol abuse.

A number of cognitive domains are most frequently compromised in TBI due to the nature of the neuropathology common to head trauma. Due to the positioning of the frontal lobes within the cranial vault, as well as the irregularities of the underlying surface of the skull, the frontal region of the cortex is quite vulnerable to the effects of head trauma. Importantly, however, the cognitive deficits associated with head trauma are often similar to those associated with chronic alcohol dependence (Bechara, Tranel, & Damasio, 2000; Grant, 1987). It has been hypothesized that the neuropsychological deficits found in alcohol-abusing individuals are the result of a number of factors, including head injury, that are cumulative and possibly interactive (Tarter & Edwards, 1986). The neuropsychological status of patients following head injury appears to be related both to the severity of the injury sustained and to the magnitude of pre-injury alcohol abuse (Dikmen, Donovan, Loberg, Machamer, & et al., 1993).

Impact on Treatment

As with the literature on psychiatric illness, studies evaluating the impact of substance-related cognitive deficits on the success of treatment of substance use disorders are quite rare. Nonetheless, because clear evidence exists associating cognitive impairments with substance use disorders, some authors have noted that cognitive deficits limit the understanding of treatment recommendations and the effectiveness of various therapeutic approaches, and thus require remediation. For example, Hesselbrock and colleagues suggested over ten years ago that "treatment programs be individualized to accommodate patients functioning at several cognitive levels" (Hesselbrock et al., 1985, p. 313). More recently, Cleaveland and Denier (1998) provided recommendations for modification of treatment interventions to increase understanding and compliance in persons with substance use disorders who have cognitive impairments.

Dual Diagnosis

As noted earlier, a fairly substantial body of research suggests that individuals who are dually diagnosed with mental illness and substance abuse or dependence tend to realize poorer treatment outcomes than those with either condition alone (Ridgely, Lambert, Goodman, Chichester, & Ralph, 1998; Young & Grella, 1998; Sacks, Sacks, De Leon, Bernhardt, & Staines, 1997; e.g., Bebout, Drake, Xie, McHugo, & Harris, 1997; Meisler, Blankertz, Santos, & McKay, 1997; Drake, Mueser, Clark, & Wallach, 1996). The high comorbidity rates between

these two types of diagnoses (Conner et al., 1995; Mowbray et al., 1995; Kessler et al., 1996; Regier et al., 1990) makes this problem even more significant. Given the evidence that mental illness and substance use disorders separately lead to cognitive impairments, it is likely that when these conditions co-occur, cognitive impairment will be a particular problem. This is even more likely when the individual also has an accompanying traumatic brain injury. Despite this, only a few studies have addressed the issue of the negative impact of cognitive deficits on the treatment outcomes of individuals with both mental illness and a substance use disorder (Cotman & Sandman, 1997; Clement, Williams, & Waters, 1993).

Section 2: Goals

We proposed to examine empirically the cognitive functioning of individuals with mental illness and chemical dependency, hypothesizing a range of cognitive dysfunction across three major areas: executive functions (e.g., problem-solving, verbal comprehension, abstract reasoning), attention, and memory. It was expected that a relationship existed between the nature and severity of cognitive disturbance and treatment outcome. We then proposed to test the impact of cognitive compensation skills training as a supplement to existing services at a substance abuse treatment program, using a two sample, experimental control group design.

Objectives

1. Determine the extent, nature, and impact of cognitive deficits in a population of individuals with mental illness and substance use disorders, some of whom carry a neurological diagnosis.
   (a) Examine the prevalence and nature of cognitive deficits overall, and within three major areas: executive functions, attention, and memory.
   (b) Determine the relationship of cognitive deficits to clinical, social, and vocational functioning at baseline assessment.
2. Test the effectiveness of supplementary Cognitive Compensation Skills Training (CCST) modules through implementation of the modules with participants.
   (a) Conduct content analysis of CCST modules utilizing expert opinion and field trials.
   (b) Implement CCST modules (12 weeks, 24 sessions) and continue standard treatment with individuals randomly assigned to the experimental CCST condition.
   (c) Measure changes in participants' cognitive skills and treatment responses between baseline and 12-week follow-up.

Hypotheses

1. Cognitive Functioning at Baseline

   (a) Participants will exhibit cognitive dysfunction across one or more of three major areas: executive functions, attention, and memory.

   (b) The severity of cognitive deficits will be negatively correlated with clinical, social, and vocational functioning, and positively correlated with severity of past and current substance abuse and with severity of mental illness.

2. Cognitive Change at 12-Week Follow-up

   (a) Participants completing the series of 24 CCST modules will demonstrate improved cognitive functioning and greater knowledge of cognitive compensation strategies, relative to their own performance at baseline;

   (b) Participants completing the series of 24 CCST modules will demonstrate improved cognitive functioning and greater knowledge of cognitive compensation strategies, relative to participants in control group.

3. Relationship of Cognitive Change to Treatment-Related Variables

   (a) Participants completing CCST modules will demonstrate treatment improvement, including less use of alcohol and other drugs and lower levels of psychiatric symptoms, as well as higher therapist ratings and self-perceptions of functioning and increased levels of life satisfaction, at 12-week follow-up.

   (b) Participants completing CCST modules will demonstrate greater levels of treatment improvement relative to participants in control group, including less use of alcohol and other drugs and lower levels of psychiatric symptoms, as well as higher therapist ratings and self-perceptions of functioning and higher levels of life satisfaction.

Instruments

The instrumentation of the study involved several neuropsychological measures, alcohol and drug use severity ratings, determinations of mental health status, and measures of satisfaction with life. The full instrument battery took approximately 2 ½ hrs to administer, and this was accomplished in two or more sessions at CAM (See full list of instruments in Appendices). The study as originally proposed was to be based solely within the outpatient CAM program in Dayton; however, a subsequent change in order to enlist more participants involved recruitment at the NOVA House Dual Diagnosis residential program in this same city. Due to limited time

available for intakes, and scheduling requirements for research staff, only the neuropsychological instruments were utilized with the NOVA House residents. The differences in data availability, where applicable, are so noted in the Results section of this report. The primary instruments for quantifying cognitive impairments involved a battery of seven neuro-cognitive measures, on both a pre-test and post-test basis, with the participants. Those seven measures were chosen based upon their perceived emphasis in regard to three major areas of the cognition process which previous research suggests are impacted by substance use/abuse. These neuropsychological measures are as follows.

MEASURES/TESTS	PERCEIVED AREA OF PRIMARY COGNITIVE EMPHASIS
Brief Test of Attention (BTA)	**Attention**
Ruff 2 & 7 Test	**Attention**
Trail Making Test	**Executive Functioning**
Revised Token Test	**Executive Functioning**
Ravens Coloured Progressive Matrices Test	**Executive Functioning**
Rey Complex Figure Test (RCFT)	**Memory**
Rey Auditory Verbal Learning Test (RAVLT)	**Memory**

Section 3: Results

This segment of the report is concerned with (a) describing the subjects who participated in the field trial and (b) addressing the set of six hypotheses posed in the original application to the Ohio Department of Mental Health. Each of the designated hypotheses is evaluated in turn and the related analyses summarized on a hypothesis-by-hypothesis basis in the sections that follow. Although this study was originally conceptualized as a pilot investigation of several aspects of the CCST concept, the analyses were conducted at a high level of specificity and rigor in order to fully discern potentially useful findings that could inform subsequent iterations of the study.

Who Were the Subjects in the Study?

As indicated earlier, the study was to originally involve only clients in the CAM outpatient treatment program who had a DSM diagnosis of some form of mental illness, along with a co-existing substance abuse problem. However, since this selection rule did not result in recruitment of an adequate number of clients during the initial half of the study, the rule was subsequently altered (with permission of the sponsor). Under the revised eligibility guidelines

two major changes occurred - (a) subjects were recruited from a local residential treatment program as well as from the CAM program (outpatient treatment) and (b) some subjects were included who did not have mental illness, per se, as a primary co-existing disability. While these alterations in eligibility criteria, along with several other modifications such as the participant reimbursement schedule, resulted in securing the projected numbers of subjects for the study, those changes had several implications in regard to the project database. More specifically, the 38 subjects recruited from the residential treatment program did not have the same breadth of data collected on them as did the 117 subjects in the CAM program. Therefore, the analyses that follow will on occasion involve the total combined sample of 155, and will on others only relate to the 117 CAM clients. On balance, to the extent possible, greater emphasis is placed on analyses of variables available across the combined participant sample.

Several basic demographic and background characteristics were collected on all participants in the study. A summary of the sample in terms of that limited set of demographic/background variables is presented in Table 1. The information provided in Table 1 suggests the following:

TABLE 1

Selected Demographic/Background Characteristics of Participants in the Study

DEMOGRAPHIC CHARACTERISTIC	DESCRIPTIVE STATISTICS	GROUPS: (A) CAM – Outpatient (n = 117)	(B) Residential (N = 38)	(C) Total Sample (n = 155)
Gender	% Female	33.3%	32.4%	32.9%
	% Male	66.7%	67.6%	67.1%
Age	Mean	37.8 Yrs.	39.2 Yrs.	38.0 Yrs
	Standard Deviation	9.4	9.3	9.3
Race/Ethnicity	% White	56.9%	59.5%	57.8%
	% African-American	43.1%	40.5%	42.2%
	% Other Minority	0.0%	0.0%	0.0%
Education Level	% 12th Grade or Less	43.6%	48.6%	45.2%
	% 12th Grade or GED	37.6%	18.9%	32.9%
	%More Than 12th Grade	18.8%	32.4%	21.9%
Employment Status	% Employed Full/Part Time	9.6%	---	---
	% Not Working - Seeking	42.3%	---	---
	% Not Working - Not Seeking	27.9%	---	---
	% Other Status	20.2%	---	---
Marital Status	% Single/Never Married	48.1%	---	---
	% Divorced/Sep/Widowed	37.7%	---	---
	% Married/Cohabitating	14.2%	---	---

- Roughly 1/3 of the subjects were female, with 2/3 being male, and these proportions were approximately the same across the outpatient and residential programs.
- On average the subjects were about 38 years old, with those in the residential program being slightly older, but not significantly older, than the CAM subjects.
- About 58% of the subjects were White/Caucasian, with the remaining 42% being African American, and the racial/ethnic composition of the residential and outpatient subjects were the same.
- Overall about 45% of the combined sample had not graduated from high school, 33% graduated from high school or completed a GED, while 22% completed some training beyond the 12^{th} grade, and although the education level of the residential subjects appeared to be a little higher than that of the CAM subjects the difference was not statistically significant.
- Only 10% of the subjects for whom data were available were working (either full or part time), while over 70% were unemployed (Note: While these data were only available for the CAM clients, since the second sub-sample was from a residential program it is likely that an even smaller proportion of that group would be employed.)
- Almost half of the sample for which data were available were single, never married, 38% were divorced/separated/widowed, and only 14% were married or cohabitating.

In summary, with regard to the available background/demographic data it would appear that the sample of subjects from the CAM - outpatient program and the residential program, respectively, were similar.

Since the focus of the study was upon individuals with a dual diagnosis, i.e., a substance abuse problem and co-existing disability (which in many cases was mental illness), virtually all of the subjects had a substance abuse problem of one sort or another. A brief overview of the substance use/abuse patterns of the subjects is presented in Table 2.

The descriptive statistics summarized in Table 2, along with related statistical tests, indicate the following:

- About 23% of the combined sample reported consuming alcohol in the last 30 days (which is significantly lower than the 57.7% reported for the general population as part of the National Household Survey), but the rate of use for the CAM subjects was significantly

higher than the usage rate for subjects from the residential program (where complete abstinence in required).

TABLE 2

Overview of Subjects' Substance Use/Abuse Patterns at Entry into the Study

SUBSTANCE USE INDICATOR	STATISTICS	*GROUPS: (A) CAM – Outpatient (n = 117)	(B) Residential (N = 38)	(C) Total Sample (n = 155)
Prevalence of Alcohol Use in Past 30 Days	% Yes	**29**	**7**	23
	% No	**71**	**93**	77
Prevalence of Other Drug Use In Past 30 Days	% Yes	**25**	**7**	21
	% No	**75**	**93**	79
Number of Days in Past 30 Used Alcohol	Mean	**2.30**	**0.14**	1.74
	Standard Deviation	5.59	0.52	4.91
Number of Days in Past 30 Used Other Drugs	Mean	**1.75**	**0.54**	1.53
	Standard Deviation	4.63	2.32	4.24
Number of Times in Past 9 Mo. Treated for Alcohol Problems	Mean	1.90	2.11	1.96
	Standard Deviation	5.18	5.00	5.06
Number of Times in Past 9 Mo. Treated for Drug Problems	Mean	**2.16**	**2.57**	2.27
	Standard Deviation	5.50	4.92	5.27
Addiction Severity Index (ASI) Alcohol Use Score	Mean	0.17	0.15	0.17
	Standard Deviation	0.15	0.15	0.15
Addiction Severity Index (ASI) Drug Use Score	Mean	0.08	0.09	0.08
	Standard Deviation	0.10	0.06	0.09

* The groups differ significantly (Test Statistics - X^2 and Mann-Whitney Z; $\alpha = .05$) on the statistics shown in **bold**.

- About 21% of the combined sample reported using illegal drugs in the last month (which is significantly higher than the 9.2% reported for the general population of adults as part of the National Household Survey), but the rate of use for the CAM subjects was significantly higher than the rate reported by subjects in the residential program.
- The number of days in the past month during which alcohol and drugs were used were significantly higher for CAM clients than for the clients of the residential program, which reflects the differences in prevalence rates noted above.
- Overall the subjects reported receiving treatment for their alcohol problems about 2 times during the previous 9 months, with the numbers of such treatments being received by the CAM and residential program consumers being about the same.

- On average the overall sample reported receiving 2.25 treatments for drug problems over the past 9 months, however, the average number of such treatments received by the residential subjects was significantly greater than the number of treatments reported by CAM subjects.
- While the average "Alcohol Use Score" on the Addiction Severity Index (ASI) was higher than the corresponding ASI "Drug Use Score" for the overall group of subjects, the residential and outpatient subjects did not differ much on either measure.

The second component of the dual diagnoses for study participants dealt with their other co-existing disability(ies). As noted earlier, the initial intent was to recruit subjects with some form of mental illness, but this was not possible given the number of such referrals to CAM and the temporal constraints associated with the study. Therefore, subjects with other co-existing disabilities were also recruited during the last 1 1/2 years of the project. A brief overview of the kinds of co-existing disabilities reported by/for the study's participants is provided in Table 3.

A review of the information in Table 3 indicates the following:

- Basically, just over 60% of the participants in the study were diagnosed as having a mental illness and the proportion of such participants in the residential program was significantly higher (84%) than the corresponding proportion in the outpatient (CAM) program (54%).
- Although the subjects from the residential and outpatient programs did not appear to differ much in regard to their overall ratings on the Brief Psychiatric Rating Scale (BPRS), they did appear to differ with regard to the "Sense of Helplessness & Hopelessness" they reported - the expression of hopelessness/helplessness voiced by the CAM subjects was significantly higher than that raised by subjects housed in the residential program.
- While it was not possible to evaluate all the subjects on the "Other Conditions" cited, it appears that about 31% of the CAM clients reported having a physical disability, while 35% reported having a speech impairment, 17% reported having a hearing impairment, 9% reported having a visual problem, and 10% reported that they were suicidal.

Overall, the results presented in Table 3 suggest that the subjects from the outpatient and residential program differed somewhat in regard to the nature of their co-existing disabilities. Those data also suggest what the co-existing disabilities may be for those subjects not classified as mentally ill.

Hypothesis 1(a) - Participants will exhibit cognitive dysfunction across one or more of three major areas: executive functioning, attention, and memory.

As noted in the background materials presented earlier, the study involved administering a battery of seven neuro-cognitive measures, on both a pre-test and post-test basis, to the participants. Those seven measures were chosen based upon their perceived emphasis in regard to three major areas of the cognition process which previous research suggests are impacted by substance use/abuse. Those seven measures and the cognitive areas to which they are deemed to be most directly related are as follows.

TABLE 3

Types of Co-Existing Disabilities Reported by/for the Study Participants

NATURE OF CO-EXISTING DISABILITY	STATISTICS	*GROUPS: (A) CAM – Outpatient (n = 117)	(B) Residential (N = 38)	(C) Total Sample (n = 155)
Mental Illness	% Yes	**53.8%**	**84.2%**	61.3%
	% No	**46.2%**	**15.8%**	38.7%
Brief Psychiatric Rating Scale				
- Total Score	Mean	28.09	27.42	27.92
	Standard Deviation	7.02	5.17	6.60
- Sense of Helplessness & Hopelessness	Mean	**2.16**	**1.63**	2.03
	Standard Deviation	1.27	0.85	1.20
Other Conditions ---				
- Severely Mentally Disabled	% Yes	13%	---	---
- Developmentally Disabled	% Yes	9%	---	---
- Mental Illness/Retardation	% Yes	16%	---	---
- Deaf/Hearing Impaired	% Yes	17%	---	---
- Blind/Visually Impaired	% Yes	9%	---	---
- Physically Disabled	% Yes	31%	---	---
- Speech Impaired	% Yes	35%	---	---
- HIV/AIDS	% Yes	3%	---	---
- Suicidal	% Yes	10%	---	---

* The groups differ significantly (Test Statistics - X^2 and Mann-Whitney Z; $\alpha = .05$) on the statistics shown in **bold**.

MEASURES/TESTS	PERCEIVED AREA OF PRIMARY COGNITIVE EMPHASIS
Brief Test of Attention (BTA)	**Attention**
Ruff 2 & 7 Test	**Attention**
Trail Making Test	**Executive Functioning**
Revised Token Test	**Executive Functioning**
Ravens Coloured Progressive Matrices Test	**Executive Functioning**
Rey Complex Figure Test (RCFT)	**Memory**
Rey Auditory Verbal Learning Test (RAVLT)	**Memory**

The seven measures listed above yielded 14 scores, which served as part of the set of criterion variables used in the study. Those 14 criteria (and the related "labels" used in subsequent analyses) were as follows:

- Brief Test of Attention - Total Score (BTA Total Score)
- Ruff 2 & 7 Test - Total Speed Score (Ruff Speed Score)
- Ruff 2 & 7 Test - Total Accuracy Score (Ruff Accuracy Score)
- Trail Making Test - Time to Complete Part A (in seconds) (Trail Part A Time)
- Trail Making Test - Time to Complete Part B (in seconds) (Trail Part B Time)
- Revised Token Score - Total Score (Token Total Score)
- Ravens Coloured Progressive Matrices - Total Score (Raven Total Score)
- Rey Complex Figure Test - Copy Total Score (RCF Copy Score)
- Rey Complex Figure Test - Immediate Recall Score (RCF Immediate Recall)
- Rey Complex Figure Test - Delayed Recall Score (RCF Delayed Recall)
- Rey Auditory Verbal Learning Test - Total Recall Score (RAVLT Total Recall)
- Rey Auditory Verbal Learning Test - Immediate Recall Score (RAVLT Immediate Recall)
- Rey Auditory Verbal Learning Test - Delayed Recall Score (RAVLT Delayed Recall)
- Rey Auditory Verbal Learning Test - Recognition Score (RAVLT Recognition)

In order to evaluate this initial hypothesis, one of the first tasks undertaken was to compare the initial ("pre") set of criteria scores observed for the participants in the study with available normative data. More precisely, each criterion score was converted into a normative- based percentile value that was then evaluated at or below the 10^{th} percentile (deemed to reflect a cognitive dysfunction) or above the 10^{th} percentile (deemed to not be reflective of a cognitive dysfunction). The results of this initial set of transformations is summarized in Table 4. Those results clearly show the levels of cognitive functioning of the participants in the study on the designated criteria were well below the levels represented by the available normative samples in all but one instance - that being performance represented by the RAVLT Recognition Score. On the first 13 indicators an average of about 34% of the participants scored at or below the 10^{th} percentile dictated by their associated norms. In the case of the RAVLT Recognition criterion 2.6% scored at or below the 10^{th} percentile. In general, these results suggest that at the time of entry into the study the cognitive performance of the subjects was depressed, i.e., substantially lower than the levels of performance reflected by the respective normative samples.

The results, reflected by the Cochran's Q-Test at the end of Table 4, indicate that the proportions of "impaired" persons across the 14 cognitive criteria are not equal. Pairwise contrasts among the observed proportions indicate that the subjects' "impairments" fall into three basic categories - see Figure 1. (At the same time, however, the set of three complex post hoc contrasts comparing the average rate of impairment for Attention (29.8%), average rate of impairment for Executive Functioning (36.4%), and average rate of impairment for Memory (30.3%) yielded no significant results. That is, the average rate of impairment observed across the three cognitive areas did not differ significantly. Thus, the significant overall statistical test, operationalized via the reported value for Cochran's Q Test, was probably due more to discrepancies in rates of impairment across the pairs of criteria than to differences in average rates of impairment across the three cognitive areas being addressed.

Table 4

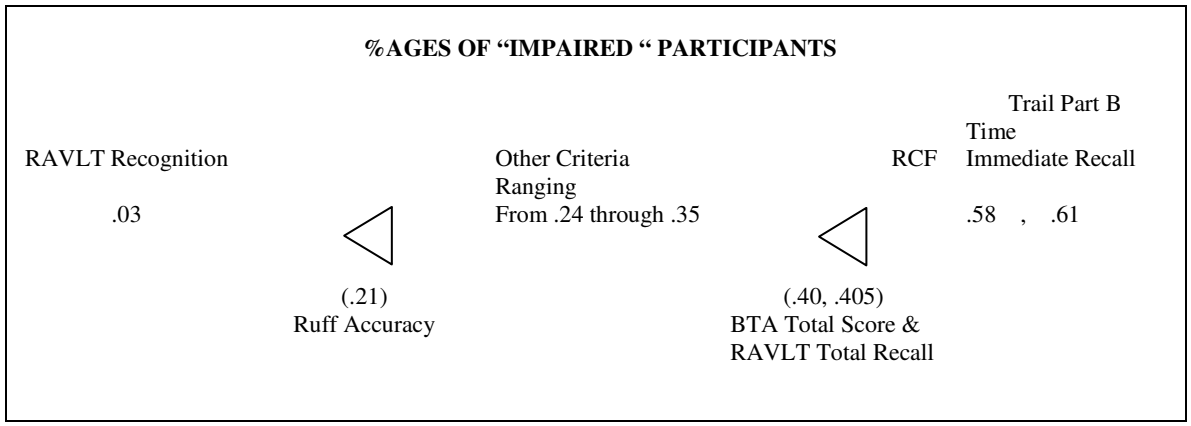
Observed Levels of "Impairment" Across the 14 Selected Cognitive Criteria

COGNITIVE AREA	CRITERION VARIABLE	Normative %ile Used to Denote "Impaired"	Observed % of Study Participants Falling in the "Impaired" Range
Attention	Brief Test of Attention (BTA) Total Score	9th	40.0%
	Ruff 2 & 7 Test - Total Speed Score	10th	28.0%
	Ruff 2 & 7 Test - Total Accuracy Score	10th	21.3%
Executive Functioning	Trail Making Test - Part A Time	10th	34.9%
	Trail Making Test - Part B Time	10th	60.9%
	Revised Token Test - Total Score	9th	25.3%
	Ravens Progressive Matrices Test - Total Score	10th	24.5%
Memory	Rey Complex Figure Test (RCF) - Copy Score	10th	29.6%
	RCF - Immediate Recall Score	10th	58.1%
	RCF - Delayed Recall Score	10th	26.3%
	Rey Auditory Verbal Learning Test (RAVLT)		
	- Total Recall Score	10th	40.5%
	- Immediate Recall Score	10th	25.5%
	- Delayed Recall Score	10th	29.4%
	- Recognition Score	10th	2.6%

Cochran's Q Test = 231.99, which is significant at $\alpha = .0001$ level with df = 13.

Figure 1

Overview of Pairwise Differences* Among Cognitive Criteria



* Significant differences indicated by sets of proportions separated by "◁ s".

Although the analyses summarized in Table 4 and Figure 1 are of interest, they do not directly address Hypothesis 1(a). As a first step in addressing that hypothesis the numbers of subjects who exhibited "impairments" in none, one, two, or three of the cognitive areas – Attention, Executive Functioning, and Memory - needed to be determined. Then, those data, i.e., frequencies by category, could be contrasted with the frequencies "expected" under the null form of the hypothesis - that is, "Participants will exhibit no cognitive dysfunction scores across any of the three major areas of cognition." (Note: If one assumes that "impairments" are unrelated, then the expected percentages of cases one might expect to observe under the null form of the hypothesis would be 70% (none), 10% (one), 10% (two), 10% (three), which would reflect the use of the normative-based 10^{th} percentiles when generating the "impairment" indicators.) The results associated with this analysis are summarized in Table 5.

The results shown in Table 5 clearly support hypothesis 1(a). Namely, the participants in the study did exhibit cognitive dysfunctions across one or more of the three cognitive areas specified --- Executive Functioning, Attention, and Memory. For that matter, over 40% of the subjects exhibited "impairments" across all three cognitive areas. Related descriptive data revealed that roughly 37% of the subjects had an attention-related "impairment", 74% had a Executive Functioning "impairment", and 73.5% had a memory "impairment". While these percentages may be somewhat erroneous (due to the disproportionate numbers of tests falling in each area (i.e., 3,4, and 7), they still, never the less, serve to roughly order the three areas of cognitive functioning in regard to prevalence of impairment.

Table 5

Evaluating the Null Form of Hypothesis 1(a)

DEPENDENT VARIABLE	RESPONSE CATEGORIES	NUMBERS OF CASES OBSERVED BY CATEGORY*		TEST STATISTIC
Number of Cognitive Areas in Which an Impairment Was Observed	0 (No Impairments Noted)	11	(7.1%)	$X^2 = 240.1$ ($p < .000$)
	1 (Impairment in One Cognitive Area Only)	34	(21.9%)	
	2 (Impairments in Two Cognitive Areas)	47	(30.3%)	
	3 (Impairments in Three or More Cognitive Areas)	63	(40.6%)	

* The reported X^2-Value is based on the "expected frequencies" given the null hypothesis described above.

Hypothesis 1(b) - Cognitive deficits will be negatively correlated with clinical, social, and vocational functioning, and positively correlated with past and current substance abuse and with severity of mental illness.

This particular hypothesis was modified slightly to better reflect the operational realities inherent in the study. More specifically, "severity of cognitive deficits" was changed to "cognitive deficits" due to the limitations in the data that would not allow for the meaningful definition of "severity". The operational definitions used to denote "cognitive deficits" are the same as those used to denote "cognitive dysfunctions" in regard to the previous hypotheses, i.e., if an individual's observed score on a particular cognitive measure transformed into a percentile value $\leq$ the 10^{th} percentile in relation to the normative sample for that measure, the individual was noted as being "impaired" on the indicator in question. In addition, the term "severity" was also removed as a descriptor of past and current substance abuse. Again, this change was necessitated by the nature of the related data available as part of the study.

Given the preceding, it should be noted that "cognitive deficits" as defined are dichotomous variables - 1= deficit, 0= no deficit. As a result, the correlations between those variables and the other sets of variables mentioned in the hypothesis will be attenuated somewhat from what they might have been if the variables in question were continuous in nature. However, since hypothesis 1(b) is concerned more with the "direction" of the relationships between subjects' "cognitive deficits" and their clinical, social, vocational functioning, substance use/abuse, and severity of mental illness, the indicated constraints on the magnitude of the observed relationships were not treated as a major concern.

For the purpose of this hypothesis clinical, social, vocational functioning, substance use/abuse, and severity of mental illness were operationally defined by the following clusters of

variables: Background/Demographic, Substance Use/Abuse Indicators, Health and Disability Issues, Legal Issues, Employment, and Psycho/Social Indicators. The specific variables included in each cluster along with their correlations with each of the 14 criterion-related "impairment" indicators are summarized in Table 6. (When reviewing that correlation matrix, it should be remembered that some of the correlations shown are based upon the total study sample, while others are based upon just the subjects in the CAM (outpatient) program due to the limitations in the database described earlier.)

As should be obvious from a review of the information presented in Table 6, the statement of the hypothesis is too general. That is, the scaling of several of the designated variables is such that negative correlations with the cognitive deficits would be expected (e.g., Satisfaction With Life Scores), but other variables of the same type are scaled so that positive correlations with cognitive deficits would be expected (e.g., Brief Psychiatric Rating Scale where a "high" score signals a "problem"). This issue was addressed in the manner shown in Table 7 - see Column 3. Furthermore, the null form of the hypothesis was evaluated - that is, it was assumed that the numbers of positive and negative correlations observed for each variable would be approximately equal and only when they deviated statistically from that assumption in the direction dictated by the hypothesis would they be viewed as supporting hypothesis 1(b).

The information regarding the relationships between "cognitive deficits" and the selected Demographic/Background variables suggests that such variables could be important in predicting cognitive deficits (even though they were not actually part of Hypothesis 1(b)). In particular, Race/Ethnicity, Age, Education Level, and "Live in Own Place" (e.g., apartment/home vs. living with someone else or in a communal situation) were all related to observed deficits in cognitive test scores. Perhaps the most surprising of these results was that dealing with "Living in Own Place", which although logical would probably not be predicted to have as strong of a relationship as some of the other variables considered.

With regard to the substance use/abuse variables Hypothesis 1(b) was not supported. Only one variable, "Used Alcohol During Life", out of the 14 considered was shown to be

Table 6

Correlation* Matrix: Cognitive Deficits with Background/Demographic, Substance Use/Abuse, Health/Disability, Legal, Employment, and Psycho-Social Variables

		DEFICITS:													
		Attention			Executive Functioning				Memory						
CLUSTER	SPECIFIC VARIABLES	BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
Background & Demographics	Gender (Male = 1 Female = 2)	**-.24**	-.15	+.09	**-.19**	-.08	-.06	+.11	-.06	+.03	+.06	+.02	-.09	-.08	+.06
	Race/Ethnicity (1 = White, 2 = African-American)	**+.23**	+.14	+.15	+.09	**+.23**	**+.23**	+.03	+.14	+.12	+.08	**+.23**	+.10	+.02	-.06
	Age (in Years)	+.15	+.08	+.07	+.14	**+.28**	+.07	-.09	+.11	-.06	+.14	**+.18**	+.03	+.01	-.09
	Education Level (1 = <12th, 2 = 12th or GED, 3 = > 12th)	**-.20**	**-.17**	-.14	-.08	**-.24**	**-.17**	**-.16**	**-.28**	-.09	-.03	-.07	-.08	-.06	-.01
	Single? (Yes = 1, No = 0)**	+.19	-.01	+.05	+.03	-.04	-.01	+.04	-.01	-.06	**-.21**	+.02	+.03	-.03	+.01
	Number of Children (None = 0, One = 1, Two or More = 2)**	**-.21**	+.08	-.04	-.17	-.17	+.02	-.02	-.00	-.03	-.06	+.12	+.04	+.08	-.09
	Live in Own Place? (Yes = 1, No = 0)**	-.12	-.02	-.07	-.00	+.12	-.05	-.10	-.05	-.13	+.01	+.03	-.09	-.10	-.14
Substance Use or Abuse Indicators	Used Alcohol During Life (Yes = 1, No = 0)**	+.06	+.20	-.02	+.19	+.07	+.07	+.21	+.17	+.12	+.10	+.08	+.19	+.13	-.08
	Used Drugs During Life (Yes = 1, No = 0)**	-.01	+.08	-.15	-.10	-.07	-.02	+.01	+.04	+.06	-.07	+.01	-.01	-.09	-.06
	Used Alcohol Last 30 Days? (Yes = 1, No = 0)	+.16	+.02	+.14	**+.19**	-.02	-.01	+.11	+.02	-.01	+.00	-.12	-.09	-.11	-.11
	Used Drugs in Last 30 Days? (Yes = 1, No = 0)	+.11	+.07	-.02	-.05	+.12	-.10	+.02	+.04	+.17	-.05	-.11	**-.25**	**-.20**	-.10
	# Days Used Alcohol in Past 30?	+.14	-.06	+.11	+.06	-.03	+.05	+.11	+.11	+.02	-.04	-.05	-.11	-.01	-.07
	# Days Used Drugs in Past 30?	+.09	-.01	+.11	-.15	+.03	-.02	+.09	+.16	**+.19**	-.04	-.03	-.17	-.09	-.07
	ASI Alcohol Use Score (0 to 1)	+.11	+.07	+.09	+.11	+.00	-.05	+.04	+.01	+.00	-.02	+.07	-.10	+.11	-.01
	ASI Drug Use Score (0 to 1)	+.00	**-.24**	-.01	-.14	-.11	+.09	+.01	+.12	+.04	-.14	+.04	-.18	+.00	-.04
	# Times Had Alcohol DT's	-.04	-.03	**+.21**	+.12	+.02	+.05	-.00	+.06	+.03	+.09	+.11	-.02	+.12	+.05
	# Times Overdosed on Drugs	-.11	-.11	+.17	**-.20**	**-.21**	-.09	-.09	-.10	**-.21**	-.10	-.08	-.06	-.06	+.11

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 6 - Continued

		DEFICITS:													
		Attention			Executive Functioning				Memory						
CLUSTER	SPECIFIC VARIABLES	BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
	Admitted to Hospital forAlcohol/Drugs in Last 9 Months? (Yes = 1, No = 0)	+.04	+.03	-.07	+.04	-.10	+.03	-.04	-.01	-.08	+.06	+.04	-.01	-.01	+.15
	# Times treated for Alcohol Problems in Last 9 Months	+.10	+.11	+.02	+.14	+.13	-.03	-.09	-.03	-.02	-.11	+.05	+.09	+.14	+.05
	# Times treated for Drug Problems in Last 9 Months	+.04	-.01	-.00	+.07	+.01	-.05	-.16	-.07	-,02	-.06	-.02	+.03	+.03	-.02
	MAST (Alcohol) Score**	-.03	-.01	-.12	+.02	-.09	+.06	+.14	-.02	-.07	+.12	+.03	+.01	-.00	+.09
Health & Dis-Ability Issues	Number of Prior Tx Episodes	+.05	-.08	+.03	-.06	-.18	**+.21**	-.03	-.02	-.02	+.07	+.00	-.07	-.08	-.00
	Mental Health History? (Yes = 1, No = 0)**	+.06	-.04	-.05	+.03	+.07	+.06	+.05	+.01	-.08	-.05	-.05	**-.19**	-.06	-.08
	Mental Illness Indicator (Yes = 1, No = 0)	+.05	-.08	-.02	-.01	-.00	-.03	+.05	+.04	-.03	+.02	+.05	-.06	+.04	+.05
	Severity of Mental Illness – from charts (0 to 5 Scale)	+.05	-.02	+.01	+.02	+.02	+.00	+.11	+.06	+.02	+.05	+.07	-.02	+.06	+.01
	Severity of Mental Illness Rating (0 = Normal to 7 = Severe)	-.04	+.08	+.17	+.15	+.12	-.10	-.01	+.04	-.08	+.02	+.06	-.04	+.06	-.08
	ASI Psychiatric Score (0 to 1)**	+.08	-.00	-.02	+.04	-.05	+.08	+.01	-.00	-.03	-.09	-.07	-.15	-.07	+.00
	Deaf/Hearing Impaired (Yes = 1)**	-.12	+.05	-.07	+.16	+.09	+.06	+.07	+.04	+.10	+.06	-.13	-.09	+.06	-.02
	Blind/Visually Impaired (Yes = 1)**	+.04	+.14	-.03	+.11	+.10	-.04	-.10	-.14	+/03	+.05	-.12	-.18	-.04	-.04
	Developmentally Disabled (Yes = 1)**	**-.19**	-.01	+.08	-.13	-.01	.-09	+.14	+.12	+.16	+.09	+.07	+.03	+.03	-.12
	Physically Disabled (Yes = 1)**	+.17	**+.37**	+.08	+.03	+.14	+.02	+.07	**+.19**	+.10	**+.19**	+.16	+.15	+.15	+.01
	Suicidal (Yes = 1)**	-.02	**+.25**	+.11	+.05	+.06	+.05	+.16	+.11	|+.13	+.15	-.02	-.09	+.07	-.06
	Suffered TBI (Yes = 1, No = 0)**	+.01	+.04	+.11	+.03	_.04	+.00	+.03	+.10	+.07	-.02	+.06	+.08	+.06	-.12
Legal Issues	# of Arrests**	+.03	+.10	-.01	+.05	-.06	**+.20**	+.01	-.04	+.11	+.00	-.01	-.01	+.00	-.00
	Months in Jail - Lifetime**	+.13	+.13	-.07	-.07	+.05	+.08	+.12	+.09	+.01	+.04	-.08	+.08	+.02	+.06
	Days in Jail -Past Month**	+.10	+.02	+.02	+.10	+.10	+.10	-.03	-.15	+.02	+.01	+.10	**+.32**	**+.30**	-.03

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 6 - Continued

		DEFICITS:												
		Attention			Executive Functioning				Memory						
CLUSTER	SPECIFIC VARIABLES	BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
	# Illegal Acts -Past Month**	-.10	+.13	**+.21**	-.10	+.07	-.07	+.15	+.12	+.06	-.07	-.10	-.07	-.08	-.02
	Rating of Legal Problems (None = 0 to Extreme = 4)**	+.02	-.00	+.09	+.01	-.08	+.06	+.09	-.10	+.05	-.10	-.06	-.07	-.01	-.03
	ASI Legal Status Score (0 to 1)**	+.04	-.03	+.08	-.02	-.00	+.08	+.14	+.03	+.02	-.12	-.05	-.08	-.01	-.10
	Convicted of DUI/DWI? (Yes = 1)**	+.05	-.10	-.17	+.08	+.01	-.02	+.03	-.08	+.05	+.02	-.10	-.02	-.01	+.04
Employment Related Indicators	Employed? (Yes = 1, No = 0)**	-.01	-.16	-.11	-.12	+.01	**+.21**	+.01	+.11	-.07	+.10	+.10	-.01	+.08	-.06
	ASI Employment Status Score (0 to 1)**	+.05	+.17	**+.23**	**+.32**	+.04	+.08	-.08	+.03	+.08	+.02	+.00	-.02	+.02	-.04
	Monthly Income**	+.07	+.03	-.05	+.00	+.07	-.00	+.09	+.02	+.08	+.05	**+.25**	**+.30**	**+.24**	+.02
Psycho-Social Indicators	Quality of Life - Self-Esteem/Well-Being (Low = 1 to High = 5)	+.06	+.07	-.07	+.04	+.08	**+.17**	**+.18**	+.08	+.07	+.08	+.11	**+.20**	+.01	+.05
	Quality of Life - Spiritual (1 to 5)	+.05	+.08	-.08	+.08	+.07	**+.23**	+.07	+.12	-.05	+.05	**+.17**	+.10	-.00	**+.16**
	Quality of Life - Interpersonal Attachment (1 to 5)	+.08	+.10	-.10	+.08	+.08	+.11	**+.20**	+.05	+.09	+.01	+.05	+.09	+.06	+.14
	Quality of Life - Avocational (1 to 5)	+.04	+.02	+.02	+.02	+.01	+.09	+.09	-.03	-.02	+.00	+.14	+.12	+.05	+.06
	Quality of Life - Economics or Basic Needs (1 to 5)	+.09	+.10	-.07	+.06	**+.19**	+.13	**+.16**	+.15	+.12	+.12	+.11	**+.25**	+.11	+.01
	Satisfaction with Life Score	+.08	-.13	+.09	-.07	-.02	+.15	+.09	-.00	-.15	-.09	+.04	**+.25**	-.06	+.10
	Brief Psychiatric Rating Score	+.03	+.10	+.04	+.08	+.05	-.03	+.05	+.07	+.02	+.02	+.00	-.03	+.06	-.06
	CIQ - Home Integration**	**-.24**	-.13	+/01	-.15	+.05	-.05	-.07	+.00	-.13	-.06	+.14	-.05	-.00	-.10
	CIQ - Social Integration**	-.05	+.07	+.02	+.08	+.00	-.10	+.11	-.18	-.11	-.15	+.00	**-.20**	-.04	-.06
	CIQ - Productivity**	+.02	-.17	-.16	+.12	+.08	+.13	-.07	+.05	-.06	+.07	+.05	+.10	**+.22**	+.09
	SF36 – Physical Functioning**	-.07	-.03	-.12	+.15	-.17	+.14	+.02	-.11	-.09	-.06	+.05	-.14	+.06	+.07
	SF36 - Role(Physical)**	+.14	+.03	+.13	+.17	+.08	+.14	+.15	-.06	+.09	+.00	+.19	+.03	+.05	+.01
	SF36 - Bodily Pain**	**+.25**	**+.21**	-.05	**+.28**	+.02	+.17	**+.24**	+.05	+.10	+.02	**+.23**	+.14	+.16	+.13

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 6 - Continued

CLUSTER	SPECIFIC VARIABLES	DEFICITS: Attention: BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Executive Functioning: Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	Memory: RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
	SF36 - General Health**	+.11	+.10	-.07	+.17	+.04	+.12	+.15	-.00	-.04	-.04	**+.22**	+.15	+.07	+.14
	SF36 - Vitality**	**+.22**	**+.20**	-.06	+.11	+.13	**+.20**	+.12	+.09	+.05	+.02	**+.26**	+.12	+.11	+.15
	SF36 - Social Functioning**	+.07	+.13	-.11	+.11	+.09	+.16	+.18	+.09	-.05	+.03	**+.31**	+.17	+.13	**+.21**
	SF36 - Role (Emotional)**	+.12	-.06	-.05	-.11	+.03	+.00	+.05	+.11	+.06	+.06	+.15	+.11	+.03	+.13
	SF36 - Mental Health**	+.09	+.08	-.02	+.09	+.02	+.15	+.13	+.06	+.08	+.17	+.17	+.11	+.08	+.16
	SF36 - Health Transition Over Last Year (Much Better = 1 to Much Worse = 5)**	+.12	+.05	-.03	+.05	**+.20**	**+.29**	+.18	**+.24**	-.13	+.05	**+.21**	+.02	+.05	+.08
	ASI Family/Social Relationships (0 to 1)**	-.14	-.08	-.10	+.10	-.01	+.14	+.18	+.08	+.02	-.14	+.04	-.09	+.05	-.02
	Sexual Abuse Victim (Yes = 1)**	-.11	-.08	+.01	**-.26**	-.03	-.10	+.02	-.06	-.06	-.11	-.08	**-.23**	-.13	+.02
	Physical Abuse Victim (Yes = 1)**	-.05	-.16	-.02	**-.21**	-.04	-.09	+.07	-.02	-.09	-.11	+.03	-.13	-.08	+.01
	Child of Addict/Alcoholic (Yes = 1)**	-.06	+.03	**+.21**	+.00	+.01	+.09	+.05	+.08	+.02	-.10	+/07	-.04	+.07	-.03
	High School Dropout (Yes = 1)**	+.03	+.12	+.10	+.04	+.15	+.11	+.08	+.15	+.07	+.10	+.14	-.04	+.07	+.08

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 7

Summary of Statistical Analyses Related to Hypothesis 1(b)

VARIABLE CLUSTER	SPECIFIC VARIABLES	Predicted Signs of Correlations Based Upon Hypothesis	Number (Percentage) of Predicted Signs Observed Across the 14 Deficits	Probability of Having the Observed Number Of Predicted Signs Given Null Hypothesis
Background & Demographic	Gender	Neither	- = 8 (57%)	p = .40
	Race/Ethnicity	Neither	+ = 13 (93%)	**p = .001**
	Age	Neither	+ = 11 (79%)	**p = .03**
	Education	Neither	- = 14 (100%)	**p =.000**
	Single?	Neither	- = 8 (57%)	p = .40
	Number of Children	Neither	- = 10 (71%)	p = .09
	Live in Own Place?	Neither	- = 11 (79%)	**p = .03**
Substance Use/Abuse Indicators	Used Alcohol During life	+	12 (86%)	**p = .01**
	Used Drugs During Life	+	5 (36%)	p = .91
	Used Alcohol Last 30 Days?	+	7 (50%)	p = .50
	Used Drug Last 30 Days?	+	6 (43%)	p = .79
	# Days Used Alcohol in Last 30?	+	7 (50%)	p = .50
	# Days Used Drugs in Last 30?	+	6 (43%)	p = .79
	ASI Alcohol Use Score	+	10 (71%)	p = .09
	ASI Drug Use Score	+	7 (50%)	p = .50
	# Times Had Alcohol DTs	+	10 (71%)	p = .09
	# Times Overdosed on Drugs	+	2 (14%)	p = .99
	Admitted to Hospital for Alcohol/Drugs in Last 9 Mo.	+	& (50%)	p = .50
	# Times Treated for Alcohol Problems in Last 9 Mo.	+	9(64%)	p = .21
	# Times Treated for Drug Problems in Last 9 Mo.	+	5 (36%)	p = .91
	MAST (Alcohol) Score	+	7 (50%)	p = .50
Health and Disability Issues	Number Prior Tx Episodes	+	5 (36%)	p = .91
	Mental health History?	+	6 (43%)	p = .79
	Mental Illness Indicator (No/ Yes)	+	7 (50%)	p = .50

Table 7 Continued

VARIABLE CLUSTER	SPECIFIC VARIABLES	Predicted Signs of Correlations Based Upon Hypothesis	Number (Percentage) of Predicted Signs Observed Across the 14 Deficits	Probability of Having the Observed Number Of Predicted Signs Given Null Hypothesis
	Severity of Mental Illness (Based on Chart review)	+	12 (86%)	**p = .01**
	Severity of Mental Illness (Clinicians' Ratings)	+	8 (57%)	p = .40
	ASI Psychiatric Score	+	5 (36%)	p = .91
	Deaf/Hearing Impaired?	+	9 (64%)	p = .21
	Blind/Visually Impaired?	+	^ (43%)	p = .79
	Developmentally Disabled?	+	8 (57%)	p = .40
	Physically Disabled?	+	14 (100%)	p = .000
	Suicidal?	+	10 (71)	p = .09
	Suffered TBI?	+	11 (79%)	**p = .03**
Legal Issues	# of Arrests	+	* (57%)	p = .40
	Months in Jail - Lifetime	+	11 (79%)	**p = .03**
	Days in Jail - Past Month	+	11 (79%)	**p = .03**
	# Illegal Acts - Past Month	+	6 (43%)	p = .79
	Rating of Legal Problems	+	6 (43%)	p = .79
	ASI Legal Status Score	+	6 (43%)	p = .79
	Convicted of DUI/DWI?	+	7 (50%)	p = .50
Employment – Related Indicators	Employed? (Yes/No)	-	7 (50%)	p = .50
	ASI Employment Status Score	+	11 (79%)	**p =.03**
	Monthly Income	-	2 (14%)	p = .99
Psycho-Social Indicators	Quality of Life - Self-Esteem & Well-Being	-	1 (7%)	p = .99
	Quality of Life - Spiritual	-	3 (21%)	p = .99
	Quality of Life - Interper-sonal attachments	-	1 (7%)	p = .99
	Quality of Life - Avocational	-	2 (14%)	p = .99
	Quality of Life - Economics or Basic Needs	-	1 (75)	p = .99

Table 7 Continued

VARIABLE CLUSTER	SPECIFIC VARIABLES	Predicted Signs of Correlations Based Upon Hypothesis	Number (Percentage) of Predicted Signs Observed Across the 14 Deficits	Probability of Having the Observed Number Of Predicted Signs Given Null Hypothesis
	Satisfaction with Life Score	-	7 (50%)	p = .50
	Brief Psychiatric Rating	+	11 (79%)	**p = .03**
	CIQ - Home Integration	-	10 (71%)	p = .09
	CIQ - Social Integration	-	8 (57%)	p = .40
	CIQ – Productivity	-	4 (29%)	p = .97
	SF36 - Physical Functioning	-	8 (57%)	p = .40
	SF36 - Role (Physical)	-	1 (75)	p = .99
	SF36 - Bodily Pain	-	1 (7%)	p = .99
	SF36 - General Health	-	4 (29%)	p = .97
	SF36 – Vitality	-	1 (7%)	p = .99
	SF36 - Social Functioning	-	2 (14%)	p = .99
	SF36 - Role (Emotional)	-	3 (21%)	p = .99
	SF36 - Mental Health	-	1 (7%)	p = .99
	SF36 – Health Transition from Last Year	+	12 (86%)	**p = .01**
	ASI Family/Social Relation-Ships	+	& (50%)	p = .50
	Sexual Abuse Victim?	+	3 (31%)	p = .99
	Physical Abuse Victim?	+	2 (14%)	p = .99
	Child of Addict/Alcoholic?	+	10 (71%)	p = .09
	High School Dropout?	+	13 (93%)	**p = .001**

related to observed “cognitive deficits”. For this set of variables probably the most surprising results related to “Used Drugs in Last 30 Days”, “# Days Used Drugs in Last 30 Days”, “ # Times Overdosed on Drugs”, and “# Times Treated for Drug Problems in Last 9 months”. In all four instances the direction of the observed correlations with “cognitive deficits” was opposite what was predicted via Hypothesis 1(b) (with the results being significant for “ # Times

Overdosed on Drugs"). What is equally surprising is that these results are basically just the opposite of those observed for alcohol use/abuse.

Hypothesis 1(b) was also not supported by the observed relationships associated with the cluster of Health and Disability variables. Furthermore, although under the hypothesis it was predicted that severity of mental illness would be correlated with observed "deficits", only one of the 4 variables quantifying subjects' mental illness was shown to exhibit such a predicted relationship. That variable was "Severity of Mental Illness" (based on a subject-by subject chart review completed by project staff). It was somewhat surprising to observe a nonsignificant relationship between the other indicator of "Severity of Mental Illness" (a rating obtained from the subjects during the course of the intake that was tempered by the assessor's judgment based upon other responses to the Brief Psychiatric Rating Scale).

Two other interesting findings related to the cluster of Health and Disability Issues concern the two variables "Physically Disabled" (Yes/No) and "Suffered TBI" (Yes/No). Both variables confirmed predictions evolving from the hypothesis.

The hypothesis in question was only partially supported by the results involving the Employment-Related variables. In one of those instances, "ASI Employment Status", the observed correlations were shown to follow the predictions derived from Hypothesis 1(b). Namely, the greater the subjects' employment problems (as reflected via a high "ASI Employment Status" score) the more likely they are to exhibit "cognitive deficits." While being employed (i.e., the "Employed?" variable) was not confirmatory, the results observed for "Monthly Income" were more surprising. In that case the observed results were the opposite of what would be predicted - higher "Monthly Income" appeared more likely to be associated with a greater chance of exhibiting a "cognitive deficit".

If the legal status variables are conceptualized as being part of "social functioning", then Hypothesis 1(b) is not fully supported by the observed results. Confirmatory results were noted for only two of the seven "Legal Issues" considered. What is interesting is that both of the variables that support the hypothesis deal with the subjects' incarceration - "Months in Jail - Lifetime" and "Days in Jail - Past Month".

Results for only three of the other 24 "Psych/Social Indicators" (which are viewed as comparable to the "clinical and social functioning" categories alluded to in the hypothesis) were in conformance with predictions suggested by Hypothesis 1(b). Those three variables were

"Brief Psychiatric Rating Score", "SF 36 - Health Transition from Last Year" (i.e., health improved or deteriorated), and "High School Dropout". What is probably most notable with regard to this set of variables is that the results for 15 of the 24 variables are in the opposite direction (and statistically significantly so) from what would be assumed if Hypothesis 1(b) were true.

Overall, it would appear that the summary results shown in Tables 6 and 7 do not support Hypothesis 1(b). Those results suggest that the hypothesis may be overly simplistic and the relationships between the sets of variables noted and "cognitive deficits" (at least with regard to the ways in which those different sets of variables and "deficits" have been operationally defined in the study) is most likely more complex than assumed when the hypothesis was formulated. However, as was noted at the beginning of this particular description, the use of "deficits" (i.e., dichotomous variables) could have served to "depress" the correlations observed and affected their direction as well, especially if an appreciable number of those correlation fluctuate around zero. (This latter supposition is partially supported by the fact that 354 or 37.7% of the total set of correlations presented in Table 6 are between - .05 and +.05 in magnitude.) As a result of these concerns, Hypothesis 1(b) was reformulated slightly and an additional set of analyses undertaken.

The modified hypothesis was as follows:

"Cognitive performance will be negatively correlated with clinical, social, and vocational functioning, and positively correlated with past and current substance use/abuse and with severity of mental illness."

The associated correlation matrix is presented in Table 8 and the attendant analyses are summarized in Table 9.

The results provided in Tables 8 and 9 confirm that the related hypothesis is most likely overly simplistic and too broadly stated, particularly given the scaling of the 67 variables considered. At the same time, the results of the associated analyses give conflicting results. In summary, the alternative hypothesis 1(b) is not supported. For example for the set of 24 Psych-Social Indicators 10 (or 42%) of the predicted results were significant in the opposite direction from what would be predicted (a logical inconsistency), while only 5 (or 21%) were found to support hypothesis-related predictions.

Hypothesis 2 (a) - Participants completing the series of CCST modules will demonstrate improved cognitive functioning and greater knowledge of cognitive compensation strategies, relative to their own performance at baseline.

First, given the evolving nature of the Cognitive Compensation Training modules, e.g., the fact that they were reduced in number from 24 to 8, but with an attendant increase in time spent on each new module, the hypothesis was reworded slightly. That is, the number of modules, originally 24, was removed from the hypothesis. In addition, since the modules were constantly undergoing development and refinement throughout the course of the 3-year project, it was not possible to develop the instrument needed to assess participants "knowledge of cognitive compensation strategies", especially as a "pre" measure. Therefore, that dependent variable, i.e., participants' "knowledge of cognitive compensation strategies", was not evaluated as part of the set of analyses reported for Hypothesis 2 (a).

Another background issue addressed prior to actually evaluating Hypothesis 2(a), as well as Hypotheses 2(b), 3(a), and 3(b), dealt with describing the nature of the Experimental subjects' involvement in the overall set of Cognitive Compensation Skills Training (CCST) Modules. For example, "For how many hours of the 20 allocated did the subjects actually participate in the CCST Program?" and "What was their level of participation in the CCST Modules?" The results of these descriptive analyses are summarized in Table 10.

The results summarized in Table 10 indicate the following:

- On average the Experimental subjects completed 15 hours or ¾ of the CCST modules with less than 25% completing 12 hours or less and more than 25% completing the entire program.
- The subjects' level of participation in the overall program was rated by the instructor as slightly lower than "Good", while less than 25% were rated "Fair" or "Poor" and over 25% were rated "Excellent". In this case, active participation in group with two or more successful verbal responses to problem solving questions constituting "good", whereas no verbal participation or leaving before the group ended was rated as "poor".
- The average behavioral ratings assigned subjects was for all intents and purposes "Average" or 2.0, with the four areas assigned the lowest average weekly rating by the instructor being "Level of Initiation", "Social Interaction", "Communication", and "Decision Making".

Table 8

Correlation* Matrix Associated with the Reformulated Version of Hypothesis 1 (b)

		PERFORMANCE CRITERIA:													
		Attention			Executive Functioning				Memory						
CLUSTER	SPECIFIC VARIABLES	BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
Background & Demographics	Gender (Male = 1 Female = 2)	**+.19**	+.14	+.02	-.10	-.12	+.11	-.05	+.01	-.05	-.05	**+.22**	**+.22**	**+.21**	**+.20**
	Race/Ethnicity (1 = White, 2 = African-American)	**-.29**	-.05	-.13	+.15	+.14	**-.25**	**-.23**	**-.18**	**-.20**	**-.17**	**-.26**	**-.20**	-.01	+.00
	Age (in Years)	**-.23**	-.06	-.03	**+.28**	**+.32**	**-.20**	**-.28**	-.12	**-.22**	-.13	**-.28**	**-.23**	-.10	-.05
	Education Level (1 = <12th, 2 = 12th or GED, 3 = > 12th)	**+.27**	+.15	**+.21**	**-.20**	**-.22**	**+.16**	**+.35**	**+.18**	+.16	+.06	+.15	+.12	**+.16**	+.15
	Single? (Yes = 1, No = 0)**	-.16	+.03	+.04	-.02	-.07	-.01	+.07	+.10	+.16	+.19	+.03	+.02	+.07	+.03
	Number of Children (None = 0, One = 1, Two or More = 2)**	+.10	+.02	+.06	-.04	-.03	+.06	-.02	-.01	+.11	+.04	-.03	-.00	-.01	+.08
	Live in Own Place? (Yes = 1, No = 0)**	-.01	+.01	+.06	+.00	-.08	+.00	+.05	-.06	+.08	-.03	-.16	-.05	-.08	+.04
Substance Use or Abuse Indicators	Used Alcohol During Life (Yes = 1, No = 0)**	-.12	-.21	-.06	+.20	+.17	-.09	-.14	**-.23**	-.10	-.18	-.20	**-.21**	-.14	-.08
	Used Drugs During Life (Yes = 1, No = 0)**	+.07	-.03	+.14	-.01	-.04	+.02	+.08	-.06	-.00	-.10	-.02	+.01	+.06	+.06
	Used Alcohol Last 30 Days? (Yes = 1, No = 0)	-.05	-.02	-.21	+.09	-.03	+.03	-.03	-.10	-.06	-.06	-.03	+.01	-.03	+.02
	Used Drugs in Last 30 Days? (Yes = 1, No = 0)	+.00	-.04	-.02	-.06	+.02	-.02	+.03	-.06	-.07	-.08	-.06	+.17	+.05	+.13
	# Days Used Alcohol in Past 30?	-.03	+.02	_.15	_.00	-.03	-.01	-.04	-.10	-.01	-.03	-.07	-.03	-.06	+.01
	# Days Used Drugs in Past 30?	+.01	+.03	-.17	-.12	-.00	-.07	-.07	-.11	-.05	-.09	+.02	+.11	+.03	+.06
	ASI Alcohol Use Score (0 to 1)	-.05	-.13	-.09	+.09	+.04	+.11	-.02	-.07	-.02	-.08	-.12	+.02	-.12	-.03
	ASI Drug Use Score (0 to 1)	+.06	+.10	+.04	**-.18**	-.17	+.02	-.01	-.09	-.01	-.05	+.02	+.11	+.04	+.09
	# Times Had Alcohol DT's	+.00	-.05	**-.20**	-.01	+.01	+.01	-.06	-.02	-.07	-.05	-.08	-.05	+.07	-.07
	# Times Overdosed on Drugs	+.14	+.05	-.10	**-.19**	**-.19**	**+.19**	+.13	+.10	**+.19**	+.13	+.15	+.14	**+.30**	-.01

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 8 - Continued

		PERFORMANCE CRITERIA:													
		Attention			Executive Functioning				Memory						
CLUSTER	SPECIFIC VARIABLES	BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
	Admitted to Hospital for Alcohol/Drugs in Last 9 Months? (Yes = 1, No = 0)	+.02	-.04	+.02	-.01	+.01	+.02	+.01	+.08	+.10	+.07	-.11	-.04	+.11	-.14
	# Times treated for Alcohol Problems in Last 9 Months	-.09	-.16	-.06	+.03	+.08	-.08	+.09	+.03	+.04	+.04	-.09	-.06	-.10	+.01
	# Times treated for Drug Problems in Last 9 Months	+.00	+.02	-.02	-.05	-.02	-.06	+.16	+.04	+.03	+.02	+.02	+.02	-.01	+.12
	MAST (Alcohol) Score**	+.08	+.12	+.14	-.07	-.09	+.01	-.09	+.05	-.09	-.02	+.06	-.07	-.07	**-.22**
Health & Dis-Ability Issues	Number of Prior Tx Episodes	+.03	+.17	-.06	-.18	-.16	-.09	+.09	+.08	-.02	+.05	-.01	-.03	-.04	-.08
	Mental Health History? (Yes = 1, No = 0)**	+.01	-.05	-.03	-.03	+.07	+.01	+.13	-.07	+.11	+.02	+.05	**+.20**	+.07	+.13
	Mental Illness Indicator (Yes = 1, No = 0)	-.03	+.05	+.03	+.00	+.03	+.07	-.03	+.01	+.04	+.04	-.03	+.06	+.06	-.05
	Severity of Mental Illness - from charts (0 to 5 Scale)	-.08	-.02	+.02	+.06	+.10	+.05	-.10	-.04	-.00	+.01	-.04	+.02	+.01	-.05
	Severity of Mental Illness Rating (0 = Normal to 7 = Severe)	-.06	-.12	-.13	+.13	+.11	+.13	+.10	-.05	+.07	+.06	-.05	+.01	-.01	-.02
	ASI Psychiatric Score (0 to 1)**	-.08	+.03	-.12	-.01	-.01	+.05	+.07	-.07	+.17	+.02	+.02	**+.20**	+.12	>03
	Deaf/Hearing Impaired (Yes = 1)**	+.01	-.02	+.10	+.02	-.03	+.01	-.04	-.02	-.07	+.01	+.06	+.00	+.01	-.04
	Blind/Visually Impaired (Yes = 1)**	-.04	-.12	+.06	+.05	-.07	+.06	+.04	**+.26**	-.01	**+.22**	+.03	+.14	+.09	+.18
	Developmentally Disabled (Yes = 1)**	+.15	+.04	-.10	-.14	+.00	+.11	-.08	-.05	-.01	-.06	+.10	+.03	+.05	+.10
	Physically Disabled (Yes = 1)**	-.14	**-.31**	-.08	+.17	**+.21**	-.11	-.15	**-.21**	-.17	-.13	**-.19**	**-.18**	**-.18**	-.03
	Suicidal (Yes = 1)**	-.07	-.10	-.13	+.12	+.12	+.04	-.06	-.10	-.11	-.05	-.02	+.07	-.04	+.06
	Suffered TBI (Yes = 1, No = 0)**	-.13	-.05	-.09	+.04	+.06	+.04	+.00	-.10	+.00	-.07	-.05	-.02	-.06	+.00
Legal Issues	# of Arrests**	-.05	-.05	+.05	-.04	-.08	-.10	-.06	-.08	-.14	-.11	-.02	-.06	-.06	-.05
	Months in Jail - Lifetime**	-.12	-.09	+.10	+.04	+.10	-.19	-.19	**-.19**	-.05	-.06	-.13	-.11	-.11	-.07
	Days in Jail -Past Month**	-.06	+.00	+.06	+.01	-.03	-.18	-.13	+.01	+.00	-.06	-.18	**-.24**	**-.25**	-.13

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 8 - Continued

		PERFORMANCE CRITERIA:												
		Attention			Executive Functioning				Memory						
CLUSTER	SPECIFIC VARIABLES	BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
	# Illegal Acts -Past Month**	+.09	-.07	-.13	-.06	-.06	+.10	+.04	-.03	+.08	+.06	+.07	+.08	+.11	+.09
	Rating of Legal Problems (None = 0 to Extreme = 4)**	-.05	+.11	-.11	-.06	-.04	-.08	-.05	-.02	+.02	-.05	+.05	+.00	-.05	+.04
	ASI Legal Status Score (0 to 1)**	-.10	+.07	-.02	-.08	-.01	-.07	-.01	-.09	+.09	+.04	+.02	+.07	+.03	+.07
	Convicted of DUI/DWI? (Yes = 1)**	-.06	+.10	**+.20**	-.04	-.05	-.00	+.02	-.02	-.06	-.05	-.01	-.05	-.05	-.05
Employment Related Indicators	Employed? (Yes = 1, No = 0)**	+.01	+.13	+.16	-.02	+.09	-.13	+.03	-.11	-.05	-.06	-.02	-.03	+.01	+.08
	ASI Employment Status Score (0 to 1)**	-.12	-.07	-.18	**+.21**	-.01	-.07	-.12	-.04	-.15	-.05	-.05	-.12	-.17	-.14
	Monthly Income**	-.06	-.04	+.05	+.11	+.12	-.11	-.12	+.02	-.05	+.01	**-.26**	-.18	**-.19**	-.07
Psycho-Social Indicators	Quality of Life - Self-Esteem/Well-Being (Low = 1 to High = 5)	-.07	-.07	+.15	+.09	+.12	**-.20**	**-.22**	-.02	-.15	-.02	-.08	**-.16**	+.03	+.00
	Quality of Life - Spiritual (1 to 5)	-.08	-.07	+.11	+.13	+.10	**-.23**	-.13	-.04	-.06	+.04	-.14	-.15	-.02	-.03
	Quality of Life - Interpersonal Attachment (1 to 5)	-.08	-.03	+.10	+.08	+.04	**-.16**	**-.19**	-.06	-.13	-.08	-.04	-.05	-.03	-.03
	Quality of Life - Avocational (1 to 5)	-.08	-.04	+.04	+.05	+.02	-.06	-.10	-.02	-.03	-.07	-.12	-.10	-.02	+.02
	Quality of Life - Economics or Basic Needs (1 to 5)	-.08	-.10	+.13	**+.18**	**+.21**	**-.19**	**-.20**	-.02	-.13	+.04	-.15	**-.19**	+.01	+.05
	Satisfaction with Life Score	-.12	+.04	-.02	-.03	-.03	-.14	-.15	+.00	+.04	+.08	+.02	-.09	**+.21**	+.06
	Brief Psychiatric Rating Score	-.04	-.09	-.05	+.10	+.06	+.07	+.03	-.12	+.01	-.04	-.04	+.05	-.04	-.01
	CIQ - Home Integration**	+.10	+.19	+.07	**-.23**	-.18	+.15	+.06	+.09	+.06	+.13	-.06	-.02	-.04	+.04
	CIQ - Social Integration**	+.01	-.06	+.05	+.06	-.03	+.09	+.06	**+.20**	+.14	+.14	+.13	**+.20**	+.18	+.17
	CIQ - Productivity**	-.02	+.08	+.18	-.01	-.04	-.16	+.02	-.01	+.07	-.05	-.11	-.12	-.13	-.09
	SF36 – Physical Functioning**	+.12	+.02	+.13	-.10	-.16	-.00	+.02	+.09	+.08	+.16	+.14	+.07	+.04	+.05
	SF36 - Role(Physical)**	-.19	-.01	-.10	+.04	-.01	-.12	-.14	+.07	-.10	+.02	-.05	-.13	-.14	-.04
	SF36 - Bodily Pain**	**-.21**	**-.24**	+.06	**+.30**	+.16	**-.21**	**-.29**	-.04	-.10	+.01	-.16	**-.22**	**-.20**	-.05

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 8 - Continued

		PERFORMANCE CRITERIA:												
		Attention			Executive Functioning				Memory						
CLUSTER	SPECIFIC VARIABLES	BTA Total Score	Ruff Speed Score	Ruff Accuracy Score	Trail Part A Time	Trail Part B Time	Token Total Score	Raven Total Score	RCF Copy Score	RCF Immed. Recall	RCF Delayed Recall	RAVLT Total Recall	RAVLT Immed. Recall	RAVLT Delayed Recall	RAVLT Recog. Score
	SF36 - General Health**	-.02	-.18	+.07	+.12	+.09	-.17	-.13	+.07	+.02	+.10	-.05	-.13	-.07	-.07
	SF36 - Vitality**	-.15	**-.29**	+.14	**+.21**	+.17	**-.26**	**-.21**	-.01	-.12	+.05	-.18	**-.22**	-.18	-.09
	SF36 - Social Functioning**	-.09	**-.22**	+.15	+.09	+.17	-.15	-.17	+.03	-.03	+.11	-.13	-.17	-.10	-.14
	SF36 - Role (Emotional)**	-.02	+.00	+.05	-.11	+.02	-.10	-.07	+.01	-.08	+.02	-.06	-.11	-.04	-.09
	SF36 - Mental Health**	-.04	**-.19**	+.10	**+.21**	**+.20**	-.17	-.17	+.03	**-.20**	-.03	-.08	-.16	-.10	-.02
	SF36 - Health Transition Over Last Year (Much Better = 1 to Much Worse = 5)**	-.07	-.12	-.01	+.00	+.10	-.19	**-.23**	-.05	-.04	+.06	-.02	-.07	-.08	-.06
	ASI Family/Social Relationships (0 to 1)**	+.07	-.01	+.05	+.11	+.05	-.01	+.00	-.02	+.09	+.13	+.11	+.07	+.04	+.09
	Sexual Abuse Victim (Yes = 1)**	+.16	+.13	-.02	**-.19**	-.13	+.13	+.02	+.04	+.13	+.06	**+.24**	**+.25**	**+.23**	+.12
	Physical Abuse Victim (Yes = 1)**	+.10	+.13	-.03	**-.23**	-.14	+.09	+.02	+.02	+.18	+.09	+.06	+.16	+.14	+.12
	Child of Addict/Alcoholic (Yes = 1)**	+.05	-.02	**-.22**	+.04	+.06	+.07	+.00	+.12	+.09	+.14	-.04	+.04	+.06	+.03
	High School Dropout (Yes = 1)**	-.09	-.18	-.18	+.10	+.05	-.02	**-.19**	-.08	-.06	+.03	-.12	-.04	-.08	-.07

* All statistically significant correlations (α = .05) are **bolded**. In addition, all correlations based on the CAM subjects only are noted by a ** following the variable name.

Table 9

Summary of Statistical Analyses Related to Revised Hypothesis 1(b)

VARIABLE CLUSTER	SPECIFIC VARIABLES	Predicted Signs of Correlations Based Upon Hypothesis	Number (Percentage) of Predicted Signs Observed Across the 14 Deficits	Probability of Having the Observed Number Of Predicted Signs Given Null Hypothesis
Background & Demographic	Gender	Neither	+ = 11 (79%)	p = .03
	Race/Ethnicity	Neither	- = 13 (93%)	p = .001
	Age	Neither	- = 13 (93%)	p = .001
	Education	Neither	+ = (100%)	p = .000
	Single?	Neither	+ = 13 (93%)	p = .001
	Number of Children	Neither	+ = 9 (64%)	p = .21
	Live in Own Place?	Neither	+ = 7 (64%)	p = .50
Substance Use/Abuse Indicators	Used Alcohol During life	- (&2+)*	14 (100%)	p = .000
	Used Drugs During Life	- (&2+)*	5 (36%)	p = .91
	Used Alcohol Last 30 Days?	- (&2+)*	10 (71%)	p = .09
	Used Drug Last 30 Days?	- (&2+)*	8 (57%)	p = .40
	# Days Used Alcohol in Last 30?	- (&2+)*	10 (71%)	p = .09
	# Days Used Drugs - Last 30	- (&2+)*	6 (43%)	p = .79
	ASI Alcohol Use Score	- (&2+)*	12 (86%)	p = .01
	ASI Drug Use Score	- (&2+)*	4 (29%)	p = .97
	# Times Had Alcohol DTs	- (&2+)*	10 (71%)	p = .09
	# Times Overdosed on Drugs	- (&2+)*	2 (14%)	p = .99
	Admitted to Hospital for Alcohol/Drugs in Last 9 Mo.	- (&2+)*	5 (36%)	p = .91
	# Times Treated for Alcohol Problems in Last 9 Mo.	- (&2+)*	9 (64%0	p = .21
	# Times Treated for Drug Problems in Last 9 Mo.	- (&2+)*	3 (21%)	p = .99
	MAST (Alcohol) Score	- (&2+)*	6 (43%)	p = .79
Health and Disability Issues	Number Prior Tx Episodes	- (&2+)*	7 (50%)	p = .50
	Mental health History?	- (&2+)*	4 (29%)	p = .97
	Mental Illness Ind. (No/Yes)	- (&2+)*	6 (43%)	p = .79

* Due to the scoring for Trails Part A Time and Trails Part B Time their correlations will be the opposite of those predicted.

Table 9 Continued

VARIABLE CLUSTER	SPECIFIC VARIABLES	Predicted Signs of Correlations Based Upon Hypothesis	Number (Percentage) of Predicted Signs Observed Across the 14 Deficits	Probability of Having the Observed Number Of Predicted Signs Given Null Hypothesis
	Severity of Mental Illness (Based on Chart review)	- (&2+)*	9 (64%)	p = .21
	Severity of Mental Illness (Clinicians' Ratings)	- (&2+)*	9 (64%)	p = ,21
	ASI Psychiatric Score	- (&2+)*	3 (21%)	p = .99
	Deaf/Hearing Impaired?	- (&2+)*	6 (43%)	p = .79
	Blind/Visually Impaired?	- (&2+)*	4 (29%)	p = .97
	Developmentally Disabled?	- (&2+)*	6 (43%)	p = .79
	Physically Disabled?	- (&2+)*	14 (100%)	p = .000
	Suicidal?	- (&2+)*	11 (79%)	p = .03
	Suffered TBI?	- (&2+)*	10 (71%)	p = .09
Legal Issues	# of Arrests	- (&2+)*	11 (79%)	p = ..03
	Months in Jail - Lifetime	- (&2+)*	13 (93%)	p = .001
	Days in Jail - Past Month	- (&2+)*	9 (64%)	p = .21
	# Illegal Acts - Past Month	- (&2+)*	3 (21%)	p = .99
	Rating of Legal Problems	- (&2+)*	7 (50%)	p = .50
	ASI Legal Status Score	- (&2+)*	5 (36%)	p = .91
	Convicted of DUI/DWI?	- (&2+)*	9 (64%)	p = .21
Employment – Related Indicators	Employed? (Yes/No)	+ (&2-)*	7 (50%)	p = .50
	ASI Employment Status Score	- (&2+)*	13 (93%)	p = .001
	Monthly Income	+ (&2-)*	3 (21%)	p = .99
Psycho-Social Indicators	Quality of Life - Self-Esteem & Well-Being	+ (&2-)*	3 (21%)	p = .99
	Quality of Life - Spiritual	+ (&2-)*	2 (14%)	p = .99
	Quality of Life - Interper-sonal attachments	+ (&2-)*	1 (7%0	p = .99
	Quality of Life - Avocational	+ (&2-)*	2 (14%)	p = .99
	Quality of Life - Economics or Basic Needs	+ (&2-)*	4 (29%)	p = .97

Table 9 Continued

VARIABLE CLUSTER	SPECIFIC VARIABLES	Predicted Signs of Correlations Based Upon Hypothesis	Number (Percentage) of Predicted Signs Observed Across the 14 Deficits	Probability of Having the Observed Number Of Predicted Signs Given Null Hypothesis
	Satisfaction with Life Score	+ (&2-)*	7 (50%)	p = .50
	Brief Psychiatric Rating	- (&2+)*	10 (71%)	p = .09
	CIQ - Home Integration	+ (&2-)*	11 (79%)	**p = .03**
	CIQ - Social Integration	+ (&2-)*	12 (86%)	**p = .01**
	CIQ - Productivity	+ (&2-)*	6 (43%)	p = .79
	SF36 - Physical Functioning	+ (&2-)*	13 (93%)	**p = .001**
	SF36 - Role (Physical)	+ (&2-)*	3 (21%)	p = .99
	SF36 - Bodily Pain	+ (&2-)*	2 (14%)	p = .99
	SF36 - General Health	+ (&2-)*	4 (29%)	p = .97
	SF36 - Vitality	+ (&2-)*	2 (14%)	p = .99
	SF36 - Social Functioning	+ (&2-)*	3 (21%)	p = .99
	SF36 - Role (Emotional)	+ (&2-)*	4 (29%)	p = .97
	SF36 - Mental Health	+ (&2-)*	2 (14%)	P = .99
	SF36 – Health Transition from Last Year	- (&2+)*	13 (93%)	**p = .001**
	ASI Family/Social Relation-ships	- (&2+)*	5 (36%)	p = .91
	Sexual Abuse Victim?	- (&2+)*	1 (7%)	p = .99
	Physical Abuse Victim?	- (&2+)*	1 (7%)	p = .99
	Child of Addict/Alcoholic?	- (&2+)*	5 (36%)	p = .91
	High School Dropout?	- (&2+)*	13 (93%)	**p = .001**

Table 10

Description of Experimental Subjects' Involvement in the CCST Program

INDICATOR	SAMPLE SIZE	DESCRIPTIVE STATISTICS: Mean	Mode	Standard Deviation	Quartiles: Q_1	Q_2	Q_3
Number of Hours Participated in CCST Modules (Out of 20 Hours)	61	15.00	20	.81	12	18	20
Overall Quality Rating of Ss' Participation by Group Leader (Poor = 1 to Excellent = 4)	61	2.70	4	1.20	2	3	4
Instructor's Rating of Ss' Behavior During Groups (Above Average = 1, Average = 2, & Below Average = 3)							
I. General Social Behavior							
1. Attendance	100	2.02	2	0.38	2	2	2
2. Level of Initiation	100	2.11	2	0.62	2	2	3
3. Affect	100	2.08	2	0.36	2	2	2
4. Social Interaction	100	2.22	3	0.58	2	2	3
5. Cooperative Team Behavior	100	2.01	2	0.30	2	2	2
6. Communication	100	2.13	2	0.57	2	2	3
II Task Behaviors							
1. Keeps Track of Task Events	100	2.12	2	0.40	2	2	2
2. Goal Orientation	100	2.04	2	0.36	2	2	2
3. Speed of Response	100	2.06	2	0.34	2	2	2
4. Frustration Tolerance	100	2.04	2	0.31	2	2	2
5. Decision Making	100	2.26	2	0.45	2	2	3
6. Memory	100	2.13	2	0.23	2	2	2
7. Orientation	100	1.95	2	0.20	2	2	2

Overall, these results confirm that during the course of the project the experimental subjects, as a group, did spend a demonstrable amount of time participating in the CCST Modules and appeared to also be "engaged" with those material/activities during the related "group sessions" in which they were involved.

Given the preceding caveats/limitations and related background information, the first analysis undertaken in relation to Hypothesis 2(a) involved the changes from "pre" to "post" testing on the 14 neurocognitive measures listed in Table 4 that were observed for the sample of subjects randomly assigned to the study's experimental condition (i.e., those subjects who were actually instructed via the CCST modules undergoing development as part of the project). A summary description of those data is provided in Table 11. In the right two columns of that table are the results of a multivariate analysis of the designated sample of subjects' change scores - the results of a single-sample Hotellings T^2 Test - followed by a set of univariate follow-up tests.

The alpha level set for the multivariate test was $\alpha = .05$, while that for the 14 univariate tests was $\alpha = .004$ (so the combined alpha level would be no greater then .056).

The results shown in Table 11 indicate that the overall hypothesis, i.e., "Did the experimental subjects' overall performance across the cognitive criteria change between the pretest and posttest?", would be rejected. The results of the univariate follow-up tests presented in the last column of the table, show on which criteria changes occurred. More specifically, one change occurred among the three "attention" related criteria - Total Speed Scores on the Ruff 2 & 7 Test increased significantly; no significant changes occurred among the four "Executive Functioning criteria; and five significant changes occurred among the seven "Memory" related criteria - increases occurred on the Rey Complex Figures Immediate Recall criterion, the Rey Complex Figure Delayed Recall scores, the Rey Auditory Verbal Learning Total Recall scores, the Rey Auditory Verbal Learning Immediate Recall scores, and the Rey Auditory Verbal Learning Delayed Recall criterion. Generally, these results suggest that the major changes may have been in the memory area, however, limitations of the design upon which the analyses in Table 11 are based leaves open other plausible explanations (e.g., practice effects associated with

Table 11

"Pre" to "Post" Performance of "Experimental" Subjects Across 14 Neurocognitive Measures/Criteria

COGNITIVE AREA	CRITERION VARIABLES	GROUP MEANS (Stan. Dev.): Pretest	Posttest	F-VALUES: Multivariate*	Univariate
Attention	BTA Total Score	12.9 (4.1)	113.6 (4.4)		F = 2.2 (p = .145)
	Ruff Speed Score	44.6 (13.5)	49.0 (13.9)		**F = 13.7 (p = .000)**
	Ruff Accuracy Score	47.0 (9.9)	45.5 (10.5)		F = 1.4 (p = .244)
Executive Functioning	Trails Part A Time	44.6 (30.2)	39.8 (25.5)		F = 5.1 (p = .028)
	Trails Part B Time	147.4 (116.6)	133.7 (110.8)		F = 2.0 (p = .158)
	Token Total Score	40.3 (4.4)	40.2 (4.5)		F = 0.0 (p = .932)
	Raven Total Score	27.9 (5.3)	28.1 (6.7)	**$F_{14,43}$ = 2.79****	F = 0.0 (p = .843)
Memory	RCF Copy Score	28.7 (8.3)	29.1 (8.1)		F = 0.3 (p = .563)
	RCF Immediate Recall	12.6 (7.6)	16.7 (9.9)		**F = 26.1 (p = .000)**
	RCF Delayed Recall	11.5 (8.0)	15.8 (10.0)		**F = 18.7 (p = .000)**
	RAVLT Total Recall	42.3 (11.1)	46.2 (12.7)		**F = 13.2 (p = .000)**
	RAVLT Immediate Recall	7.9 (3.2)	9.2 (3.8)		**F = 14.1 (p = .000)**
	RAVLT Delayed Recall	8.0 (3.3)	9.4 (3.7)		**F = 22.6 (p = .000)**
	RAVLT Recognition	13.7 (1.8)	13.9 (2.0)		F = 0.9 (p = .347)

* The useable n for this composite analysis (across all 14 criteria simultaneously) was 57 subjects; ** Significant at α = .005 level

the memory-related pretests were more "powerful" than were the practice effects associated with most of the other cognitive variables). Thus, Hypothesis 2(a) is partially supported by the observed results, i.e., participants who worked on the CCST modules demonstrated improved cognitive functioning on several criteria over the course of the study, but related design limitations do not enable us to directly attribute those changes to subjects' having experienced working on the CCST modules, per se.

Hypothesis 2(b) - Participants completing the series of CCST modules will demonstrate improved cognitive functioning and greater knowledge of cognitive compensation strategies, relative to participants in a control group.

With this hypothesis, as occurred with Hypothesis 2(a), two major limitations or modifications in the original hypothesis were invoked --- (1) the number of CCST modules (i.e., 24 as noted in the original application) was not specified due to changes made in the composition/structure of the modules over the course of the study and (2) no measure of "knowledge of cognitive compensation strategies" was developed and emphasized during the study. With these limitations in mind, a multivariate mixed model analysis was completed. The primary hypothesis of concern under that analysis was the interaction hypothesis. In other words, the primary concern focused upon assessing whether the changes in the cognitive criteria observed for the "experimental" subjects (and described in Table 11) differed significantly from the associated changes (if any) observed for the control subjects. The descriptive statistics associated with the indicated analysis are summarized in Table 12, while the MANOVA results are provided in Table 13.

A review of the means across Table 12 indicates that the average changes in performance from pre to post-testing across the 14 cognitive criteria for the Control and Experimental subjects were as follows:

		AVERAGE CHANGES ACROSS COGNITIVE CRITERIA IN TABLE 12:												
GROUPS	**BTA Total**	← TO												**RAVLT Recog.** →
Control	+ 0.4	+4.3	-0.3	-3.3	-19.	+0.4	+0.7	+0.3	+2.5	+3.5	+4.5	+0.9	+0.5	+ 0.3
Experimental	+ 0.7	+4.4	-1.5	-4.8	-14.	-0.1	+0.2	+0.4	+4.1	+4.3	+3.9	+1.3	+1.4	+0.2

Table 12

"Pre" to "Post" Performance of "Control" and "Experimental" Subjects Across 14 Neurocognitive Measures/Criteria

COGNITIVE AREA	CRITERION VARIABLES	GROUP MEANS (Stan. Dev.): (A) CONTROL* Pretest	(A) CONTROL* Posttest	(B) EXPERIMENTAL* Pretest	(B) EXPERIMENTAL* Posttest
Attention	BTA Total Score	13.1(3.7)	13.5 (4.1)	12.9 (4.1)	13.6 (4.4)
	Ruff Speed Score	46.3 (11.5)	50.6 (12.7)	44.6 (13.5)	49.0 (13.9)
	Ruff Accuracy Score	47.3 (9.7)	47.0 (11.2)	47.0 (9.9)	45.5 (10.5)
Executive Functioning	Trails Part A Time	41.2 (21.4)	37.9 (17.8)	44.6 (30.2)	39.8 (25.5)
	Trails Part B Time	135.1 (91.0)	115.4 (62.5)	147.4 (116.6)	133.7 (110.8)
	Token Total Score	40.0 (4.3)	40.4 (4.2)	40.3 (4.4)	40.2 (4.5)
	Raven Total Score	27.2 (6.6)	27.9 (5.1)	27.9 (5.3)	28.1 (6.7)
Memory	RCF Copy Score	29.2 (7.3)	29.5 (7.2)	28.7 (8.3)	29.1 (8.1)
	RCF Immediate Recall	13.9 (7.8)	16.4 (9.8)	12.6 (7.6)	16.7 (9.9)
	RCF Delayed Recall	13.0 (8.4)	16.5 (9.5)	11.5 (8.0)	15.8 (10.2)
	RAVLT Total Recall	41.4 (10.3)	45.9 (12.5)	42.3 (11.1)	46.2 (12.7)
	RAVLT Immediate Recall	8.2 (3.20	9.1 (3.6)	7.9 (3.2)	9.2 (3.8)
	RAVLT Delayed Recall	8.1 (3.8)	8.6 (3.5)	8.0 (3.3)	9.4 (3.7)
	RAVLT Recognition	13.6 (1.8)	13.9 (1.4)	13l7 (1.8)	13.9 (1.8)

* The useable n's for this analysis were 28 for the Control Group and 57 for the Experimental Group.

Table 13

Results of the Multivariate, Mixed-Model Analysis*

TEST STATISTICS	CRITERION VARIABLES	STATISTICAL HYPOTHESES EVALUATED: (A) Experimental vs Control	(B) Pre vs. Post	(C) Interaction
Multivariate F		$F_{14,70} = 0.5$ (p = .905)	**$F_{14,70} = 3.4$ (p = .000)**	$F_{14,70} = 0.6$ (p = .878)
Univariate F's (Follow-Up)	BTA Total Score	F = 0.0 (p = .948)	F = 2.2 (p = .140)	F = 0.1 (p = .747)
	Ruff Speed Score	F = 0.3 (p = .578)	**F = 18.8 (p = .000)**	F = 0.0 (p = .974)
	Ruff Accuracy Score	F = 0.2 (p = .682)	F = 0.8 (p = .362)	F = 0.3 (p = .580)
	Trails Part A Time	F = 0.2 (p = .635)	F = 4.9 (p = .029)	F = 0.2 (p = .688)
	Trails Part B Time	F = 0.5 (p = .502)	F = 4.6 (p = .035)	F = 0.1 (p = .700)
	Token Total Score	F = 0.0 (p = .963)	F = 0.2 (p = .684)	F = 0.3 (p = .609)
	Raven Total Score	F = 0.1 (p = .725)	F = 0.5 (p = .483)	F = 0.2 (p = .652)
	RCF Copy Score	F = 0.1 (p = .798)	F = 0.4 (p = .507)	F = 0.0 (p = .964)
	RCF Immediate Recall	F = 0.1 (p = .794)	**F = 22.3 (p = .000)**	F = 1.3 (p = .261)
	RCF Delayed Recall	F = 0.4 (P = .553)	**F = 23.9 (p = .000)**	F = 0.3 (p = .603)
	RAVLT Total Recall	F = 0.1 (p = .820)	**F = 20.5 (p = .000)**	F = 0.1 (p = .743)
	RAVLT Immediate Recall	F = 0.0 (p = .870)	**F = 15.9 (p = .000)**	F = 0.4 (p = .572)
	RAVLT Delayed Recall	F = 0.2 (p = .665)	**F = 12.0 (p = .001)**	F = 3.4 (p = .071)
	RAVLT Recognition	F = 0.0 (p = .991)	F = 2.0 (p = .164)	F = 0.1 (p = .770)

* The useable n's for this analysis were 28 for the Control Group and 57 for the Experimental Group, and each of the **bolded F-Values** is significant at $\alpha = .001$ level.

Generally speaking, those average changes are quite similar, which suggests that the primary statistical hypothesis, the Interaction Hypothesis, would likely not be rejected. This supposition is directly confirmed by the related statistical analyses shown in the last column of Table 13. Clearly, those results do not support the basic premise reflected in Hypothesis 2(b), i.e., that participation in the CCST modules will positively impact participants' cognitive test scores more than will just taking the tests without any exposure to the CCST modules.

At the same time, the changes observed across the two groups of subjects in the study appear to be quite constant (i.e., positive changes in one group are generally mirrored by like changes in the other group), which suggests that there may be a significant pre vs. post main effect. The related results in Table 13 verify that in effect such a significant main effect was observed. That is, the overall performance of all the subjects in the study (both Control and Experimental subjects) appeared to increase from the time of pre-testing to the time of post-testing by an amount that could not be attributed to "chance" alone. The related set of follow-up tests revealed that the changes causing this significant overall effect were attributable in large measure to the changes that occurred on six of the cognitive variables. The six variables were the same ones on which significant changes were observed as part of Hypothesis 2(a) - Speed scores on the Ruff 2 & 7 Test (Attention Area), both the Immediate and Delayed Recall scores on the Rey Complex Figure Test (Memory Area) and the Total Recall, Immediate Recall, and Delayed Recall scores on the Rey Auditory Verbal Learning Test (Memory Area). One possible explanation for these results is that there is a practice effect associated with administration of the associated pretests, which is "stronger" in its impact than the comparable effects associated with the other cognitive areas.

The results of the "Experimental vs. Control" Hypothesis summarized in Table 12 reaffirm the comparability of the criterion scores across the two experimental conditions or groups. The overall levels of criterion performance of the two groups of subjects appeared to be quite similar, when collapsed across the pre- and post-tests.

When taken together, the results observed in regard to Hypothesis 2(a) and 2(b) show that cognitive performance on six of the 14 cognitive measures for the subjects in the study increased significantly between the time of pre-testing and the time of post-testing. However, the observed increases appeared to be quite similar for both experimental and control subjects, which negates the opportunity to attribute the changes noted for the experimental subjects to their involvement

with the CCST Modules. Rather, the results could be better explained as being attributable to some kind of practice affect that impacted both groups of subjects similarly. Why those effects were not uniform across the array of 14 cognitive criteria is not clear at this time. It is not possible to definitively analyze why five of the six significant changes are associated with the memory area.

Hypothesis 3 (a) - Participants completing the CCST Modules will demonstrate treatment improvements, including less use of alcohol and other drugs and lower levels of psychiatric symptoms as well as higher therapist ratings and self-perceptions of functioning and increased levels of life satisfaction, at the time of follow-up.

As occurred with the preceding hypothesis, this one was altered slightly as well. In particular, the phrase "at 12-week follow-up" occurring at the end of the original hypothesis was changed to "at the time of follow-up". This change was made to reflect the changes made in the length of the CCST modules and related delivery time during the course of the project.

The specific analyses undertaken in relation to Hypothesis 3(a) involved changes from "pre" to "post" testing that occurred as a number of "non-cognitive" dependent variables that were observed across the sample of subjects randomly assigned to the study's experimental condition (i.e., where they were instructed via the CCST Modules developed as part of the project). A summary description of those data is provided in Table 14. In the right hand column of that table are the results of a related set of analyses. As can be seen in that column a separate analysis was undertaken for each dependent variable listed. This strategy was used, as contrasted with the use of a multivariate strategy, due to the variant nature/quality of the variables in question and to the different sample sizes (i.e., some dependent variables were available for all the "experimental" subjects while others were only available for the CAM subjects, which is reflected in "n's" that vary from 37 to 61).

A review of Table 14 indicates that significant changes occurred on 12 of the 41 variables considered. Those variables on which significant changes were observed were---

- Change in Place Where Living - at closure more subjects were living in their own place than would be predicted if no change occurred
- Frequency of Use - Primary Drug - the reduction in primary drug use was more than would be expected by chance

- Brief Psychiatric Rating Scale Score - this indicator (sum of 18 ratings by the person assessing the subjects) went down significantly, which suggests a degree of progress
- Admitted to Hospital for AOD Problems in Last 9 Months? - subjects reported more frequent hospital admits for AOD problems at closure than at the beginning of study involvement
- Quality of Life-Spiritual - subjects reported that this aspect of their lives improved a significant amount
- Quality of Life-Avocational - this aspect of subjects' lives was reported as improving
- Quality of Life-Economics or Basic Needs - this area was also reported as improving between entry and closure from the study
- Subjects' Rating of Own Memory, Attention, Language, Problem Solving, and Reasoning Skills - all five areas were rated significantly lower at closer than at entry into the study, which is the opposite of what is predicted via Hypothesis 3(a)

While these results are interesting, limitations in the design underlying the reported analyses negate the possibility of unequivocally attributing the noted changes to the subjects' involvement with the CCST Modules and related training sessions. For example, at this juncture an equally plausible explanation would be that history or maturation "caused" the changes to occur. In the case of at least one of the variables even a "halo" effect in assessor ratings is a possible explanation for the observed change.

Hypothesis 3(b) - Participants completing the CCST modules will demonstrate greater levels of treatment improvement relative to participants in the control group, including less use of alcohol and other drugs and lower levels of psychiatric symptoms, so well as higher therapist ratings and self-perceptions of functioning and higher levels of life satisfaction.

This hypothesis was evaluated using the same array of dependent variables considered in relation to Hypothesis 3(a). The difference between the two hypotheses concerns the associated "designs" - a single group design vs. the randomized control trial associated with the current hypothesis. The results generated via the related mixed model ANOVAs are summarized in Table 15 (Descriptive Statistics) and Table 16 (Mixed Model Analyses). Unlike what occurred earlier in the analysis of Hypothesis 2(b), the analyses summarily described in Table 16 did not start with an overall multivariate model and employ univariate F-tests as "follow-up statistics" to help interpret any significant multivariate results. In the current case, only univariate tests were

Table 14

"Pre" to "Post" Performance of Experimental Subjects Across 41 "Non-Cognitive" Dependent Variables

CLUSTER OR AREA	DEPENDENT VARIABLES	GROUP MEANS (Stand. Dev.) OR %AGE BY CATEGORY WHERE APPLICABLE Pretest		Posttest	TEST STATISTIC
Background & Family Characteristics	Family Size	0.70 (1.46)		0.60 (1.40)	$F_{1,49} = 0.9^{NS}$
	Change in Place Where Live (Own Place vs. Living with Someone or in Institution)	-1 (2%)	0 (84%) (n = 50)	+1 (14%)	**$X^2_2 = 86.0$****
Substance Use/ Abuse Indicators	Frequency of Use - Primary Drug	1.7 (1.7)		1.4 (1.7)	**$F_{1,49} = 4.0$***
	Frequency of Use - Secondary Drug	0.9 (1.0)		0.9 (1.3)	$F_{1,27} = 0.1^{NS}$
	# Days Used Alcohol in Last 30	1.8 (4.0)		1.4 (4.2)	$F_{1,37} = 0.3^{NS}$
	# Days Used Drugs in Last 30	1.4 (3.9)		3.4 (8.5)	$F_{1,38} = 2.3^{NS}$
	# Alcohol DTs in Last 9 Months	2.0 (5.8)		4.2 (13.7)	$F_{1,40} = 2.1^{NS}$
	# Drug Overdoses in Last 9 Months	0.8 (2.4)		0.6 (1.3)	$F_{1,47} = 1.1^{NS}$
	# Times Treated for Alcohol Problems in Last 9 Months	1.9 (3.2)		3.8 (6.4)	$F_{1,44} = 3.43^{NS}$
	# Times Treated for Drug Problems in Last 9 Months	2.0 (3.6)		3.2 (6.5)	$F_{1,41} = 1.8^{NS}$
	# Alcohol Detox Tx's in Last 9 Mo.	0.0 (0.2)		0.3 (1.4)	$F_{1,43} = 1.0^{NS}$
	# Drug Detox Tx's in Last 9 Mo.	0.0 (0.2)		1.0 (4.7)	$F_{1,43} = 1.6^{NS}$
	# Days Treated as Alcohol Outpatient in Last 30	6.2 (9.4)		7.3 (9.8)	$F_{1,44} = 0.4^{NS}$
	# Days treated as Drug Outpatient in Last 30	5.6 (10.1)		5.5 (9.4)	$F_{1,43} = 0.0^{NS}$
	ASI Alcohol Use Score	0.17 (0.14)		0.16 (0.13)	$F_{1,50} = 0.2^{NS}$
	ASI Drug Use Score	0.07 (0.06)		0.07 (0.06)	$F_{1,37} = 0.0^{NS}$
Health & Disability Issues	# Hospital Admits in Last 12 Months	0.4 (0.6)		0.3 (0.6)	$F_{1,47} = 1.3^{NS}$
	# ER Admits in Last 12 Months	0.8 (1.8)		0.6 (1.8)	$F_{1,47} = 1.0^{NS}$
	# Outpatient Care Visits - Last 12 Mo.	1.2 (5.4)		1.8 (6.9)	$F_{1,47} = 0.7^{NS}$
	# Dr./Dentist Visits in Last 12 Mo.	3.5 (8.3)		3.9 (8.1)	$F_{1,47} = 2.4^{NS}$
	Brief Psychiatric Rating Scale Score	28.0 (6.9)		26.4 (6.8)	**$F_{1,61} = 5.2$***
	Admitted to Hospital for AOD Problem in Last 9 Months?	Yes ("Pre") = 3%		Yes ("Post") = 16%	Cochrans Q 4.0*

* NS – Not Significant; * - Significant at α = .05 level; ** - Significant at α = .01 Level.

Table 14 - Continued

CLUSTER OR AREA	DEPENDENT VARIABLES	GROUP MEANS (Stand. Dev.) OR %AGE BY CATEGORY WHERE APPLICABLE			TEST STATISTIC
		Pretest		Posttest	
Legal Issue	# of Arrests	1.5 (1.6)		1.3 (1.4)	$F_{1,49} = 1.8^{NS}$
Employment-Related Indicators	Change in Employment Status (Work vs. No Work at "pre" and "Post)	-1 (2%)	46 (90%) (n = 51)	4 (8%)	**$X^2 = 24.7$****
	Monthly Gross Income	240.70 (377.50)		240.60 (376.50)	$F_{1,44} = 0.0^{NS}$
Psycho-Social Variables	Quality of Life - Esteem/Well-Being	3.0 (1.0)		3.2 (0.8)	$F_{1,61} = 3.8^{NS}$
	Quality of Life - Spiritual	3.2 (1.2)		3.6 (1.1)	**$F_{1,61} = 6.3$***
	Quality of Life - Interpersonal Attach.	2.7 (1.0)		2.6 (1.0)	$F_{1,61} = 0.0^{NS}$
	Quality of Life - Avocational	2.6 (1.1)		3.1 (1.0)	**$F_{1,61} = 9.0$****
	Quality of Life – Economics or Basic Needs	2.0 (1.2)		2.5 (1.2)	**$F_{1,61} = 8.6$****
	Satisfaction with Life Score	12.5 (4.9)		14.1 (4.9)	$F_{1,34} = 2.6^{NS}$
Therapists' Ratings of Subjects' Cognitive Skill Levels	Memory	2.8 (1.2)		2.6 (1.2)	$F_{1,60} = 2.0^{NS}$
	Attention	2.3 (1.1)		2.2 (1.2)	$F_{1,60} = 0.8^{NS}$
	Language	2.1 (1.2)		1.9 (1.4)	$F_{1,60} = 1.3^{NS}$
	Problem Solving	2.5 (1.2)		2.3 (1.4)	$F_{1,60} = 0.9^{NS}$
	Reasoning	2.2 (1.2)		2.0 (1.4)	$F_{1,60} = 2.1^{NS}$
Subjects' Ratings of Own Cognitive Skill Levels	Memory	3.7 (2.4)		2.6 (1.1)	**$F_{1,61} = 12.7$****
	Attention	3.6 (2.5)		2.3 (1.1)	**$F_{1,61} = 16.9$****
	Language	2.9 (2.7)		1.5 (0.8)	**$F_{1,61} = 14.9$****
	Problem Solving	3.1 (2.7)		2.2 (1.2)	**$F_{1,61} = 6.7$***
	Reasoning	3.0 (2.7)		2.0 (1.1)	**$F_{1,61} = 7.4$****

* NS – Not Significant; * - Significant at α = .05 level; ** - Significant at α = .01 Level.

completed. This strategy (through less desirable) was implemented due to the variant "n's" available across the set of dependent variables considered - caused by the fact that data on some variables were available for the entire subject pool, while the data on other variables were available for only the subjects in the CAM (outpatient) Program.

Overall, the results presented in Tables 15 and 16 do not support Hypothesis 3(b). More specifically, those results do not demonstrate that participation in the CCST Modules leads to greater levels of treatment improvement (at least as operationalized via the 41 variables considered) than does participation in the control group. None of the interaction tests reported in Table 16 reached even the $\alpha = .05$ level of statistical significance, despite the fact that it represent a very "liberal" criterion, when viewed from an "experimentwise" perspective. Of the statistical tests shown in Table 16 that did reach statistical significance the vast majority (86%) were related to the changes observed from "pretest" to "posttest". While these findings generally support the results reported in Table 14 for the "Experimental Group" alone, they go further and suggest that the changes observed in that earlier table occurred for both control as well as experimental subjects. Apparently the changes noted are not uniquely related to use of the CCST Modules, but are effects associated with participation in substance abuse treatment.

One of the most consistent set of results reported dealt with the changes in subject's rating of their cognitive scores between "pre" and "post" testing. For some reason, between those two assessment points the respondents, both those in the control and experimental groups, significantly reduced their self-appraisals of their own cognitive skill levels. As shown in Table 16, these changes were observed across all five of the cognitive areas considered.

Table 15
Descriptive "Pre-Post" Statistics for the "Control" and "Experimental" Subjects on 41 "Non-Cognitive" Variables

CLUSTER OR AREA	DEPENDENT VARIABLES	GROUP MEANS (Stand. Dev.) OR %AGE BY CATEGORY WHERE APPLICABLE			
		(A) CONTROL*		(B) EXPERIMENTAL*	
		Pretest	Posttest	Pretest	Posttest
Background & Family Characteristics	Family Size	0.4 (0.9)	0.4 (0.9)	0.7 (1.5)	0.6 (1.4)
	Change in Place Where Live (Own Place vs. Living with Someone or in Institution)	-1 (0%) 0 (92%) (n = 24) +1 (8%)		-1 (2%) 0 (84%) (n = 50) +1(14%)	
Substance Use/ Abuse Indicators	Frequency of Use - Primary Drug	1.6 (1.9)	1.2 (1.9)	1.7 (1.7)	1.4 (1.7)
	Frequency of Use - Secondary Drug	1.2 (1.4)	0.8 (1.4)	1.0 (1.0)	0.9 (1.3)
	# Days Used Alcohol in Last 30	2.3 (4.8)	1.7 (5.2)	1.8 (4.0)	1.4 (4.2)
	# Days Used Drugs in Last 30	2.3 (4.0)	0.9 (2.1)	1.4 (3.9)	3.4 (8.5)
	# Alcohol DTs in Last 9 Months	1.7 (4.4	1.5 (4.4)	2.0 (5.8)	4.2 (13.7)
	# Drug Overdoses in Last 9 Months	0.7 (1.3)	0.4 (0.9)	0.8 (2.4)	0.6 (1.3)
	# Times Treated for Alcohol Problems in Last 9 Months	4.4 (11.3)	6.7 (15.4)	1.9 (3.2)	3.8 (6.4)
	# Times Treated for Drug Problems in Last 9 Months	5.5 (11.4)	5.8 (10.7)	2.0 (3.6)	3.2 (6.5)
	# Alcohol Detox Tx's in Last 9 Mo.	0.1 (0.3)	0.0 (0.2)	0.0 (0.2)	0.3 (1.4)
	# Drug Detox Tx's in Last 9 Mo.	0.0 (0.2)	0.0 (0.2)	0.0 (0.2)	1.0 (4.7)
	# Days Treated as Alcohol Outpatient in Last 30	2.3 (6.9)	6.9 (14.1)	6.2 (9.4)	7.3 (9.8)
	# Days treated as Drug Outpatient in Last 30	3.4 (7.2)	5.5 (7.9)	5.6 (10.1)	5.5 (9.4)
	ASI Alcohol Use Score	0.17 (0.17)	0.14 (0.12)	0.17 (0.15)	0.16 (0.13)
	ASI Drug Use Score	0.10 (0.07)	0.07 (0.04)	0.07 (0.06)	0.07 (0.06)
Health & Disability Issues	# Hospital Admits in Last 12 Months	0.6 (1.3)	1.0 (2.1)	0.4 (0.6)	0.3 (0.6)
	# ER Admits in Last 12 Months	0.5 (0.8)	0.5 (0.8)	0.8 (1.8)	0.6 (1.8)
	# Outpatient Care Visits - Last 12 Mo.	1.0 (3.1)	0.6 (2.4)	1.2 (5.4)	1.8 (6.9)
	# Dr./Dentist Visits in Last 12 Mo.	4.3 (4.6)	3.5 (4.5)	3.5 (8.3)	3.9 (8.1)
	Brief Psychiatric Rating Scale Score	27.6 (6.5)	26.4 (7.2)	28.0 (6.9)	26.4 (6.8)
	Admitted to Hospital for AOD Problem in Last 9 Months?	0.2 (0.4)	0.2 (0.4)	**0.0 (0.2)**	**0.2 (0.4)**

* The n's for Control and Experimental Groups (assuming no missing data on a particular variable) are 25 and 51, respectively.

Table 15 - Continued

CLUSTER OR AREA	DEPENDENT VARIABLES	GROUP MEANS (Stand. Dev.) OR %AGE BY CATEGORY WHERE APPLICABLE			
		(A) CONTROL		(B) EXPERIMENTAL	
		Pretest*	Posttest*	Pretest*	Posttest*
Legal Issue	# of Arrests	0.9 (1.2)	0.8 (1.2)	1.5 (1.6)	1.3 (1.4)
Employment-Related Indicators	Change in Employment Status (Work vs. No Work at "pre" and "Post)	-1 (4%) 0 (92%) (n = 25)	+1 (4%)	-1 (2%) 0 (90%) (n = 51)	+1 (8%)
	Monthly Gross Income	428 (322)	381 (298)	241 (378)	290 (356)
Psycho-Social Variables	Quality of Life - Esteem/Well-Being	3.0 (0.9)	3.3 (0.9)	3.0 (1.0)	3.2 (0.8)
	Quality of Life - Spiritual	3.5 (1.2)	3.5 (1.4)	3.2 (1.2)	3.6 (1.1)
	Quality of Life - Interpersonal Attach.	2.8 (1.1)	3.1 (1.1)	2.7 (1.0)	2.6 (1.0)
	Quality of Life - Avocational	2.7 (1.2)	2.9 (1.1)	2.6 (1.1)	3.1 (1.0)
	Quality of Life – Economics or Basic Needs	2.0 (1.0)	2.4 (1.1)	2.0 (1.2)	2.5 (1.2)
	Satisfaction with Life Score	14.9 (7.6)	14.1 (7.3)	12.5 (4.9)	14.1 (4.9)
Therapists' Ratings of Subjects' Cognitive Skill Levels	Memory	2.5 (1.4)	2.3 (1.1)	2.8 (1.2)	2.6 (1.2)
	Attention	2.5 (1.3)	2.2 (1.0)	2.3 (1.1)	2.2 (1.2)
	Language	1.8 (1.1)	1.9 (1.1)	2.1 (1.2)	1.9 (1.4)
	Problem Solving	2.4 (1.2)	2.0 (1.0)	2.5 (1.2)	2.3 (1.4)
	Reasoning	2.3 (1.2)	1.9 (1.0)	2.2 (1.2)	2.0 (1.4)
Subjects' Ratings of Own Cognitive Skill Levels	Memory	3.3 (2.5)	2.7 (2.0)	3.7 (2.4)	2.6 (1.1)
	Attention	3.2 (2.5)	2.3 (2.1)	3.6 (2.5)	2.3 (1.1)
	Language	2.6 (2.7)	1.9 (2.1)	2.9 (2.7)	1.5 (0.8)
	Problem Solving	3.1 (2.5)	2.5 (2.1)	3.1 (2.7)	2.2 (1.2)
	Reasoning	2.7 (2.3)	2.3 (2.1)	3.0 (2.7)	2.0 (1.1)
Disposition at Discharge	Disposition - Goals Met (Yes or No)	---	Yes= 9(36%)	---	Yes= 10(20%)

* The n's for Control and Experimental Groups (assuming no missing data on a particular variable) are 25 and 51, respectively.

Table 16

Results of Mixed Model Analyses Re. Hypothesis 3(b) Data

TEST STATISTICS	DEPENDENT VARIABLES	STATISTICAL HYPOTHESES EVALUATED* (A) Exper. vs. Control	(B) Pre vs. Post	(C) Interaction
Univariate F	Family Size	$F_{1,73} = 0.8$ (p = .38)	$F_{1,73} = 0.8$ (p = .37)	$F_{1,73} = 0.2$ (p = .70)
Chi-Square	Change in Place Where Live (Own Place vs. Living with Someone or in Institution)	---	---	$X^2 = 1.0$ (p = .60)
Univariate F's	Frequency of Use - Primary Drug	$F_{1,73} = 0.1$ (p = .78)	**$F_{1,73} = 8.3$ (p = .01)**	$F_{1,73} = 0.3$ (p = .57)
	Frequency of Use - Secondary Drug	$F_{1,44} = 0.1$ (p = .82)	$F_{1,44} = 3.2$ (p = .08)	$F_{1,44} = 2.2$ (p = .14)
	# Days Used Alcohol in Last 30	$F_{1,52} = 0.1$ (p = .75)	$F_{1,52} = 0.5$ (p = .49)	$F_{1,52} = 0.0$ (p = .94)
	# Days Used Drugs in Last 30	$F_{1,53} = 0.4$ (p = .54)	$F_{1,53} = 0.1$ (p = .75)	$F_{1,53} = 2.3$ (p = .14)
	# Alcohol DTs in Last 9 Months	$F_{1,61} = 0.5$ (p = .48)	$F_{1,61} = 0.8$ (p = .38)	$F_{1,61} = 1.2$ (p = .28)
	# Drug Overdoses in Last 9 Months	$F_{1,69} = 0.2$ (p = .65)	$F_{1,69} = 1.9$ (p = .18)	$F_{1,69} = 0.0$ (p = .93)
	# Times Treated for Alcohol Problems in Last 9 Months	$F_{1,64} = 3.0$ (p = .09)	$F_{1,64} = 1.6$ (p = .21)	$F_{1,64} = 0.0$ (p = .93)
	# Times Treated for Drug Problems in Last 9 Months	**$F_{1,62} = 4.4$ (p = .05)**	$F_{1,62} = 0.3$ (p = .61)	$F_{1,62} = 0.1$ (p = .72)
	# Alcohol Detox Tx's in Last 9 Mo.	$F_{1,65} = 0.3$ (p = .58)	$F_{1,65} = 0.3$ (p = .58)	$F_{1,65} = 0.7$ (p = .39)
	# Drug Detox Tx's in Last 9 Mo.	$F_{1,65} = 0.9$ (p = .36)	$F_{1,65} = 0.9$ (p = .36)	$F_{1,65} = 0.9$ (p = .36)
	# Days Treated as Alcohol Outpatient in Last 30	$F_{1,62} = 1.1$ (p = .30)	$F_{1,62} = 2.6$ (p = .12)	$F_{1,62} = 1.0$ (p = .33)
	# Days treated as Drug Outpatient in Last 30	$F_{1,62} = 0.3$ (p = .56)	$F_{1,62} = .05$ (p = .50)	$F_{1,62} = 0.6$ (p = .46)
	ASI Alcohol Use Score	$F_{1,72} = 0.1$ (p = .76)	$F_{1,72} = 2.0$ (p = .16)	$F_{1,72} = 0.8$ (p = .37)
	ASI Drug Use Score	$F_{1,52} = 1.3$ (p = .27)	$F_{1,52} = 1.7$ (p = .20)	$F_{1,52} = 2.0$ (p = .16)
Univariate F's	# Hospital Admits in Last 12 Months	**$F_{1,70} = 5.0$ (p = .03)**	$F_{1,70} = 1.1$ (p = .29)	$F_{1,70} = 1.9$ (p = .17)
	# ER Admits in Last 12 Months	$F_{1,70} = 0.3$ P = .61)	$F_{1,70} = 0.8$ (p = .38)	$F_{1,70} = 0.2$ (p = .66)
	# Outpatient Care Visits - Last 12 Mo.	$F_{1,71} = 0.3$ (p = .57)	$F_{1,71} = 0.0$ (p = .86)	$F_{1,71} = 0.9$ (p = .35)
	# Dr./Dentist Visits in Last 12 Mo.	$F_{1,71} = 0.0$ (p = .92)	$F_{1,71} = 0.3$ (p = .58)	$F_{1,71} = 3.7$ (p = .06)
	Brief Psychiatric Rating Scale Score	$F_{1,91} = 0.0$ (p = .87)	**$F_{1,91} = 5.0$ (p = .03)**	$F_{1,91} = 0.1$ (p = .80)
	Admitted to Hospital for AOD Problem in Last 9 Months?	**$F_{1,46} = 2.6$ (p = .12)**	**$F_{1,46} = 1.1$ (p = .30)**	**$F_{1,46} = 1.1$ (p = .30)**

*Test Statistics with a p-value less than or equal to .05 are bolded and no attempt is made to control α experiment wide, therefore, the tests shown are as "liberal" as possible.

Table 16 - Continued

TEST STATISTICS	DEPENDENT VARIABLES	STATISTICAL HYPOTHESES EVALUATED* (A) Exper. Vs. Control	(B) Pre vs. Post	(C) Interaction
Univariate F	# of Arrests	$F_{1,73} = 3.0$ (p = .09)	$F_{1,73} = 1.9$ (p = .18)	$F_{1,73} = 0.0$ (p = .88)
Chi-Square	Change in Employment Status (Work vs. No Work at "pre" and "Post)	---	---	$X^2_2 = 0.6$ (p = .72)
Univariate F's	Monthly Gross Income	$F_{1,67} = 3.4$ (p = .07)	$F_{1,69} = 1.9$ (p = .17)	$F_{1,67} = 1.9$ (p = .17)
Univariate F's	Quality of Life - Esteem/Well-Being	$F_{1,91} = 0.4$ (p = .53)	**$F_{1,91} = 8.4$ (p = .01)**	$F_{1,91} = 0.4$ (p = .56)
	Quality of Life - Spiritual	$F_{1,91} = 0.0$ (p = .84)	$F_{1,91} = 1.5$ (p = .22)	$F_{1,91} = 2.2$ (p = .14)
	Quality of Life - Interpersonal Attach.	$F_{1,91} = 2.4$ (p = .13)	$F_{1,91} = 2.0$ (p = .16)	$F_{1,91} = 2.5$ (p = .12)
Clinician Rating	Quality of Life - Avocational	$F_{1,91} = 0.1$ (p = .74)	**$F_{1,91} = 7.2$ (p = .01)**	$F_{1,91} = 0.6$ (p = .43)
	Quality of Life – Economics or Basic Needs	$F_{1,91} = 0.1$ (p = .82)	**$F_{1,91} = 10.1$ (p = .00)**	$F_{1,91} = 0.2$ (p = .68)
	Satisfaction with Life Score	$F_{1,47} = 0.6$ (p = .45)	$F_{1,47} = 0.1$ (p = .73)	$F_{1,47} = 1.6$ (p = .21)
Multivariate F's		**$F_{5,86} = 3.1$ (p = .01)**	$F_{5,86} = 1.5$ (p = ,20)	$F_{5,86} = 0.9$ (p = .49)
And Univariate F's (Follow-Ups)	Memory	$F_{1,90} = 2.6$ (p = .11)	$F_{1,90} = 2.1$ (p = .16)	$F_{1,90} = 0.0$ (p = .83)
	Attention	$F_{1,90} = 0.4$ (p = .54)	$F_{1,90} = 2.6$ (p = .11)	$F_{1,90} = 0.3$ (p = .60)
	Language	$F_{1,90} = 0.2$ (p = .67)	$F_{1,90} = 0.1$ (p = .82)	$F_{1,90} = 1.3$ (p = .26)
Client Rating	Problem Solving	$F_{1,90} = 1.2$ (p = .28)	$F_{1,90} = 2.6$ (p = .11)	$F_{1,90} = 0.2$ (p = .69)
	Reasoning	$F_{1,90} = 0.0$ (p = .98)	**$F_{1,90} = 5.1$ (p = .03)**	$F_{1,90} = 0.2$ (p = .65)
Multivariate F's		$F_{5,87} = 0.6$ (p = .69)	**$F_{5,87} = 3.2$ (p = .01)**	$F_{5,87} = 0.4$ (p = .87)
And Univariate F's (Follow-Ups)	Memory	$F_{1,91} = 0.2$ (p = .67)	**$F_{1,91} = 8.0$ (p = .01)**	$F_{1,91} = 0.8$ (p = .38)
	Attention	$F_{1,91} = 0.3$ (p = .57)	**$F_{1,91} = 13.1$ (p = .00)**	$F_{1,91} = 0.4$ (p = .55)
	Language	$F_{1,91} = 0.0$ (p = .91)	**$F_{1,91} = 10.0$ (p =.00)**	$F_{1,91} = 0.9$ (p = .35)
	Problem Solving	$F_{1,91} = 0.1$ (p = .70)	**$F_{1,91} = 5.5$ (p = .02)**	$F_{1,91} = 0.2$ (p = .70)
	Reasoning	$F_{1,91} = 0.0$ (p = .99)	**$F_{1,91} = 4.3$ (p = .04)**	$F_{1,91} = 0.5$ (p = .47)
Chi-Square	Disposition - Goals Met (Yes or No)	$X^2_1 = 2.4$ (p = .12)	---	---

*Test Statistics with a p-value less than or equal to .05 are bolded and no attempt is made to control α experiment wide, therefore, the tests shown are as "liberal" as possible.

Discussion and Conclusions

Demographic Description of Clients.

Initially conceptualized as a study of persons with substance use disorder and co-occurring mental illness, the study subsequently expanded to include persons with disabilities other than (or in addition to) mental illness. Also, a second intervention site was added to the study in order to contribute additional subjects to the intervention cohort. In spite of these changes, the majority of persons in the study were individuals falling within the original proposal, e.g., individuals with the dual disorders involving substance use disorder and mental illness. The descriptive information provided in Tables 1, 2, and 3 would appear to suggest that the modal subject in the study is a single, white male approximately 39 years old, has less than a high school education, is not working, has a mental illness, and has a 1 in 4 chance of having consumed alcohol or taken drugs in the past month. At the same time, that modal depiction does not tell the whole story, particularly as relates to subjects recruited from one outpatient and one residential program. More specifically, while the subjects from the two types of programs did not appear to differ much in terms of their background/demographics, they did differ in regard to their current substance use (i.e., residential clients were less active with current alcohol and drug use than persons in the outpatient setting) and in regard to the nature of their co-existing disabilities. Given these differences, some caution is exercised in tracing their implications for the results observed during the evaluation of each of the study's hypotheses.

Cognitive Functioning of Study Participants.

Regardless of the specific combination of identified disabilities, clients at both research sites were documented with appreciable levels of cognitive impairment. At the time of entry into the study, cognitive performance of subjects was substantially lower than normative samples, with a third or more of subjects at or below the 10^{th} percentile on performance averaged across all measures. Although memory functions were the most depressed, deficits in attention and executive functioning also were low. Notably, 61% of subjects on the Trails Making Test – Part B and 58% of subjects on the RCF – Immediate Recall scored in the lowest 10% on the published norms of those instruments.

Recent literature has alluded to "multiple co-morbidity" as being prevalent for the most needy persons in substance use disorder treatment and the current study appears to substantiate this (Shavelson, 1998). Cognitive deficits tended to be greater among persons who were older,

had less stable housing, lower educational attainment, membership in a minority group (principally African American), and a history of incarceration. Moreover, persons reporting a physical disability and/or traumatic brain injury also were more likely to have greater cognitive impairments. Worth noting is that some findings in this study also suggest that having a "physical disability" is more highly correlated with cognitive impairments than having mental illness.

Traumatic brain injuries, sometimes not reported or diagnosed, may be a particularly common occurrence for persons in chemical dependency treatment (Acquilano et al., 1995). Utilizing data from predictor variables in Table 7, the factors that correlate most highly with cognitive impairment include lower education attainment level and a reported physical disability (p=.000). These are followed by race (minority) and high school drop out status (p=.001). Alcohol use during lifetime, severity of mental illness, and health transitions in the last year form the third tier of correlates (p=.01), followed by a fourth tier of "live in own place", experience a brain injury, months and days in jail, employment status, and scores on the Brief Psychiatric Rating (p=.03). Persons who experience multiple correlates from the above factors (likely many persons in substance abuse treatment) may benefit from screenings for cognitive impairment prior to treatment planning.

Recent research on cognitive impairments associated with persons who experience substance dependence clearly indicate that neuropathology from substance abuse contributes to diminished cognitive functioning for many treatment clients (Heffernan, et al., 2002; Bates et al., 2002; Tracy & Bates, 1999). The current study suggests this as well, given that cognitive functioning levels between the intervention and control groups tended to show similar degrees of change from pre to post testing. In the current study, illicit drug use was associated with greater levels of cognitive impairment than was alcohol use; however, both alcohol and illicit drug use appeared to impact cognitive functioning.

Cognitive Measures Require Norming for Special Populations

A detailed review of the instrument battery and the associated norms suggested that one potential benefit of this study would be to publish normative data on study participants. It can be argued that substance dependence treatment agencies in the U.S. serve comparable populations of persons on a regular basis, although it is not common to identify functional levels of cognitive impairment at the time of treatment intake. For that reason, the test data available through this

study are being analyzed in order to delineate instrument norms for the subject population. These results will be disseminated through conferences and papers, as well as inclusion in the SARDI website. Increasingly, treatment providers are embracing an "integrated model" of services provision, and more comprehensive functional assessments are becoming more commonplace. Consequently, providers will potentially benefit from published normative data for populations of persons with multiple conditions that may impact cognition. The first paper on this topic has been submitted for a national NIMH conference in 2003.

Cognitive Compensation Skills training

One of the most challenging aspects of this study was to operationalize the concept of "cognitive compensation skills". These are by definition "compensatory" skills used to overcome cognitive deficits, or to "recompense for something" (Webster's Unabridged Dictionary, 1994). As such, cognitive compensation skills may or may not be reflected in change scores on traditional tests of cognitive functioning. There is debate in the literature about how and where to "recompense". The approaches range from concentrating on cognitive areas such as unilateral attention, memory, metamemory, executive functions, verbal skill, and processing speed. Other approaches focus on techniques for improving performance such as rehearsal strategies, talking books, memory books, over-learning, computer enhanced learning, and electronic personal desk assistants. Yet other approaches tend to be more environmentally focused such as environmental manipulation, posting cues and signs in the treatment setting, or introducing other environmental cues (Bates et al., 2002; Wilson, 2000). Moreover, the list of cognitive instruments utilized in related studies are quite diverse and extensive, as alluded to in the literature review in the first section of this report.

Considering that the present study was a pilot project in a new and nearly untested area, there were several challenges to and limitations in the design and execution of the CCST. One challenge was in the measurement of "cognitive compensation skills", as mentioned above. Although cognitive functioning levels were assessed, these may not be the most direct means for measuring acquisition of compensation skills. In future studies, the investigators plan to initiate a series of "real time" tests of compensation skills, where subjects will be required to choose from a group of compensation strategies and then apply one to a common scenario. Measurement will then be based on 1.) knowledge of multiple compensation strategies, 2.) ability to choose an appropriate strategy, and 3.) demonstration of the strategy in context.

Improvement in performance also will be quantified. In keeping with the primary modalities utilized in mental health and chemical dependency treatment settings, the majority of compensation skills will address auditory learning processes.

A related problem identified early in the study was low compliance with between-group subject practice sessions. Although wrist watch alarm reminders, or alternately, phone call reminders, were conceptualized as assisting with practice, neither proved feasible for the larger groups. Subsequent development of this curriculum will involve homework assignments that will result in additional monetary compensation for persons completing their "homework". Moreover, more of the actual group time will be divided between instruction, discussion, and actual homework practice.

Also, the groups were originally planned for a 24 group - 12 week series, but subject attrition and the total time required for completion of the study did not allow for this configuration. Eventually the group was changed to one 150 minute contact per week for eight weeks, with a mid-group break provided to participants. Although not an ideal period of time (too long for some consumers), it represented the best compromise for accommodating persons in outpatient treatment who must find free time and transportation in order to attend group. It was usually not practical to schedule this group on the same day as other required program activities. Even when this was possible, fatigue from attending two group sessions in one day appeared to be a factor for some individuals (validated by respondent comments provided in the Appendices).

Benefits of Group Participation

In spite of the lack of significant changes in cognitive functioning between experimental and control participants, the feedback provided by experimental group members was quite positive and participants expressed that they had benefited from the experience. Several participants expressed appreciation for the awareness that the group created about their cognitive deficiencies and their attempts to attain sobriety. Interestingly, respondents rated their own cognitive abilities as lower at the post-test than at the pre-test in both the experimental and control groups. The CCST group the only venue where clients could routinely discuss cognitive limitations and specifically apply that content to their recovery, but apparently even taking the cognitive assessments were sufficiently daunting that clients became more aware of their cognitive limitations.

Conclusions:

A particular contribution of the current study was the documentation of the pervasiveness of cognitive impairments among clients who experience mental illness or other disability conditions across two different chemical dependency treatment sites. Although additional study is necessary in order to more fully understand the most common etiologies for cognitive impairments, it is clear that a substantial portion of persons with dual diagnoses within the chemical dependency treatment system experience depressed levels of cognition that can very likely impede their progress to stabilization and recovery. Chemical dependency treatment providers should include measures of cognitive functioning as routine components of their intake assessment battery and the results from these instruments should be considered when formulating client treatment plans. Moreover, subjects in this study, irrespective of their assignment to experimental or control conditions, demonstrated cognitive improvements over their first two to three months of enrollment in the program. Interestingly, these effects appeared to hold for persons in a residential treatment program, as well as for those in an outpatient program. Self-reported substance use was far more common at follow up for persons in the outpatient program, therefore simply being abstinent from substance use may not be directly related to the observed changes.

Research is needed to better understand the etiologies of cognitive impairments in persons who are dual diagnosed, both related to aspects of mental illness and the influence of alcohol or other drug use. For example, research has shown that both mental illness and substance dependence can independently lead to significant cognitive dysfunctions, but the combination of these factors may increase cognitive impairments multiplicatively, not additively.

Given the potential clinical importance in determining levels of cognitive functioning among clients in substance abuse treatment settings, more research is needed on instruments and their related clinical population norms, particularly those applicable to dual diagnosed populations. At the present time there is substantial debate surrounding the conceptualization of critical cognitive skills and in the operational definition of "cognitive compensation skills". Additional work in these areas would further illuminate rehabilitation strategies for clients with cognitive impairments. Such work could have far-reaching impacts if viewed from a larger continuum of

cognitive impairments, from women being served by TANF or job placement services, to juvenile justice settings, to populations being served in America's criminal justice system.

Participants in the study rated their experiences favorably in most cases, and frequently made connections between the curriculum content and their own recovery, even when the steps for doing this were not specified within the group activities. It may be that given a longer duration of follow up evaluation, CCST group participation may have a more pronounced impact on substance use reduction. This is consonant with other philosophies of dual diagnosis treatment where the first year of treatment is characterized as an "engagement phase" where rapport is developed with clients and trust is established. Then more aggressive substance use reduction treatment can be initiated in subsequent years (Drake, et al., 1996).

The researchers plan on making further refinements in the CCST modules, including a more detailed analysis of specific cognitive skills, further identification of compensation skills that can be readily assessed and taught, and a re-design of the group structure to provide additional in-group and between-group practice of the compensation skills addressed. A proposal has been developed to further refine cognitive domains and compensation strategies using techniques of brain mapping via evoked response testing.

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